Year 11 Knowledge Organisers

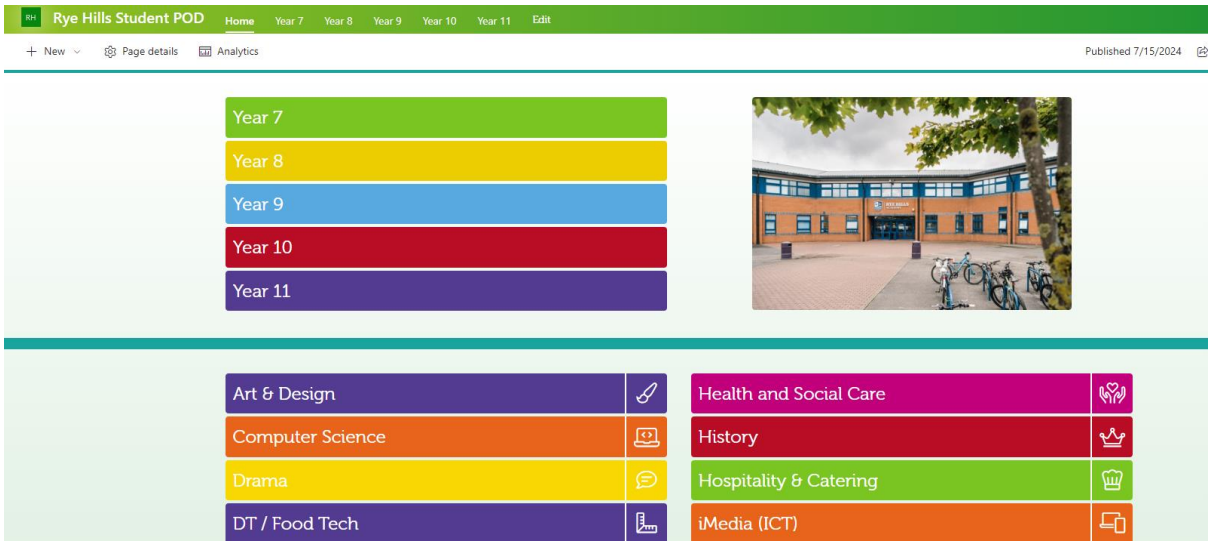
Topic summaries for revision and to help with homework.

Autumn Term 1.1

Student Pod is a website, just for Rye Hills students.It houses lots of school information and resources for every subject.

Here you will find Student Knowledge Organisers, which aim to support students at home. Student Knowledge Organisers are brief summaries of important key words and information for a topic. They are a great starting point for revision – use them to help make flashcards and mind maps. They are also a useful tool when completing homework.

You can access Student Pod through EASI or the school website.



The Student Knowledge Organisers for the current half term are embedded into this booklet, alternatively you can access all the Student Knowledge Organisers for the year via each subject page.

This half term we will be hosting an information evening where we will talk about how to support students at home and how to use Student Pod and Knowledge Organisers. We will send more information soon.

Annotation guide

What next?

Why was this research useful to your developing project?

What ideas will you take into your next work?

- What visual elements will you take inspiration from?
- Are there conceptual ideas that have inspired you?

Which elements of the artists' work will you choose to explore? Why?

How does this artists work link to your theme/developing idea?

How could this be inspirational to your developing ideas?

How does this link to the work of other artists and ideas you have explored?

If you were to create work in a similar way, it would include:

(e.g.)

- A black background
- Impasto paint application
- Subject centralised within the composition
- Use of complementary colours
- Mark making to suggest texture

Message?

Is there a message the artist is conveying through their work?

How has this been achieved?

Do you have a message to convey? If so, how will you ensure the viewer understands?

What set up would be required to create visually similar work? What equipment would you need to achieve these results? What media and techniques will you need to explore and refine?

Why did the artist choose to capture the subject/s in this way?

What have you observed/learnt by analysing this artists' work?

What do you like about these images? What makes them successful?

What Formal Elements?

Carefully consider…

Composition

How have the subject/s been positioned within the frame? What effect does this have?
How has the artist used the space?

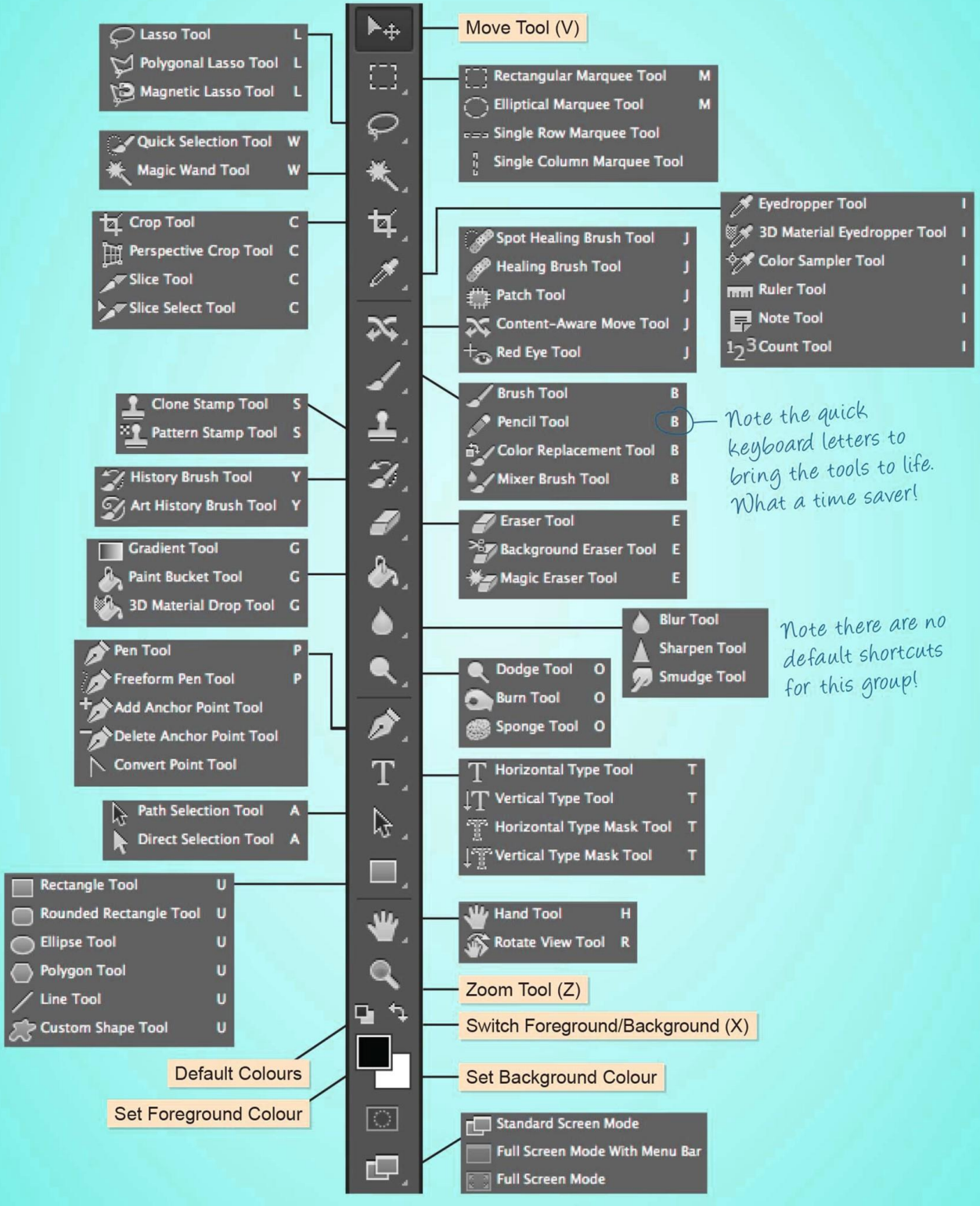
Colour, Tone, Texture, pattern, line, shape, form…?

1. Include <u>relevant</u> facts about the artist.
2. Include **5** words to describe the style.
3. Your initial opinion about their work.
4. What formal elements are important within this work?
5. Present 3 to 5 images.

AO1 AO3

PHOTOSHOP

CS6 AND CC SHORTCUTS



ART VOCAB

You may find the following words useful when writing about your own artwork or that of others. If there are words you do not know then use a dictionary to look them up or ask a friend.

ELEMENTS OF DESIGN

Colour:
Blend
Bright
Clash
Cold
Deep
Dull
Glowing
Harmonious
Intense
Luminous
Mixed
Opaque
Pale
Pastel
Primary
Pure
Saturated
Secondary
Soft
Tint
Translucent
Transparent
Vibrant
Warm

Line:
Angular
Broken
Confident
Faint
Flowing
Fluent
Free
Hesitant
Scribble
Sweeping
Tight
Woolly

Shape:
Angular
Body
Conical
Figure
Form
Frame
Harmonious
Image
Precise
Sharp
Uniform
Vague

Texture:
Coarse
Cross-hatching
Fine
Flat
Glaze
Hatching
Impasto
Jagged
Matt
Rough
Shiny
Smooth
Soft
Splatter
Thick
Thin
Wash

Tone:
Bleach
Bright
Contrast
Crisp
Dark
Fade
Fair
Gradation
Harsh
Intense
Smooth
Sombre

Pattern:
Embellish
Flowing
Fluid
Geometric
Irregular
Natural
Negative
Order
Ornamental
Overlap
Plain
Positive
Repeat
Simple
Spiral
Stamp
Stencil
Structure
Symmetric
Uniform

Composition:
Background
Blurred
Complex
Confused
Design
Distant
Eye-line
Focus
Foreground
Form
Middle-ground
Near
Perspective
Plane
Proportion
Scale
Shape
Sharp
Space
Symmetry

Light:
Artificial
Dapple
Dark
Ethereal
Evening
Fall of light
Fierce
Gentle
Harsh
Haze
Highlight
Intense
Light
Midday
Natural
Night
Shading
Shadow
Soft
Source
Tone

Feeling:

Alive	Atmospheric	Delicate
Depressing	Dignified	Disturbing
Exciting	Expressive	Fresh
Happy	Humorous	Imposing
Moving	Nostalgic	Sad

Sentence Starters: Artist Work

- In this piece I can see...
- The materials the artist have used are....
- The technique the artist has used is....
- I think this piece is about.....
- I think that because....
- The artist created this work because....
- The focal point for me is.....
- The artist links to my topic because.....
- I like/dislike this work because.....

Sentence Starters: Own Work

- In this piece I have...
- My work links to my artist because....
- My focus artist influenced me.....
- I am proud of.....
- An area I need to improve is....
- To develop this piece further I could...
- I made this piece personal to me by....
- Through working in this way I have learnt....
- The materials I have used are....
- The technique I used is....

Knowledge Organiser

Mixed Media

Ideas

Drawing on different surfaces.

Draw on newsprint

If you experiment with drawing on newspaper, remember that the text becomes a part of your work; this needs to be an intentional and considered decision. The words should not be too distracting or you could paint or cover the text slightly with paint or other media.

What is mixed media?

A technique involving the use of two or more artistic media, such as ink and pastel or painting and collage, that are combined in a single composition.

It is important to remember that art-making mediums should be used in a way that supports your ideas, there are times when a dash of unpredictability and thinking-outside-the-box can help.

Draw on cardboard

Card can provide a sturdy base for a painting and, when cut-outs are glued into a work, can create elevated surfaces that segment a composition, adding depth and shadows.

Textured paper

There are lots of textured papers available. Some are machine made, pressed with a uniform mesh of bumps or grooves; others are handmade, with flecks of fibre, thread, tissue.

If you don't have access to textured papers, you can easily find or make your own. Tear apart packaging or other recycling products. Source whatever scraps you can and draw on them.

- Packaging
- Envelopes
- Newspaper
- Book pages

Draw on patterned or textured wallpapers, gift wrap, tissue paper or hand made paper

Care needs to be taken when integrating patterned items; it can be easy for the pattern to dominate and overpower a work. When appropriate imagery is selected, however, patterned items can provide excellent drawing surfaces or collaged material.

Mark making

Test a variety of drawing tools to see how they take to the surface you are using

Background

Creating background Texture & Colour

Create a background
Consider your background carefully. Ensure that it represents the mood, object or subject that you are studying. You can create a background yourself using different colours, textures or marks.


Artists who use mixed media
- **Mark Powell**
- **Paula Swisher**
- **Nikau Hindin**
- **Olivier Catte**
- **Evol**
- **Ian Murphy**
- **Sven Pfrommer**




Layers of different media


Layers of paper

White paint/emulsion over text or texture



Use ripped, scrunched, folded papers
Tissue paper can be creased and glued onto a painting (shaping as required) to create a textural surface that can be painted over. As with other textures, dry-brushing will exaggerate them and make the fine web of creases more visible.

Tips & Common misconceptions

- Glue paper so that it is flat to the surface - never scrunch tissue paper!
- Most pens do not work over wet surfaces - allow to dry first
- Match background colours and textures to your topic/subject

2.2 PROGRAMMING FUNDAMENTALS

KEYWORDS		
1	**Python**	A high level programming used to write programs. Similar to the English language so easier to read, write and understand by humans. Difficult to understand by computers, so needs compiling or interpreting into low level language or machine code once written.
2	**Programming**	A 'bit' is a binary digit. A binary digit is the smallest unit of data a computer can store. Each 'bit' is represented using either a 1 (true) or 0 (false).
3	**Code**	The instructions that a program uses.
4	**Sequence** 	A programming construct where code is executed in the order it is written.
5	**Selection** 	A programming construct where more than one block of code is available and code is selected to be executed based upon a condition being met, such as an IF statement.
6	**Iteration** 	A programming construct where code is repeated either until a conditions is met (condition controlled i.e. while loop) or a set number of times (count controlled i.e. FOR loop).
7	**Variable**	A name for a location in memory, that stores a value and **can be changed** when the program is running. It can be local or global.
8	**Local Variable**	A variable which can only be used within the code they are declared in.
9	**Global Variable**	A variable which can only be used in any part of the code after they are declared.
10	**Constant**	A name for a location in memory, that stores a value and **never changes** when the program is running.
11	**Function**	A collection of code that works outside the main program. These are created to speed up programming and reduce chance of errors. They can be called from a single line of code at any time.
12	**Comparative Operator**	A symbol used to compare multiple values.
13	**Arithmetic Operator**	A symbol used to manipulate numerical values.

	Syntax	Syntax Error	Logic Error
14	The grammar associated with a programming language. The way the code is written so that a computer can understand it.	An error that will stop a program as the computer doesn't understand the code.	An error that will not stop the program as it has used the correct syntax, but will give an unexpected output.

PYTHON TO ENGLISH	
`print("hello!")`	Prints a value on screen (in this case, hello!)
`input("")`	Inputs a value into the computer.
`x = input("")`	Inputs a value and stores it into the variable x.
`x = int(input(""))`	Inputs a value into x, whilst also making it into an integer.
`answer = x + y`	Saves the result of x and y added together in a variable named answer.
`print(str(x))`	Prints the variable x, but converts it into a string first.
`print("Hello", "World")`	Prints the two strings concatenated with a space between. This code would output "Hello World".
`age = 12` `print("Age: " + str(age))`	The + joins together two variables when printing. Str has to be used to cast age to be a string. This code will output "Age: 12".
`if name == "Fred":`	Decides whether the variable 'name' ha a value which is equal to 'Fred'.
`else:`	The other option if the conditions for an if statement are not met (eg. name = 'Bob' when it should be Fred)
`elif name == "Tim":`	elif (short for else if) is for when the first if condition is not met, but you want to specify another option.
`# COMMENT`	# is used to make comments in code – any line which starts with a # will be ignored when the program runs. They are used to describe the code to a programmer.
`for i in range(0,10):` `  # WRITE CODE HERE`	Repeats any code indented after this line a set number of times, in this case, 10.
`while x < 10:` `  # WRITE CODE HERE`	Repeats any code indented after this line until a condition is met, in this case x becoming equal to or greater than 10.
`list = ["",""]`	Creates a variable and makes it an array – a list which can store many values.

2.2 PROGRAMMING FUNDAMENTALS

DATA TYPES		
1	**String**	**Any character on the keyboard, including spaces, symbols and numbers – Alphanumeric e.g. "Hello !"**
2	**Integer**	**Whole number e.g. 32**
3	**Float/Real**	**Decimal number e.g. 1.2**
4	**Boolean**	**Two values e.g. true or false**
5	**Character**	**A single character e.g. b**

Casting

6 Sometimes a programmer needs to change the data type of the contents of a variable. For example, an integer may need to be converted to a string in order to be displayed as part of a message.

This process is known as casting.

The following examples in Python convert a string to an integer:

```
number = input("Please enter a number")
int_number = int(number)
result = int_number * 2
print(result)
```

```
num1 = int(input("First number: "))
num2 = int(input("Second number: "))
total = num1 + num2
print ("Result " + str(total))
```

Comparative Operators		
7	= =	Equal to
8	! =	No equal to (or different to)
9	>	Greater than
10	<	Less than
11	> =	Greater than or equal to
12	< =	Less than or equal to

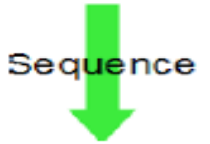
```
litter = int(input("How many puppies were born?"))

if litter <= 5:
    print("good size")
elif litter == 6:
    print("just right")
elif litter == 7:
    print("large litter")
else:
    print("goodness me")
```

```
number=0
while number != 8:
    number = number + 1
    print ("the number is", number)
```

Arithmetic Operators				
	Operation	**Symbol**	**Example**	**Output**
13	**Addition**	+	2 + 10	12
14	**Subtraction**	-	9 – 6	3
15	**Multiplication**	*	5 * 4	20
16	**Division**	/	5 / 2	2.5
17	**DIV (Floor Division)**	/ /	7 / / 2	3
18	**MOD (Modulus – Remainder)**	%	7 % 3	1
19	**Exponentiation (to the power)**	^	2 ^ 5	32

2.2.3 ADDITIONAL PROGRAMMING TECHNIQUES

PROGRAMMING CONSTRUCTS



A Sequence is when there are programming steps that are carried out one after another.

Selection is where there are different paths in your code eg: IF, ELIF, ELSE

Iteration is when there is repetition (loops) in code. This could be a WHILE loop (do something WHILE a condition is met) or a FOR loop (do something for a set number of times)

This count-controlled loop would print "Hello World" 8 times.:

```
for i=0 to 7
      print ("Hello")
next i
```

These condition controlled loops would check if a password's correct:

```
while answer != "letmein123"
      answer=input("Enter password")
endwhile
```

```
do
      answer=input("Enter password")
until answer=="letmein123"
```

Finding errors – follow these steps

1. Have you checked that you have closed all brackets correctly?
2. Have you checked that you have closed all quotes correctly?
3. Are your variable names spelt in the same way consistently? Remember that Python is case sensitive
4. Have you remembered to use commas to separate the variables inside print?
5. Have you used quotes around strings which you want to print out word for word?
6. Have you used int or float on number inputs?

STRING MANIPULATION

```
0   1   2   3
W   o   r   d
```

The characters in a string are numbered starting with position 0.

Function	Purpose
x.length	Gives the length of the string
x.upper	Changes the characters in the string to upper case
x.lower	Changes the characters in the string to lower case
x[i]	Gives the character in position i. Eg: x[2] = "r"
x.substring(a,b)	Gives the characters from position a with length b. Eg: x.subString(1,2) = or
+	Joins (concatenates) two strings together

IF/ELSE AND SWITCH/CASE FOR SELECTION

IF ELSE	SWITCH/CASE

If choice == "a" then
  print("You chose A")
elseif choice=="b" then
  print("You chose B")
else
  print("Unrecognised choice")
	Switch entry:
	  case "A":
	  print("You chose A")
	  case "B":
	  print("You chose B")
	  default:
	  print("Unrecognised choice")

2.2.3 ADDITIONAL PROGRAMMING TECHNIQUES

SUB PROGRAMS

Procedures are a set of instructions stored under a name so that you can call the procedure to run the whole set of instructions.
A **function** is like a procedure but always returns a value.
Parameters are variables used to pass values into a function or procedure.

A procedure **with** parameters	A procedure **without** parameters
procedure intro (name) print("Hello " +name) print("Welcome to the game") endprocedure	procedure intro () print("Hello") print("Welcome to the game") endprocedure

SQL (Structured Query Language)

SQL is the language used to manage and search databases.

Commands	Example	What it does
SELECT FROM	SELECT name, age FROM students	Displays the name and age of everyone in the students table
WHERE	SELECT name FROM students WHERE gender=male	Displays the name of everyone in the students table who's gender is male
LIKE	SELECT name FROM students WHERE name LIKE "% Smith"	Displays the students' names that end with Smith.
AND	SELECT name FROM students WHERE gender=male AND attendance > 90	Displays the students who are male and have an attendance of more than 90.
*	SELECT * from students	Selects all of the fields from the students table

ARRAYS

One-Dimensional Arrays- this is like a list.
In this example an array has been created called students. The list can hold 3 items (as shown).

```
array students [3]
students [0] = "Bob"
students [1] = "Dave"
students [2] = "Bob"
```

This command would print the second item (1) From the array. It would print "Dave".

```
print(students[1])
```

Two-Dimensional Arrays - these are lists within lists (like a table)

```
Grades=[["Bob", "22%", "44%"], ["Dave", "85%", "100%"]]
```

The code above creates the 2D array. The code Below would output:
"Bob's first test score was 22%"

	0	1	2
0	Bob	22%	44%
1	Dave	85%	100%

```
print("Bob's first test score was " + Grades [0, 1]
```

FILE HANDLING

Myfile=openRead("myfile.text")	Opens the file in read mode
Myfile=openWrite("myfile.text")	Opens the file in write mode
Myfile.writeLine ("Hello")	Writes a line to the file
Line1=myfile.readLine()	Reads one line of the file
Myfile.close()	Closes the file
endOfFile()	Used to determine the end of a file

CM1: Media products

Description:

A media product is a platform used to communicate information to a specific audience. There are different formats that can be used for this purpose.

Digital imaging and graphics

Definition/Meaning:
A product that uses technology to create images in digital form. This may involve the use of graphic tablets, cameras or specific software such as Photoshop.

Digital games

Definition/Meaning:
A product that uses games consoles aswell as personal computers to entertain the audience. In particular, online gaming.

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R093: Creative iMedia in the media industry

Video

Definition/Meaning
A product that includes moving images and in most cases an auditory element. It's also referred to as an audio-visual product.

Audio

Definition/Meaning
A product that is recorded or transmitted in the form of sound. For example, sound effects.

Animation

Definition/Meaning:
A product that converts still images into moving elements to illustrate a sequence of events.

Music

Definition/Meaning:
A product that records audio as a way to express emotion.

Visual effects (VFX)

Definition/Meaning:
Technology is used to incorporate effects that may be too dangerous or impossible to add any other way. For example, a spaceship flying across the screen.

Special effects (SFX)

Definition/Meaning:
Special effects that can be created on set. This includes physical character creation, puppetry, animatronics or humans wearing prosthetic make-up and costumes.

CM1: Media products

Description:

A media product is a platform used to communicate information to a specific audience. There are different formats that can be used for this purpose.

Social media

Definition/Meaning:
Websites and applications that enable users to create and share content or to participate in social networking.

Apps

Definition/Meaning:
A mobile application or app is a computer program or software application designed to run on a mobile device such as a phone, tablet, or watch.

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Comics and graphic novels

Definition/Meaning
A product that is designed to tell stories an in more visual way through illustrations and speech bubbles for dialogue.

Multimedia

Definition/Meaning:
A product that combines a range of assets such as text, images, video, animation and sound.

Virtual reality (VR)

Definition/Meaning:
Virtual reality is a computer-generated simulation in which a person can interact within an artificial three-dimensional environment.

Websites

Definition/Meaning
A product that combines a range of multimedia elements to create a webpage that can be accessed with an internet connection.

eBooks

Definition/Meaning:
A product that is available in electronic form and accessible via apps or e-readers (e.g. Kindle)

Augmented reality (AR)

Definition/Meaning:
Augmented reality allows the user experience the real world, which has been digitally augmented or enhanced in some way.

CM4: Interactivity

Description:

Interactivity is a two-way flow of information between a computer and a computer-user; responding to a user's input.

Animation

Description:

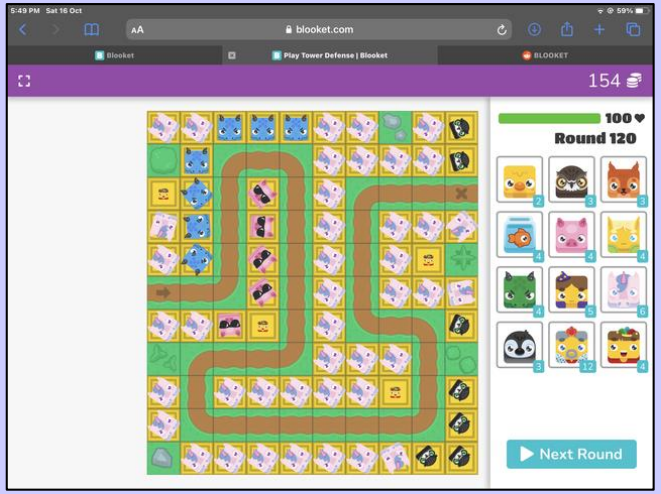
- Taking still images and creating a sequence of moving images that follow a timeline.

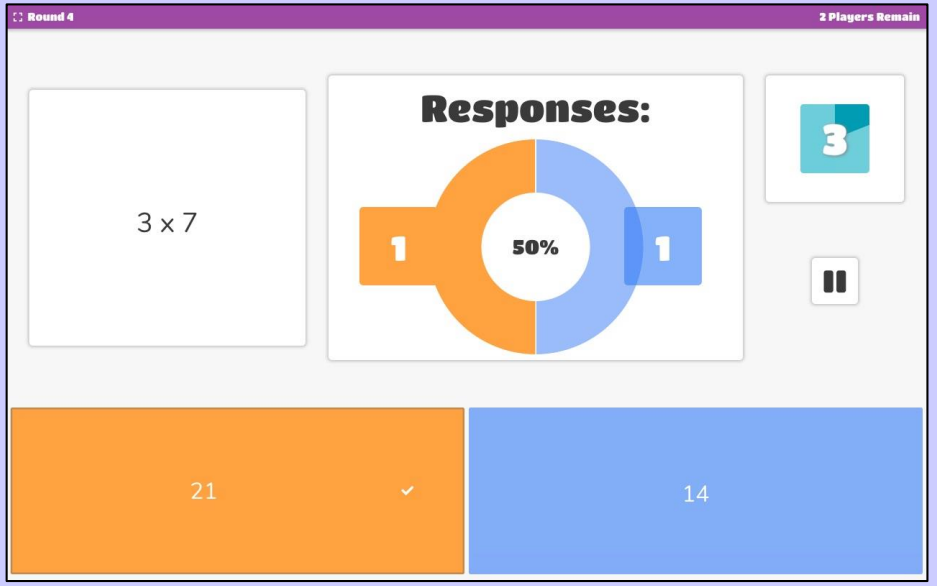
Examples:

- 3D Animation – this can include the use of Computer Generated Imagery (CGI)
- 2D Animation – hand drawn characters frame by frame.
- Vector 2D Animation – a rigged character.
- Animated graphics/text
- Motion capture – Claymation, puppet, silhouette.

Apps & Websites

Worked example: Blooket





Examples:

- Icons
- Graphics
- Animations
- Audio
- Video
- Music
- Navigation – buttons, icons, hyperlinks, rollovers, hotspots.

CM5: Purpose

Description:

Every media product is created for reason and this is known as purpose.

Inform

Description:
- To display information normally in a formal language because it's important.

Examples:
- Maps
- Books
- Leaflets

Influence

Description:
- To persuade consumers to change their behaviour.

Examples:
- Health advertisements
- Educational advertisements
- Political advertisements

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R093: Creative iMedia in the media industry

Entertain

Description:
- This is to provide a narrative/plot/storyline that entices the user to consume the content.

Examples:
- Films
- TV shows
- Books
- Apps
- Video games

Advertise/Promote

Description:
- This is to persuade the consumer into committing to a product or service.

Examples:
- Posters
- Billboards
- TV advertisements
- Radio advertisements
- Banners on webpages
- Social media posts

Educate

Description:
- This is to provide consumers with information that enables them to learn/gather new information

Examples
- Text books
- YouTube videos
- Online learning platforms

Job roles:

Content creator
Copywriter
Campaign manager
Photographer
Web developer
Web designer
Animator
Games developer

CM5: Purpose

Description:

The style, content and layout has to be adapted meet a particular type of purpose such as: colour, conventions of genre, formal/informal language, tone of language, positioning of elements, audio representation and visual representation.

Colour

Definition/Meaning:
The colour can help to create a particular mood as they can represent certain feelings. For example red can represent danger, love and blood whereas blue can represent calm, peace or trust.

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Conventions of genre

Definition/Meaning
Conventions are a commonly accepted way of doing things. Advertisements will share a common set of characteristics.

Visual representation

Definition/Meaning
The content used in the media product that helps the consumer to make a connection with that and the product that is being advertised.

Tone of language

Definition/Meaning:
The tone can help to identify how serious the message may be. This depends on the type of media product.

Positioning of elements

Definition/Meaning:
Content will be placed at certain parts of product because that is where consumers may naturally be drawn to.

Audio representation

Definition/Meaning:
A media product that can be represented in the form sound such as the use of music, dialogue and sound effects.

Formal/Informal language

Definition/Meaning:
The purpose of the product can affect the nature of the language used. For example, informal language is used for adverts where formal language may be used for educational purposes.

CM6: Audience segmentation

Description:

Target audience is made up of different characteristics known as demographics which are split into segments to help clearly define who the target audience is.

Benefits of audience segmentation

- Clearly defined target audience
- Increased chance of sales
- Personalised approach to marketing/advertising.
- Increased level of interest.

Lifestyles/Interests

Definition/Meaning:
This is linked to hobbies and what people actually enjoy. For example, a person who loves horror films will be more interested in products of this genre.

Location

Definition/Meaning
This is how accessible the product is. It might be available within a certain radius, in a city/town, a country or it may have a wider reach if it's an online service.

Age

Definition/Meaning:
This can be an age range such as 18-25 or broader categories such as teenagers, adults, retired people.

Occupation/Income

Definition/Meaning:
The type of job can determine the level of disposable income that person has and therefore shapes their consumer behaviour depending on what they can afford.

Ethnicity

Definition/Meaning
This focuses on cultures, country, religion or language. For example, some software used in the UK is designed using US English language instead.

Gender

Definition/Meaning:
Some products may be aimed at one gender more than the other.

Education

Definition/Meaning:
The population have different levels of education such as: degree level, A-level or GCSE and this can define the sort of language used in media products.

Client requirements

Description

A client brief is a written document or verbal discussion that outlines the key requirements of a project.

Client brief

Types:

- **Formal** - A scheduled meeting that will take place between the client and the producer.
- **Informal** - Client will discuss requirements during a telephone call, no do documentation provided. More of a verbal agreement.
- **Negotiated** - The client and the producer work together to develop a brief for a media product.
- **Commissioned** - A client will hire a separate independent company to create the media product for them.

How are client briefs communicated?

A client brief can be **written** and discussed in a **meeting**.

Interpreting client brief

Description:
A client brief would typically consist of the following components.

Type of product

The product that is being created.

Timescales

Key dates and deadlines for the project.

Audience

The segment of people this product is aimed at.

Purpose

The objective of the product

Client ethos

Ensuring the product meets the brands values.

Content

What needs to be included in the media product?
For example, a digital product then further consideration would need to be made into the use of other assets such as: sound, animation, video etc..

Genre, style and theme

The brand and their values will influence the design.
The type of product will follow a particular theme.

Client brief constraints

- Conflict of interest when it comes to design choices.
- A client brief can restrict what the production company can do.

CM8: Primary research

Description:

Primary data is any original information that you collect for the purposes of answering your research question (e.g. through focus groups, interviews, online surveys and questionnaires.

Focus groups

Description:

- A group of people assembled to participate in a discussion about a product before it is launched.

Pros	Cons
Valid set of results Less time-consuming than a survey. Additional feedback can be gathered in the session.	Sample size too small. Small samples can lack validity. Moderator might not record all responses.

Interview

Description:

- A meeting of people face to face or online.

Pros	Cons
Allow for more in-depth data collection and comprehensive understanding. Can be used for quantitative research	Interviews are more time consuming to recruit and conduct. Expensive form of research. Limited scope: you might miss out on interesting data

Online surveys

Description:

- A structured form that is completed over the internet.

Pros	Cons
Cost-effective and can capture a large sample very quickly. Quick to gather large sample sizes.	Need an internet connection to participate in a survey. Some respondents might lack technical skills to complete survey.

Questionnaires

Description:

- A list of questions or items used to gather data from respondents about their attitudes, experiences, or opinions

Pros	Cons
No technological constraints as it's paper-based so it's easy for everyone to access. Can include open and closed questions.	Paper can easily be misplaced/lost Time consuming Expensive to employ surveyors.

CM9: Secondary research

Description:

Secondary data are information that has already been collected by other researchers.

Primary v Secondary research

Primary research:

Pros	Cons
Can answer specific questions You control the sampling methods and size.	Time consuming to collect data. Staff might need training on collecting data.

Secondary research:

Pros	Cons
Easier and faster to access Collect data from a wider geographical location.	Time consuming, regularly need to check sources. No control over the data as it's already there.

Books

Pros	Cons
Indicate areas of professional interest Up to date coverage of news and opinion	Can become outdated quickly. Can include subjective content.

Television

Pros	Cons
Present information in different formats. Can include facts and opinions. Can be an up-to-date source of information.	Can be biased May not give further references to follow up. May not always give a fair representation of a subject. Often created for entertainment purposes.

Websites

Pros	Cons
Quick access to information Can be kept up to date easily	Not quality checked – anyone can create a website Not always reliable or of an academic standard

Questionnaires

Pros	Cons
Present information in different formats. Can include facts and opinions. Can be an up-to-date source of information.	Can be biased May not give further references to follow up. May not always give a fair representation of a subject. Often created for entertainment purposes.

1.2 OCR Cambridge National in Creative iMedia R093: Creative iMedia in the media industry

Hardware

Description:

Hardware is an item you can physically touch. There is computer hardware in the form of internal components such as the CPU, RAM and Hard Drive. In addition to this, is external computer hardware known as peripheral devices. These are accessories that support the functionality of a computer system.

Multi-functional devices

Description:
There are some devices that can receive and send data (both input and output)

Device	Purpose
Touch screen	A display device that allows the user to interact with a computer by using their finger or stylus.
Graphics tablet	A device that enables a user to hand-draw images, animations and graphics, with a special pen-like stylus.

Input and Output devices

Description:
Input devices allows the computer to receive data.

Device	Purpose
Mouse	It moves a pointer on the screen, allowing the user to select icons, buttons and menus.
Keyboard	Used to enter characters and functions into the computer system by pressing buttons, or keys.
Scanner	Captures images from photographic prints to be stored electronically.

Description:
Output devices that allows the computer to send data.

Device	Purpose
Monitor	Displays the computer's user interface and open programs.
Printer	A device that accepts text/graphic output from a computer and transfers the information to paper.
Speakers	To produce audio output that can be heard by the listener.

Additional hardware

Microphone, Headphones, Computer/Laptop, Headsets.

Software

Description:

Software is a program that can be ran on the computer. Application software is a program designed for users to perform specific tasks. Each type of application software will be able to perform more specialised tasks. However, some can be a little more versatile.

Software used in the three phases:

Pre-production
- Word processing software
- Spreadsheet software
- Desktop publishing software

Production
- Graphic software
- Web authoring software
- Animation software

Post-production
- Audio editing software
- Video editing software

*This list is not exhaustive.

Different types of Software:

Word processing software	Allows the user to create, edit, format, and print written documents.	Database software	Used for storing, manipulating, and managing data.
Spreadsheet software	Displays data in a grid format and allows the user to enter and manipulate data using formulas.	Diary management software	Used to manage emails, calendars and set up appointments.
Presentation software	Used to show information, normally in the form of a slide show.	Graphics editing software	Used to manipulate or enhance digital images.
Desktop publishing software	Designed for creating visual communications in print form. (e.g. posters)	Audio editing software	Allows editing and generating of audio data.
Video-editing software	Involves putting together raw footage of various shots to create a sequence or scene.	Web browser software	Allows users to open and display web pages.
Web-authoring software	A type of desktop publishing tool that allows users to create websites.	Animation software	Allows for the creation of motion on a frame-by-frame basis.

CM11: Mind maps

Description:

Mind Maps are used to organise thoughts into a more formalised structure by having a main idea which branches off into different ideas that link to the central theme. It's a common pre-production document used in the first meeting because it's a quick way to generate new ideas.

Hardware & Software used:

Hardware:

- Mouse
- Keyboard
- Monitor
- Touch screen
- Graphics tablet
- Laptop/Computer

Software:

- Mind map software
- Desktop publishing software

Components of a mind map

Central idea

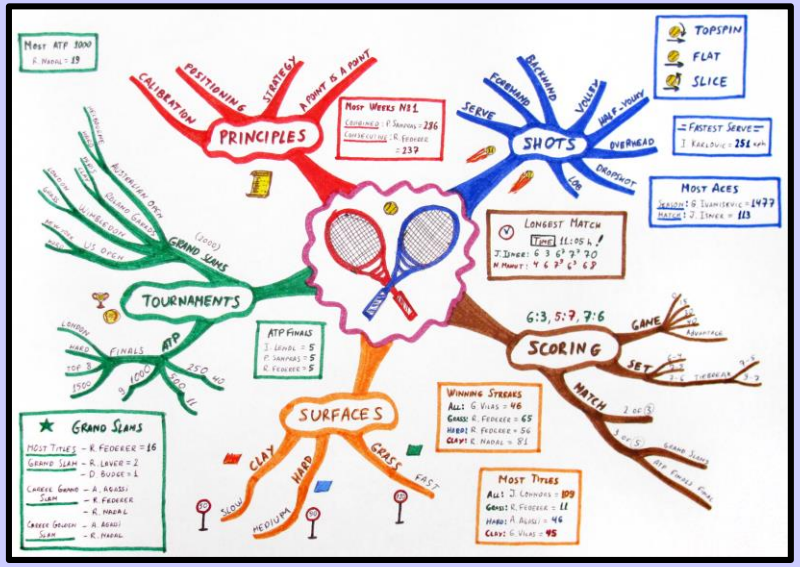
The central idea is what the project is about or what the theme is.

Nodes

Nodes are points connected to the central idea using branches which illustrated how the ideas are related to each other.

Sub-nodes

These are connected to nodes to organise ideas more clearly and provide more detail.



Keywords

Specific words may be used to help express the idea.

Colours

Colours can be used to differentiate between the ideas. Each node is in different colour in this example.

Who would use the mind map?

Creative director, Production manager, Illustrator, Graphics artist, Web designer, Director

CM11: Moodboard

Description:

A moodboard is a collection of sample materials which can be in paper or digital form. It's a way of generating ideas/setting a theme for the product.

Hardware & Software used:

Hardware:

- Mouse
- Keyboard
- Monitor
- Touch screen
- Graphics tablet
- Laptop/Computer
- Microphone
- Headphones
- Speakers
- Headset

Software:

- Desktop publishing software
- Graphics software
- Video editing software
- Presentation software

Components of a mind map

Colours

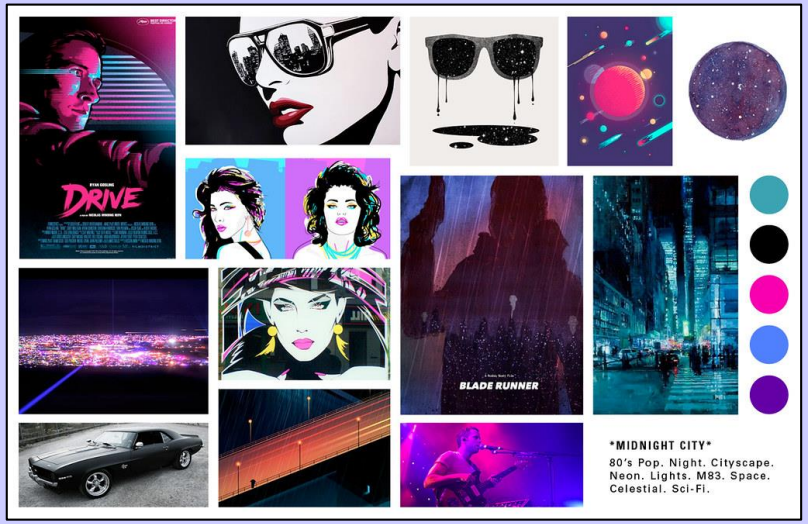
This can be represented with the inclusion of a colour swatch or colour palette.

Fabrics

A physical moodboard may include actual cut-outs of material that are stuck to the paper.

Multimedia assets

A digital moodboard may use videos, audio and animation to express an idea.



Images

Images are a key feature of a moodboard because of the visual representation it provides for the idea.

Text

Text may be used in the form of keywords that represent the theme or to provide information typography and colour schemes that could be used.

Who would use the mind map?

Creative director, Production manager, Illustrator, Graphics artist, Web designer, Director

CM12: Visualisation diagram

Description:

A draft version to plan out a product in a visual way. It can be used to show the client what the final product could look like. This can be a good opportunity for the client to provide useful feedback to the designer.

Hardware & Software used:

Hardware:

- Mouse
- Keyboard
- Monitor
- Touch screen
- Graphics tablet
- Laptop/Computer

Software:

- Desktop publishing software
- Graphics software

People:

Illustrator, Graphics artist, Graphics designer, Content creator, Copywriter and Photographer

Components of a visualisation diagram

Title

This is because it tells you what the graphic is about. In this example, the title has been used to promote a festival, it's name and when it takes place.

Font

This is refers to typography choice such as font colour, size and style. This is helpful as it can help to determine to sizes of headings, sub-headings and the main body of text.

Text

This is refers to information that needs to be on the graphic.

Logo

The most recognisable part which should be easily visible to the viewer.

Colour

This is important because if it's left out then the graphics designer may not known what the colour scheme will be.

Images

This provides a more visual representation of what the product will look. Using clear images make it easier for the graphics designer to understand what assets need to be added.

Annotation

Another term used for labelling and this is important when doing a sketch design because it's not always easy to provide a complete visual representation of the final product. The more annotation, the more information the graphics has to work with.

CM13: Storyboard

Description:

A timeline that is designed to illustrate a sequence of events for content that requires movement. It allows changes to be seen over time, narrative to be included, storylines to be developed through dialogue and allows the ideas to be planned and linked together.

Hardware & Software used:

Hardware:

- Mouse
- Keyboard
- Monitor
- Touch screen
- Graphics tablet
- Laptop/Computer
- Microphone
- Headphones/Headset
- Speakers

Software:

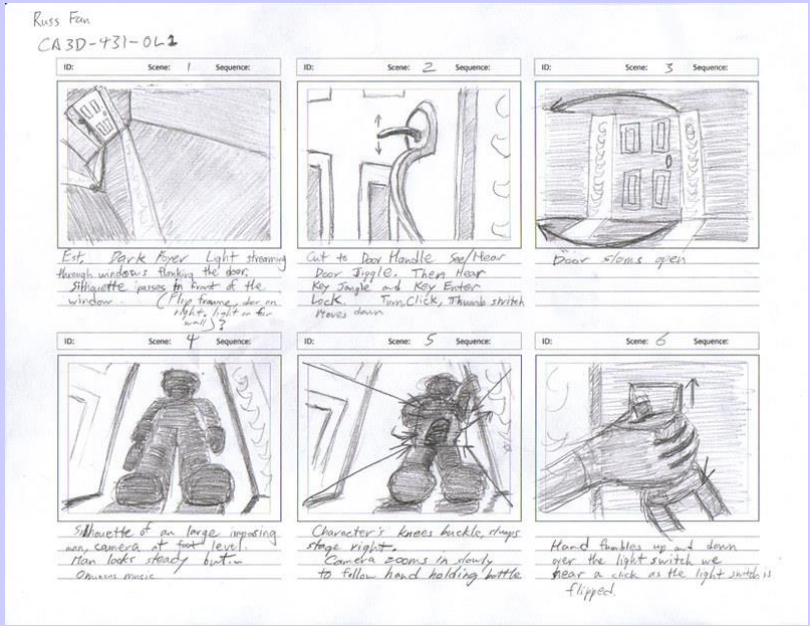
- Desktop publishing software
- Graphics software
- Video editing software

Components of a storyboard

Scene content
This can be inferred from the drawings found in each panel.

Timings
How long each scene will last.

Scene numbers
Each panel will have clearly defined scene number which makes it easier to film these in isolation and use editing techniques to put them together.



Order of panels
The storyboard should follow a logical structure to make it easier to put together.

Location
The scene is filmed outside (EXT) or inside (INT)

Camera
This can be used to identify camera shots, movements and angles. It can also identify camera type such as a virtual camera.

Sound
Background music, dialogue or sound effects could be expressed

Lighting
Specify use of lighting techniques in scenes.

Who would use the storyboard?

Creative director, Camera operator, Audio technician, Illustrator, Graphics artist, Director

CM14: Wireframe

Description:

A planning document that illustrates how a product will look. It will show how pages/screens are linked together and is used commonly for websites and apps. Wireframe focuses more on how the website will look and will be used by a front-end web developer.

Hardware & Software used:

Hardware:

- Mouse
- Keyboard
- Monitor
- Touch screen
- Graphics tablet
- Laptop/Computer

Software:

- Word processing software
- Desktop publishing software

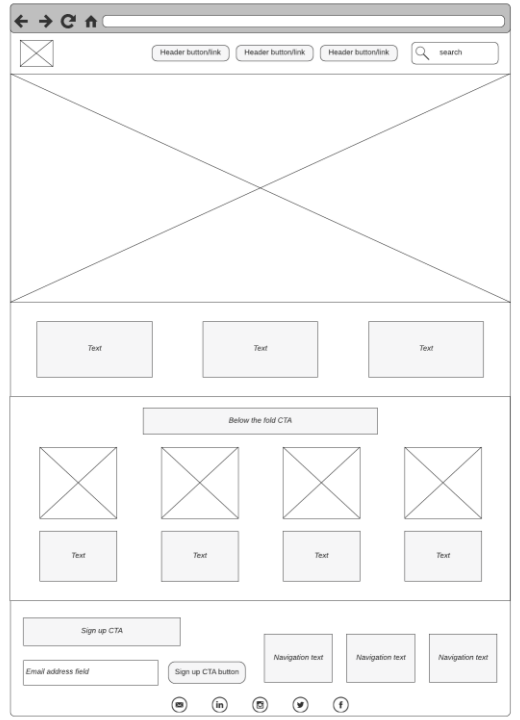
Components of a wireframe

Images
These are usually displayed as a box with a cross which represents an image.

Video
The word video is displayed inside the box.

Text
These are usually displayed as a box with straight lines, the actual copy or by a placeholder text such as Lorem ipsum.

Annotation
This allows the designer to explain how different elements are linked together.



Hierarchy
The importance of a page is created by using headings, most often bold or heavier weighted text, of different sizes and location.

Links
Links are represented most often as blue, underlined text. Links may also be a different colour, keeping in line with a particular visual design direction.

Who would use the wireframe?

Photographer, Web designer, Illustrator, Graphics artist, Web developer

CM15: Legislation for individuals

Description:

Legislation is the process of enacting laws so if they're breached then it can become a criminal office. Some laws are in place to protect individuals when they make a contribution to the creation of a media product.

Permissions when filming

Key facts:

- It's not against the law to film in a place that may include general members of the public.
- You may need to request permission of anyone who has been filmed if it was for commercial purposes.
- If filming takes place on private property then you must ask the land owner for permission.
- Photographers can capture images and sell them on image libraries.

3.4 OCR Cambridge National in Creative iMedia
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Key term:

Defamation the action of damaging the good reputation of someone; slander or libel. Slander is a verbal statement and Libel is a written statement.

Slander

Description:

The action or crime of making a false spoken statement damaging to a person's reputation.

Libel

Description:

A published false statement that is damaging to a person's reputation; a written defamation.

Data protection

Description:

A piece of legislation that aims to protect a person's personal data.

Principles:

- Used for a specific purpose (as shown above)
- Relevant and not more than needed (as shown above)
- Accurate and kept up to date.
- Not kept longer than necessary (e.g. user closes account)
- Stored securely

CM16: Legislation for assets

Description:

Intellectual property is legislation designed stop your work from being copied and distributed without your permission and there are three types of intellectual property: Copyright, Trademarks and Patents which aim to protect ideas.

3.4

OCR Cambridge National in Creative iMedia
R093: Creative iMedia in the media industry

Trademarks

Description:
A sign or logo that identifies a brand or company as a unique entity. This is represented by the TM symbol. The R symbol protects words and phrases.

Using copyrighted materials

Examples:
- Ask permission from the copyright holder.
- Creative commons licensing
- Royalty free – pay a fee to gain a licence to use the image and remove the watermark.
- Stock libraries – assets that are free to use.

Copyright

Description:
- Copyright is the legal right to protect the original work of the people whom it may belong to.
- Copyright can protect….

Books	Music	Art
Images	Sound	Software

Fair use
This is when copyrighted material may be used for news reporting, commentary or educational purposes.

Creative commons licence

Description:
This license allows copyrighted material to be more freely distributed.

Attribution: Material can be copied, modified and used. However, the original creator must be given credit.

Non-commercial: Material can be copied, modified and used as long as there is no intention to make money from it.

Share-a-like: Material can be modified and used but must be covered by a similar license.

No derivative works: Material can be copied and used, but it cannot be modified.

CM16: Asset log

Description:

A pre-production document that is used to record all the assets that are potentially used when creating a media product and understand any legislative constraints there may be.

Hardware & Software used:

Hardware:

- Mouse
- Keyboard
- Monitor
- Touch screen
- Laptop/Computer

Software:

- Word processing software
- Spreadsheet software

Key term:

Assets: in the context of digital media, refers to the different components that can be used in a product such as: text, images, videos, animation and audio.

Components of an asset log

No/Asset ID

A count of how many assets are recorded or to give an asset a unique ID which is useful if the log contains a large volume of assets.

Filename

So the user knows what the file is called if they need to use it.

No.	Filename	Description	Properties	Source	Legal issues	Use
1	Pizza.jpg	Image of a pizza.	800 x 1022 96 DPI	https://clipart.world/pizza-clipart/simple-pizza/	Should only be for personal use.	To be used in the YePizza logo.
2	Pizza paddle.jpg	Pizza paddle	450 x 450	https://www.123rf.com/photo_134983275_pizza-cooking-shovel-icon-isometric-style.html?vti=nbubvpvytl89e1e66y-1-2	Subscription required to download which will remove the watermark.	To be used in the YePizza logo.
3	Phone icon.png	Image of a phone	320 x 431	Client image	Not applicable	To be used to represent contact details on a poster.
4	Wood_fire_pizza.jpg	Image of a pizza that has been in a wood fire oven.	6016 x 4016 96 DPI	https://www.pexels.com/photo/baked-pizza-on-pizza-peel-in-oven-905847/	Free to use	To be included in the promotional poster.
5	Tomatoes.jpg	Image of fresh tomatoes	640 x 320	I took the image myself	Free to use as I'm the original owner.	To be included in the promotional poster to promote how fresh the ingredients are.

Description

To provide a description of what the asset is so the user knows what it is before they open it.

Properties

The resolution and dimensions if it's a digital graphic in case it needs repurposing.

Source

Where the asset has come from by recording the URL.

Legal issues

To record any legal considerations such as whether they need to ask permission to use the asset.

Use

What it will and what it could be used for.

Who would use the asset log?

Graphic artist, Web designer, Games programmer, Animator

CM17: Regulation, Classification and Certification

3.4

OCR Cambridge National in Creative iMedia R093: Creative iMedia in the media industry

Description

The control or guidance of media content by governments and other bodies. This means media production and consumption are monitored.

Example:

Background:

- The ASA banned this Ryanair newspaper campaign featuring scantily-clad flight attendants, ruling that it linked female cabin crew with sexual behaviour.

BBFC

Description:

- The British Board of Film Classification who regulate media content and classify films that are distributed in the UK.

Ofcom

Description:

- The Office of Communications regulate all broadcasted content across UK television channels.

ASA

Description:

- The Advertising Standards Agency regulate all broadcast and non-broadcast content across the UK.

PEGI

Description

- Pan European Game Information have classified all video game content in the UK. It used to be the role of the BBFC.

Key terms:

Certification

This is the award given to a media product as a result of the classification process which is displayed on the product. For example, a film might have an 18 certificate placed on the front cover.

Key terms:

Classification

The process of giving age ratings and content advice to films and other audio-visual content to help children and families choose what's right for them and avoid what's not..

CM19: Distribution considerations

Description:

Distribution is the methods by which media products are delivered to audiences, including the marketing campaign.

Online platforms

Apps

- One of the most popular forms of distribution is they can be accessed via mobile devices
- They can be more responsive than website.
- However, some apps require an internet connection to use, even if they're downloaded onto the device.

Websites

- A popular method of distribution because of it's wider audience reach.
- It's ability to distribute content in different ways such as: videos, audio and images.
- Less favoured to apps as some websites aren't as responsive.
- Some website aren't user friendly especially when using mobile devices to access them.

4.1 OCR Cambridge National in Creative iMedia R093: Creative iMedia in the media industry

Physical media

Examples:

- CD/DVD – Portable and cheap method of distribution but can be easily damaged.
- Memory stick – Portable method distribution but expensive and easy to misplace/lose.
- Paper-based media – A physical method of distribution, no device needed to access but can be expensive to print and transport.

Physical platforms

Computers

- Lots of people have access to a laptop or desktop computer which makes it a good choice to distribute content.
- Not very portable and may need to be constantly plugged in.

Mobile devices

- A small, lightweight and portable platform that allows users to access content on the go.
- Limited battery life and would need to be charged.

Interactive TV

- Providers users with more flexibility and not tied down to a schedule.
- Have to be physically plugged in to access.

Kiosks

- Automated system that provides users with real-time information.
- Fixed in one position and cannot be moved around.

CM20: Static image files

Description:

Static images are images that have no moving elements.

File formats:

JPG:
- This is a bitmap image file format.
- Uses lossy compression.
- Commonly used to store photographs.

PNG:
- This is a bitmap image file format.
- Uses lossless compression.
- Supports transparency
- Commonly used for web graphics.

SVG
- This is a vector image file format.
- Uses lossless compression.
- Small in file size.
- Commonly used for web graphics.

TIFF
- This is a bitmap image file format.
- Uses lossless compression.
- Large in file size.
- Commonly used for print graphics.

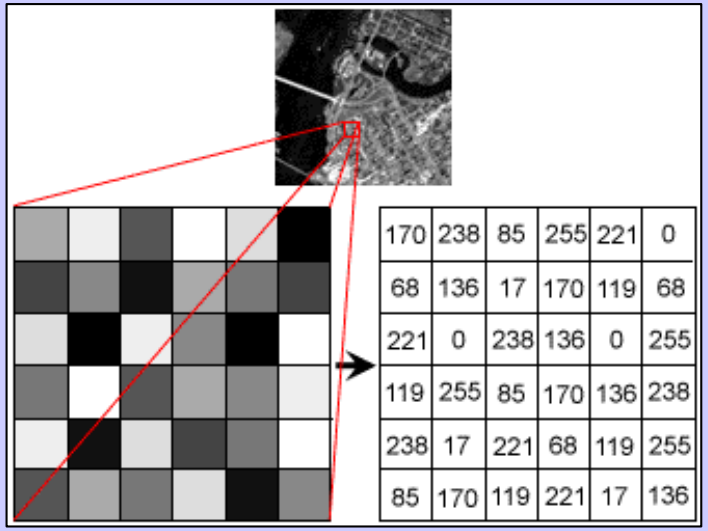
4.2 OCR Cambridge National in Creative iMedia R093: Creative iMedia in the media industry

Vector graphics

Examples:
- Made up of lines of curves using mathematical equations to determine the scale of the graphic.
- It doesn't use pixels and is not dependent on resolution.
- Commonly used to create logos.

Bitmap images

Description:
Made up of pixels which help to determine the dimensions of an image which is measured by the number of pixels in height x number of pixels in length.



Resolution:
- The number of pixels stored in an image.
- Measured in PPI (Pixels per inch)/DPI (Dots per inch)
- Higher the resolution, the much sharper the quality of the image will be.
- Recommended resolution for a print graphic is 300 DPI.
- Recommended resolution for a web graphic is 72 DPI.

CM20: Compression

Description:

Compression is an algorithm designed to reduce the size of a file. There are two types of compression: Lossy and Lossless.

Lossy and Lossless Compression:

Lossy Compression	Lossless Compression
It reconstructs all the original data but this means data is lost during the compression process.	Data is reconstructed and doesn't remove any data.
Once data is removed, it's permanent and cannot be restored. It's irreversible.	Because data is retained, it's reversible so changes can continue to be made.
This can impact the overall quality of the graphic.	The overall quality of the graphic is retained.
It does significantly reduce the overall size of the file.	The size of these files tend to be large.
JPG is a common file format that uses lossy compression.	PNG are common file formats that use lossless compression.

4.2 OCR Cambridge National in Creative iMedia
R093: Creative iMedia in the media industry

Impact on size:

cafe wonderland teaparty	08/09/2020 12:38	JPG File	84 KB
cafe wonderland teaparty	10/05/2019 10:51	Adobe Photoshop...	2,449 KB

Example:

The top file has been compressed using lossy and this will:

- Save space on the device it's being stored.
- Use less bandwidth if file is transferred over a network (i.e. e-mail)

Impact on quality:

Example:

As you can see above, the image at the top has been saved in a lossless format whereas the image below, has been saved in a lossy format. You can see that the quality of the image below has reduced because data has been permanently removed.

Remember:

- Lossy and Lossless can impact audio and moving images.

CM21: Audio files

Description:

Audio can be in the form of music, dialogue and sound effects.

File formats:

MP3:
- This is a lossy file format.
- Small file size
- Stored on portable devices.

WAV:
- This is a lossless file format.
- No quality is lost.
- Used for studio recordings.

AAC:
- This is a lossy file format.
- Maintains a high quality of sound.
- The format for standard music for iTunes, Android etc…

FLAC:
- This is a lossless file format.
- Maintains all the data so quality retained.
- Can reduce file size.

4.2

OCR Cambridge National in Creative iMedia
R093: Creative iMedia in the media industry

Bit depth

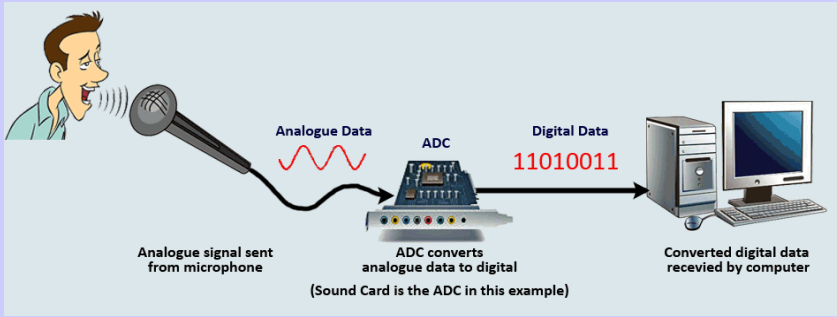
Uncompressed audio formats

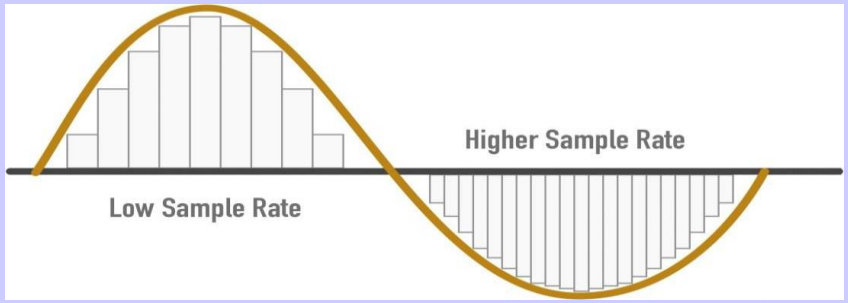
Bit Depth	Sample Rate	Application
16 bit	44.1 kHz	CD quality audio
24 bit	48 kHz	High quality music production
24 bit	96 kHz	Archival quality audio

BLOG.LANDR.COM

Description
Bit depth is the number of bits available for each sample . If the bit depth increases it can increase the dynamic range of volume (this affects how loud the sound will be). This will also contribute to the quality of the sound file improving.

How sound becomes digitised





Analogue to Digital
During the conversion process, samples are taken that are then converted from analogue into a digital recording.

Sampling
When sound is recorded, samples are taken at regular intervals as you can see in the diagram on the right. The sample rate is measured in Hz (Hertz). The more samples taken improves the playback quality.

CM22: Moving image files

Description:

Moving images can be in the form of a video or animation.

File formats:

MP4:
- This is a lossy file format.
- Small file size
- Used for streaming videos and films.

AVI:
- This is a lossless file format.
- No quality is lost.
- Used for editing raw footage.

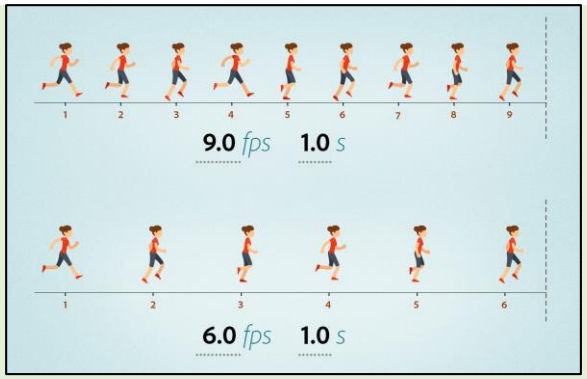
MPEG:
- This is a lossy file format.
- Maintains a high quality of sound.
- Used to be broadcasted on TV and released on DVD's

MOV:
- This is a lossy file format.
- Only compatible on Apple devices such as iPhone, iPad etc..

GIF and SVG

4.2 OCR Cambridge National in Creative iMedia
R093: Creative iMedia in the media industry

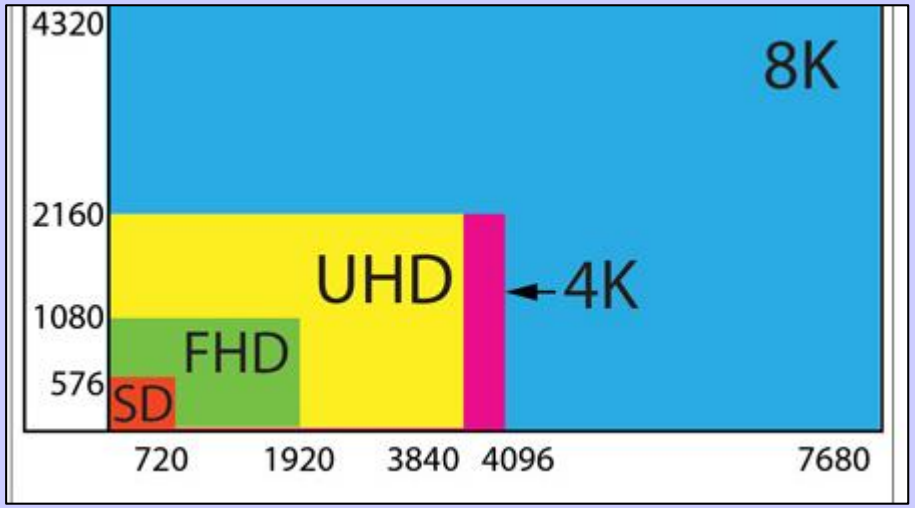
Frame rate



Description
Frame rate (frames per second or fps) is the speed at which individual still photo (frames) are projected onto a screen.

Impact
- A higher frame rate leads to a smoother motion.
- If the frame rate is too fast it will blur the details of the animation.
- If the frame rate is too slow will have a start/stop and jittery non-fluid effect.

Resolution



Description
Video resolution determines the amount of detail in your video, or how realistic and clear the video appears and is measured by the number of pixels. Examples include:
- SD (Standard)
- HD (High Definition)
- 4K UHD (4K Ultra High Definition)
- 8K UHD (8K Ultra High Definition)

Drama

Key information about the topic

This half term you will working on Component 1 *The Exam* - Interpreting Theatre. This is a written examination: 1 hour 30 minutes. There are 60 marks available. 45 marks on I Love You, Mum- I Promise I Won't Die (set text) and 15 marks on Live Theatre.

You will be focused on I Love You, Mum- I Promise I Won't Die content and context this half term.

We will look at structuring exam answers and creating your own response to the work as a performer, designer, director and audience member.

Component 2 Section A

For your set text I Love You, Mum- I Promise I Won't Die you will need to consider how the text is constructed and how performances create meaning through:

- the characteristics of the performance text, including, genre, structure, character, form and style, language/dialogue, stage directions
- the social, historical and cultural context including the theatrical conventions of the period in which the performance text was created
- how meaning is interpreted and communicated through; performance conventions, use of performance space and spatial relationships on stage, including the impact of different stages (proscenium arch, theatre in round, traverse and thrust) on at least one scene, relationships between performer and audience, the design of lighting, sound, set (including props) and costume and make-up, the actor's vocal and physical interpretation of character.

Thinking Questions

- Do I know what the teacher wants me to do?
- Do I know how to get the best marks possible?
- How do I find more information?
- Have I communicated everything I wanted to?
- Does everyone know what I mean?
- Have I included as many key terms in my writing as possible?
- Can I do more research on my own?
- How can I extend my work?

Evidence required

You will need take part in workshops, read the script, take notes, practice exam questions.

Mark Scheme

The exam requires you to - Create and develop ideas to communicate meaning for theatrical performance / Apply theatrical skills to realise artistic intentions in live performance / Demonstrate knowledge and understanding of how drama and theatre is developed and performed / Analyse and evaluate their own work and the work of others.

Top marks – You need to look at the mark schemes for the questions and to find out what each style of question needs to you discuss.

Key words

Action / Alter ego / Back story / Chorus/ chorus work / Collage / Communal voice / Conscience corridor (also known as 'conscience alley' or 'thought tunnel') / Flashback / Forum theatre / Frame distancing / Freeze-frame / Hot-seating / Improvisation / Narration / Narrator / Pace / Pause / Pitch / Ranking / Rehearsal techniques / Role reversal / Role transfer / Sculpting / Soundscape / Split screen / Tableau(x) / Tempo / Thoughts in the head or thought tracking / Transporting a character / Alienation / Anti-climax / Arena staging / Aside / Audience / Auditorium / Caricature / Character / Climax / Composite setting / Dance drama / Dramatic irony / Dramatic tension / End on staging / Epic theatre / Fourth wall / Genre / Monologue / Naturalism / Physical theatre / Promenade staging / Proscenium / Realism / Style / Subtext / Theatre in the Round / Thrust stage / Traverse stage

Drama

TASK 1

Re-read the entire play of I Love You, Mum- I Promise I Won't Die by Mark Wheeller. Try to find others to read this with you to give an idea of different characters.

TASK 2

Annotate the I Love You, Mum- I Promise I Won't Die script with key notes on staging and performance. E.g. key movements of characters, how lines are delivered, etc.

TASK 3

Make a mind-map on key storylines, subtext, characters, and motives. These should all interlink and show the connections between each character.

TASK 4

Draw out the set designs as they would have been for the play's original context, and an alternative version with a different staging type and style.

TASK 5

Make yourself a mindmap / poster which explains key design elements such as—staging types / lights and lighting techniques / sound / set / props. Ensure that you explain WHAT they are, HOW they are used and WHY you will use them in your performance.

TASK 6

Review the feedback you have received following your practice MOCK. Pick one of the larger (10 or 15) mark questions and re-write this. You should aim to increase your mark by at least 3 marks where possible. Look at the marking criteria and comments from teachers.

TASK 7

The teacher will set another task here that is individual to you and your needs based on your work this half term.

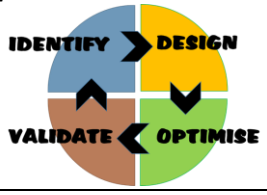
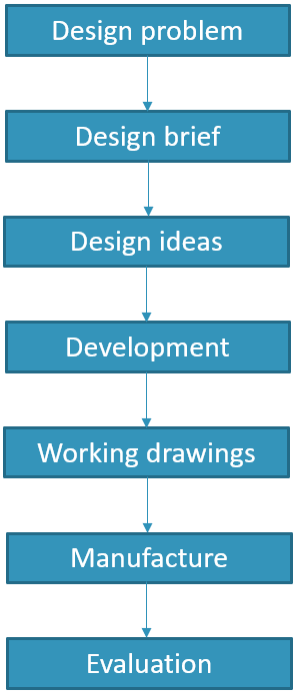
EXTRA WORK

If you want extra work to push yourself further -

Watch as many performances of I Love You, Mum- I Promise I Won't Die as you can find online.
You need to look at the design ideas, how the actors chose to show each of the characters, key techniques used in performance, how the director has chosen to communicate meaning.
Think about how it is different from the original performance conditions.

Revision Topics R038

You will need to revise the following topics:

<table>
<tr><td>Design Cycle and phases:
 
</td><td>
<table>
<tr><td>Identify</td><td>Brief</td><td>Research</td><td>Process Planning</td></tr>
<tr><td>Design</td><td>Specification</td><td>Design</td><td>Manufacturing Plan</td></tr>
<tr><td>Optimise</td><td>Prototyping</td><td>Error proofing</td></tr>
<tr><td>Validate</td><td>Test</td><td>Evaluate</td></tr>
</table>
</td></tr>
<tr><td>Design process</td><td>
<table>
<tr><td> 
</td><td>
<table>
<tr><td>Design Problem – client’s problem that needs to solve. Interview will to conducted and further research to create final design brief
• Existing product analysis
• Customer survey
• Materials and manufacturing method – linked to scale of production and cost</td></tr>
<tr><td>Design Brief – a statement about the design problem to be solved.
• Further research will create a design specification – success criteria for a yet to be designed product</td></tr>
<tr><td>Design ideas – solutions to the design brief and design specification</td></tr>
<tr><td>Development – ideas are tested and developed to create an optimal solution that answers the design brief and specification</td></tr>
<tr><td>Working drawing – detailed drawing that gives manufactures the information they need to construct the design/product. Sizes, materials, finishes and manufacturing processes.</td></tr>
<tr><td>Evaluation – the success of the product is reviewed against the design specification after testing. Modifications may be made.</td></tr>
</table>
</td></tr>
</table>
</td></tr>
<tr><td>Design brief</td><td>Design Brief – a statement about the design problem to be solved.
The client will be interviewed to find out about the problem. Some basic research conducted to develop and write the brief.
<u>The problem will be identified, along with basic features/functions and target market.</u>
Budget, scale of production and branding may be included</td></tr>
<tr><td>Design specification</td><td>Design Specification – a success criteria for a yet to be designed product. A statement about the product and what it should be or do or be with a reason why. Specification points should always be backed up by research.

It is a very important document that allows the designer to evaluate and review designs to make sure they answer the original problem (Design Brief).</td></tr>
<tr><td>Types of research</td><td>• Primary research – first-hand information. Surveys, questionnaires, interviews, observations/photographs, tests. You have physically undertaken the research yourself and created the information/data first hand. This method will give you accurate high quality information but is more time consuming than secondary research and therefore costs more.
• Secondary – second hand information. Someone else has created the information or data. Types include internet research, books, magazines. Secondary research is quicker than primary but not provide exactly the information you need.</td></tr>
<tr><td>Linear design</td><td>A design strategy with very little testing (prototypes/models) and development.</td></tr>
</table>

<table>
<tr><td></td><td>Quicker and less expensive than iterative design but is less developed.
Suitable for simple products or products that need to be designed and developed quickly.</td></tr>
<tr><td>Iterative design</td><td>A design strategy with lots of testing (prototypes/models) and development.

It takes a long time to test and develop products and so is more expensive than linear design.
Suitable for more complex products.</td></tr>
<tr><td>Inclusive design</td><td>A design process where the needs of specific groups of people are considered who may be traditionally excluded.

A good example is a pedestrian crossing: the lowered/drop curb for wheelchair or pram users. The rumble/textured tiles for the blind with canes. Buzzer for blind people to tell them when to cross. Flashing light for the deaf. Lowered button for wheelchair users.</td></tr>
<tr><td>User centred design</td><td>A design process where the needs of the user are used to develop a product. A product is tested and developed using the feedback of the user/s feedback. Focus groups and product testing are especially important.</td></tr>
<tr><td>Sustainable design

• Finite: will run out
• Non-finite: will not run out – timber, paper, cotton, bamboo etc
• Renewable: can be replaced
• Biodegradable: can break down/rot naturally</td><td>A design process that aims to make a product as environmentally friendly as possible (reduce the impact on the environment).
We must choose materials and manufacturing methods very carefully. Other factors that should be considered are material extraction/refining and transportation.

6 Rs of sustainability should be considered to help reduce the environmental impact of a new product:
1. Recycle – can the product be designed in a way to make it easier to take apart and recycle? Can the materials be recycled?
2. Repair – can the product be designed in a way that makes it easier to fix and extend its life?
3. Reuse – can the product be reused at the end of its life (extend its life)?
4. Refuse – should we refuse to use certain materials that are damaging to the environment? Are they difficult to recycle or damaging when they are refined or extracted?
5. Rethink – can we change the design to reduce its impact?
6. Reduce – can we reduce the amount and number of materials and energy required to manufacture the product?</td></tr>
<tr><td>Ergonomic design</td><td>To design a product to be more comfortable, safe, and easier to use.
Ergonomic factors:
• Size
• Shape
• Texture
• Weight
• Colour
Anthropometric data = sizes of the human body needed to create safe and comfortable products</td></tr>
<tr><td>ACCESSFM – product analysis and writing design specifications

• Why is a product the way that it is?

• How can a product be improved?</td><td>
<table>
<tr><td>Aesthetics</td><td>• Appearance - Size, shape, colour, texture of a product. Branding is also an important factor.
• How will you make it appealing?</td></tr>
<tr><td>Cost</td><td>What price should the product be? – link to materials, manufacturing, transport, retail (shop) price</td></tr>
<tr><td>Customer</td><td>Who is the customer?
• Target market – gender, age range, lifestyle.
• What do they want/need?</td></tr>
<tr><td>Environment</td><td>How will you make the product environmentally friendly?
• Reduce the impact a product has on the environment
• Location – where will it be used? How will this affect its design?</td></tr>
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</td></tr>
</table>

<table>
<tr>
<td>• Find strengths and weaknesses or a starting point.</td>
<td>
<table>
<tr><td></td><td>• Design for disassembly – how can you make the product easier to repair/fix?</td></tr>
<tr><td>Size</td><td>What size a product should be - link to anthropometric data and ergonomics and where it will be used (location).
• Size of materials and components</td></tr>
<tr><td>Safety</td><td>How will you make the product safe?
• Safety of the final user – link to materials, design features and ergonomics.
• Manufacture (DFMA – design for manufacturing assembly – how to make it safer and easier for the production line</td></tr>
<tr><td>Function</td><td>What a product does – this will be many factors</td></tr>
<tr><td>Materials
Manufacture</td><td>What type of material properties are required to answer the brief or specification?
Cost – determine appropriate materials and manufacturing methods
Scale of production – linked to materials and manufacturing selection.</td></tr>
</table>
</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer aided design
<table>
<tr><th>Advantages</th><th>Disadvantages</th></tr>
<tr><td>Changes (edits/modifications) can be made quickly</td><td>Expensive to set up</td></tr>
<tr><td>Ideas can be tested virtually to reduce prototyping costs and reduce design time</td><td>Expensive to train staff</td></tr>
<tr><td>Accurate – compared to hand drawings</td><td>Data can become corrupted, and work lost</td></tr>
<tr><td>Improved communication - designers can work together on the same CAD drawing to reduce design time</td><td></td></tr>
</table>
Computer aided manufacture – CAD drawings can be used to control items of CAM machinery e.g., laser cutters and 3d printers.
</td>
</tr>
<tr>
<td>Physical and virtual prototype</td>
<td>Prototype – test, model. Can be part or a whole of the product.
• Aesthetical prototype – test the appearance
• Functional prototype – test its function
• Electrical prototype – test electrical components, circuits, coding
Virtual prototype (computer based) – CAD simulation of design
Physical protype – real life model
<table>
<tr><th>Virtual prototype</th><th>Virtual prototype</th><th>Physical protype</th><th>Physical protype</th></tr>
<tr><td>Advantages</td><td>Disadvantages</td><td>Advantages</td><td>Disadvantages</td></tr>
<tr><td>Cheaper than a physical model</td><td>Test data may be inaccurate.</td><td>A real sense of the product can be achieved. Missing elements from virtual model/testing can be identified.</td><td>Expensive – requires highly skilled people to make</td></tr>
<tr><td>Quicker to create than a physical model</td><td>Virtual models do not give a true/real sense of the product being designed and developed.</td><td>More accurate testing data can be gathered from a physical model rather than the predictions of a virtual model.</td><td>Time consuming – delays development time</td></tr>
</table>
</td>
</tr>
</table>

1. Characters

Inspector Goole	Moral compass / Catalyst for change / Priestley's social and political mouthpiece
Mr Arthur Birling	Rejects social mobility / Epitome of industrialist greed / Capitalist mentality
Mrs Sybil Birling	Blissfully ignorant / Symbolises the hypocrisy of the generation / Callous and uncompassionate
Sheila Birling	Potential for seismic change / Undergoes a transformative journey / Frivolous and child-like
Eric Birling	Product of his environment / Reckless youth / Potential for change
Gerald Croft	Bound by social construct / Arguably less culpable than Mr and Mrs Birling / Symbol of the fickle attitude of the aristocratic world
Eva Smith / Daisy Renton	Symbolises the plight of the working class / Unfortunate victim of circumstance / Represents the disparity between the classes

2. Plot

Act 1	Sheila and Gerald's engagement is celebrated
Act 1	Birling says there will be no war; references Titanic
Act 1	Inspector arrives; a young girl has committed suicide
Act 1	Birling threw her out after strike; Sheila had her fired for laughing
Act 2	Gerald had an affair with Daisy Renton
Act 2	Mrs Birling refused to give charity to Eva; blames father
Act 3	Eric's involvement revealed; possible rape hinted at
Act 3	Inspector leaves. Gerald returns; met policeman, no Inspector Goole
Act 3	Telephone rings; an Inspector is coming

3. Vocabulary

Apathy
Nuances
Indifferent
Neoteric
Social critique
Proselytise
Ethics / **E**galitarian / **E**thereal
Collective conscience
Tumultuous
Oppressive
Rhetoric
Culpable
Allegory
Laissez-faire
Laced / **L**iberal
Social mouthpiece / **S**cathing

4. Key quotations

Birling's confidence	'We're in for a time of steadily increasing prosperity'
Birling on society	'the way some of these cranks talk and write now, you'd think everybody has to look after everybody else'
Sheila's recognition	'but these girls aren't cheap labour – they're *people*'
Sheila's regret	'it's the only time I've ever done anything like that, and I'll never, never do it again to anybody'
Sheila on the Inspector	'we all started like that – so confident, so pleased with ourselves until he began asking us questions'
Sheila on Eric	'he's been steadily drinking too much for the last two years'
Inspector on guilt	'I think you did something terribly wrong – and that you're going to spend the rest of your life regretting it'
Mrs Birling defends herself	'she was claiming elaborate fine feelings and scruples that were simply absurd in a girl in her position'
Eric explains	'I'm not very clear about it, but afterwards she told me she didn't want me to go in but that – well, I was in that state when a chap easily turns nasty – and I threatened to make a row'
The Inspector says	'but each of you helped to kill her. Remember that'
Inspector's message	'millions and millions of Eva Smiths and John Smiths…their lives, their hopes and fears, their suffering, and chance of happiness, all intertwined with our lives…We do not live alone. We are members of one body'

5. Themes

- Social divide
- Generational divide
- Capitalist greed
- Power and control
- Attitudes towards women
- Lack of social mobility
- Responsibility
- Class struggle
- Family

6. Theatrical Stagecraft: Dramatic Devices

1. Dramatic irony	the audience knows what the characters don't
2. Stage directions	Instructions for the actors; often revealing
3. Setting	Constant throughout but subtle changes e.g. lighting
4. Tension	Builds up throughout the play
5. Resolution	Is there even one?

7. Key concepts and context

1912	Play is set here; just before WWI and sinking of the Titanic
1945	Priestley wrote the play then; start of the welfare state and ideals of social equality made real
Social responsibility	Or socialism; we must all look after each other
Capitalism	Business should make money no matter the human cost; we are all responsible only for ourselves
Class	A gulf exists between the upper and lower classes
Age	Old vs young; new and old ideas counterposed
Attitudes to women	Patriarchal leading to misogyny

1. Characters	
Inspector Goole	
Mr Arthur Birling	
Mrs Sybil Birling	
Sheila Birling	
Eric Birling	
Gerald Croft	
Eva Smith / Daisy Renton	

2. Plot	
Act 1	
Act 1	
Act 1	
Act 1	
Act 2	
Act 2	
Act 3	
Act 3	
Act 3	

3. Vocabulary

4. Key quotations	
Birling's confidence	
Birling on society	
Sheila's recognition	
Sheila's regret	
Sheila on the Inspector	
Sheila on Eric	
Inspector on guilt	
Mrs Birling defends herself	
Eric explains	
The Inspector says	
Inspector's message	

5. Themes
Social divide
Generational divide
Capitalist greed
Power and control
Attitudes towards women
Lack of social mobility
Responsibility
Class struggle
Family

6. Theatrical Stagecraft: Dramatic Devices	
1. Dramatic irony	
2. Stage directions	
3. Setting	
4. Tension	
5. Resolution	

7. Key concepts and context	
1912	
1945	
Social responsibility	
Capitalism	
Class	
Age	
Attitudes to women	

1. Characters	
Inspector Goole	
Mr Arthur Birling	
Mrs Sybil Birling	
Sheila Birling	
Eric Birling	
Gerald Croft	
Eva Smith / Daisy Renton	

Complete each box, adding the soundbites for each character.

2. Plot	
Act 1	
Act 1	
Act 1	
Act 1	
Act 2	
Act 2	
Act 3	
Act 3	
Act 3	

List things that happen in each act. Each box must be filled in.

4. Key quotations	
Birling's confidence	
Birling on society	
Sheila's recognition	
Sheila's regret	
Sheila on the Inspector	
Sheila on Eric	
Inspector on guilt	
Mrs Birling defends herself	
Eric explains	
The Inspector says	
Inspector's message	

Complete with key quotations

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2. Plot	
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Act 3	Telephone rings; an Inspector is coming

Paper 1 Q2: Language Subject Terminology

4. Word Classes

Noun	Identifies a person (girl), thing (wall), idea (luckiness) or state (anger).
Verb	Describes an action (jump), event (happen), situation (be) or change (evolve).
Adjective	Describes a noun (**happy** girl, **grey** wall).
Adverb	Gives information about a verb (jump **quickly**), adjective (**very** pretty) or adverb (**very quickly**).

5. Sentence Structures

Fragment	An incomplete sentence (no subject verb agreement). *"Nothing." "Silence everywhere."*
Simple	A sentence with one independent clause. *"She went to the shop."*
Compound	A sentence with multiple independent clauses. *"She went to the shop and bought a banana"*
Complex	A sentence with one independent clause and at least one dependent clause. *"Sometimes, when she goes to the shop, she likes to buy a banana."*

6. Language Techniques

Lexis	The vocabulary of a language.
Hyperbole	The use of extreme exaggeration.
Imagery	When the writer provides mental "pictures".
Irony	Like sarcasm, where the opposite is implied.
Juxtaposition	Two ideas together which contrast each other.
List (of three)	A number of connected items (three= effect).
Metaphor	Something is presented as something else.
Oxymoron	Contradictory terms together "*bittersweet*".
Pathos	Language used to appeal to the emotions.
Personification	Giving human traits to something non-human.
Repetition	When a word, phrase or idea is repeated.
Semantic Field	A set of words from a text related in meaning.
Simile	Something is presented as like something else.
Symbolism	An idea is reflected by an object/character etc.
Syntax	The way words and phrases are arranged.

1. This Quotation/ Reference…

Achieves	Advances	Affects
Allows	Alludes to	Builds
Concludes	Confirms	Conveys
Denotes	Develops	Demonstrates
Displays	Justifies	Exaggerates
Encourages	Enhances	Establishes
Exemplifies	Emphasises	Explores
Exposes	Forces	Generates
Highlights	Hints	Identifies
Ignites	Illustrates	Impacts
Implies	Identifies	Indicates
Initiates	Introduces	Involves
Justifies	Juxtaposes	Kindles
Launches	Leads to	Maintains
Manifests	Notifies	Offers
Portrays	Presents	Produces
Progresses	Promotes	Prompts
Provokes	Questions	Represents
Reveals	Reinforces	Signifies
Sparks	Suggests	Supports
Symbolises	Transforms	Triggers
Typifies	Upholds	Underscores
Validates	Verifies	Yields

2. Stock Phrases

Creates a picture of…
Paints an image of…
Reinforces the view that…
Emphasises the writer's point that…
Exemplifies the idea that…

3. Sophisticated Discourse Markers

Whilst	Although	Despite
Since		

7.Cause and Effect Discourse Markers

Therefore	Thus	As a result
Consequently		

Paper 1 Q3: Structural Subject Terminology

8. Types of Narrator

Limited 3rd person	External narrator with knowledge of one character's feelings (he).
Omniscient 3rd person	External narrator- knowledge of more than one character's feelings (he).
1st person	Told from a character's perspective (I).
2nd person	Directed to the reader (you).
Unreliable narrator	When the perspective offered makes us question the narrator's credibility.

9. Narrative Styles

Linear	Events are told chronologically.
Non-Linear	Events are not told chronologically.
Dual	Told from multiple perspectives.
Cyclical	Ends the same way it begins.

10. Explaining the Extract.

Focusing	Our attention is aimed somewhere.
Introducing	An idea or character is first shown.
Building	When an idea/tension is increased.
Developing	An earlier point is extended.
Changing	A shift is created for an event/idea.
Concluding	Ideas/ events are drawn to a close.

11. Structural Techniques

Atmosphere	The mode or tone set by the writer.
Climax	The most intense or decisive point.
Dialogue	The lines spoken by characters.
Exposition	The start where ideas are initiated.
Analepsis	(flashback) Presents past events.
Prolepsis	flashforward Present future events
Foreshadowing	Hints what is to come(can mislead).
Motif	A recurring image.
Resolution	Th recurring element in a story e answer or solution to conflict.
Setting	A geographical/historical moment.
Spotlight	Emphasis is placed on something.
Shift	A switch or change of focus.
Tension	The feeling of emotional strain.

Terms for Analysis: The poem…

Achieves	Advances	Affects	Symbolises
Allows	Alludes to	Builds	Transforms
Concludes	Confirms	Conveys	Typifies
Denotes	Develops	Demonstrates	Reinforces
Displays	Justifies	Exaggerates	Offers
Encourages	Enhances	Establishes	Presents
Exemplifies	Emphasises	Explores	Portrays
Exposes	Forces	Generates	Questions
Highlights	Hints	Identifies	Provokes
Ignites	Illustrates	Impacts	Signifies
Implies	Identifies	Indicates	Juxtaposes

Comparative Connectives

Compare
- Similarly
- In the same way
- Like
- Likewise

Contrast
- On the other hand
- Differently
- Alternatively
- Contrary to
- On the contrary

Structural Techniques

Rhythm	The beat of the poem
Volta	The point in the poem where the mood changes
Caesura	A deliberate break or pause in a metric line
Enjambment	Sentences running on over more than one line
Stanza	A group of lines in a poem
Rhyme	Words that have the same rhyming sound
Rhyme Scheme	Patterns of rhyming words
Meter	The pattern of stressed and unstressed syllables
Free Verse	Lines of poetry that do not follow any regular metrical structure
Blank Verse	Lines of poetry that are unrhymed but follow a regular meter
Repetition	Repeated words or phrases
Anaphora	The repetition of words or phrases at the beginning of a line or sentence

Language Techniques

Simile	A comparison using *like* or *as.*
Metaphor	A comparison using *is*, *was* or *were.*
Imagery	When the writer creates a mental picture or image.
Symbolism	The use of "symbols" to signify or connote particular (usually well-established) ideas.
Motif	A recurring image in a poem.
Personification	Giving human attributes to something non-human.
Zoomorphism	Giving animal attributes to something which is not an animal.
Oxymoron	Two words which directly contrast, placed together.
Alliteration	Repeating the same letter.
Connotations	Associated words or meanings.
Pathos	Creating a strong emotional effect.
Semantic field	A group of words related by meaning.
Emotive Language	Language which appeals to the emotions.
Hyperbole	The use of exaggeration for dramatic effect
Imperatives	Command words which direct the reader.
Syntax	The order of words within a line.
Sibilance	Repetition of the S sound.
Euphony/ Cacophony	Pleasant sounds/ Harsh and discordant sounds

Poetry Key Terms

Word classes	Nouns, adjectives, adverbs, verbs, pronouns
Language	Word choices made by the poet
Structure	How the poem appears - the order and flow
Form	Physical layout of the poem, what kind of poem it is
Tone	How a text sounds, e.g. humorous or serious
Mood	How readers feel or respond to texts, e.g. playful, lonely, warm
Theme	Underlying messages, or "big ideas"

Number of lines in or within a poem		**Couplet** **Rhyming Couplet**	2
Tercet	3	**Sestet**	6
Quatrain	4	**Septet**	7
Quintet	5	**Octave**	8
Sonnet	A 14-line poem		

Tier 2 Vocabulary Bank- Add as you go

Poem	Tier 2 Vocabulary
Storm on the Island	
London	
My Last Duchess	
The Charge of the Light Brigade	
Exposure	
Strom on the Island	
Bayonet Charge	
Remains	
Poppies	
War Photographer	
Tissue	
The Emigree	
Checking Out Me History	
Kamikaze	

Unit 2c

The Challenge of Resource Management

AQA

Resource Challenges

Resources are things that humans require for life or to make our lives easier. Humans are becoming increasingly dependent on exploiting these resources, and as a result they are in high demand.

Significance of Water

Resources such as food, energy and water are what is needed for basic human development.

FOOD

Without enough nutritious food, people can become **malnourished**. This can make them ill . This can prevent people working or receiving education.

WATER

People need a supply of **clean and safe water** for drinking, cooking and washing. Water is also needed for food, clothes and other products.

ENERGY

A good supply of energy is needed for a basic standard of living. People need **light and heat** for cooking or to stay warm. It is also needed for industry.

Demand outstripping supply

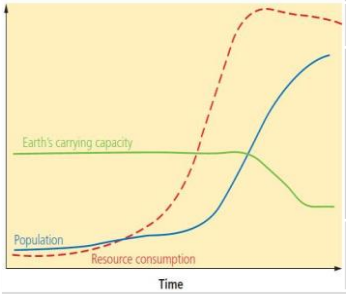
The demand for resources like food, water and energy is rising so quickly that supply cannot always keep up. Importantly, access to these resources vary dramatically in different locations

1. Population Growth

- Currently the global population **is 7.3 billion**.
- Global population has risen **exponentially** this century.
- Global population is expected to reach **9 billion by 2050**.
- With more people, the **demand** for food, water, energy, jobs and space **will increase**.

2. Economic Development

- As **LICs** and **NEEs** develop further, they require **more energy** for industry.
- **LICs** and **NEEs** want similar lifestyles to **HICs**, therefore they will need to **consume more resources**.
- Development means **more water is required** for food production as diets improve.



Resource Reliance Graph

Consumption – The act of using up resources or purchasing goods and produce.
Carry Capacity – A maximum number of species that can be supported.

Resource consumption exceeds Earth's ability to provide!

3. Changing Technology and Employment

- The demand for resources has driven **the need for new technology** to reach or gain more resources.
- More people in the **secondary and tertiary industry** has increased the **demand for resources** required for electronics and robotics.

Food in the UK

Growing Demand

- The UK imports about 40% of its food. This increases people's **carbon footprint**.
- There is growing demand for greater choice of **exotic foods** needed all year round.
- Foods from abroad are more affordable.
- Many food types are unsuitable to be grown in the UK.

Impact of Demand

Foods can travel long distances (food miles). Importing food adds to our carbon footprint.
+ Supports workers with an income
+ Supports families in LICs.
+ Taxes from farmers' incomes contribute to local services.
- Less land for locals to grow their own food.
- Farmers exposed to chemicals.

Agribusiness

Farming is being treated like a large industrial business. This is increasing food production.
+ Intensive faming maximises the amount of food produced.
+ Using machinery which increases the farms efficiency.
- Only employs a small number of workers.
- Chemicals used on farms damages the habitats and wildlife.

Sustainable Foods

Organic foods that have little impact on the environment and are healthier have been rising.
Local food sourcing is also rising in popularity.

- **Reduces emissions** by only eating food from the UK.
- **Buying locally sourced** food supports local shops and farms.
- A third of people **grow their own food**.

Energy in the UK

Growing Demand

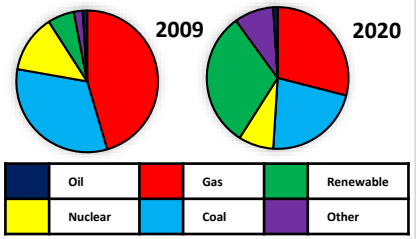
The UK **consumes less energy** than compared to the 1970s despite a smaller population. This is due to the **decline of industry**.

Energy Mix

The majority of UK's energy mix comes from **fossil fuels**. By 2020, the UK aims for 15% of its energy to come from **renewable sources**. These renewable sources do not contribute to **climate change**.

Changes in Energy Mix

- 75% of the UK's oil and gas has been used up.
- Coal consumption has declined.
- UK has become too dependent on imported energy.



Water in the UK

Growing Demand

The average water used per household has risen by 70%. This growing demand is predicted to increase by 5% by 2020.
This is due to:

- A growing UK population.
- Water-intensive appliances.
- Showers and baths taken.
- Industrial and leisure use.
- Watering greenhouses.

Deficit and Surplus

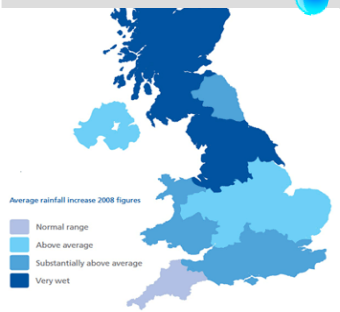
The north and west have a **water surplus** (more water than is required).
The south and east have a **water deficit** (more water needed than is actually available).
More than half of England is experiencing **water stress** (where demand exceeds supply).

Pollution and Quality

Cause and effects include:

- Chemical run-off from farmland can destroy habitats and kills animals.
- Oil from boats and ships poisons wildlife.
- Untreated waste from industries creates unsafe drinking water.
- Sewage containing bacteria spreads infectious diseases.

Water stress in the UK



Management

UK has **strict laws** that limits the amount of discharge from factories and farms.
Education campaigns to inform what can be disposed of safety.
Waste water treatment plants remove dangerous elements to then be used for safe drinking. Pollution traps catch and filter pollutants.

Water Transfer

Water transfer involves moving water through pipes from areas of surplus (Wales) to areas of deficit (London).
Opposition includes:

- Effects on **land and wildlife**.
- High maintenance **costs**.
- The **amount of energy** required to move water over long distances.

Energy in the UK (continued)

Significance of Renewables

+ The UK government is investing more into low carbon alternatives.
+ UK government aims to meet targets for reducing emissions.
+ Renewable sources include wind, solar and tidal energy.
- Although infinite, renewables are still expensive to install.
- Shale gas deposits may be exploited in the near future

Exploitation

Nuclear	New plants provide job opportunities. Problems with safety and possible harm to wildlife. Nuclear plants are expensive.
Wind Farm	Locals have low energy bills. Reduces carbon footprint. Construction cost is high. Visual impacts on landscape. Noise from wind turbines.

Option 1: FOOD

Food Security is when people at all times need to have physical & economic access to food to meet their dietary needs for an active & healthy life. This is the opposite to Food Insecurity which is when someone is unsure when they might next eat.

Human

- **Poverty** prevents people affording food and buying equipment.
- **Conflict** disrupts farming and prevents supplies.
- **Food waste** due to poor transport and storage.
- **Climate Change** is affecting rainfall patterns making food production difficult.

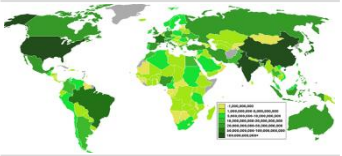
Physical

- The **quality of soil** is important to ensure crops have key nutrients.
- **Water supply** needs to be reliable to allow food to grow.
- **Pest, diseases and parasites** can destroy vast amounts of crops that are necessary to populations.
- **Extreme weather** events can damage crops (i.e. floods).

Daily Calorie Intake

This map shows how many **calories per person** that are consumed on average for each country.
This can indicate the global distribution of **available food** and **food inequality.**

Food Supply



This map shows the amount of **food produced** in different countries. Whilst Asia and **North America** have **high** production outputs, **Africa** and **Central America** have **low** production outputs.

Increasing Food Supply

Hydroponics - A method of growing plants without soil. Instead they use nutrient solution.
New Green Revolution - Aims to improve yields in a more sustainable way. Involves using both GM varieties and traditional and organic farming.
Biotechnology - Genetically modified (GM) crops changes the DNA of foods to enhance productivity and properties.
Irrigation - Artificially watering the land so crops can grow. Useful in dry areas to make crops more productive.

Sustainable Food Supply

This ensures that fertile soil, water and environmental resources are available for future generations.

Organic Farming - The banned use of chemicals and ensuring animals are raised naturally.
Permaculture - People growing their own food and changing eating habits. Fewer resources are required.
Urban Farming - Planting crops in urban areas. i.e. roundabouts.
Managed Fishing – Includes setting catch limits, banning trawling and promoting pole and line methods.

C.S. Thanet Earth

Located in Kent, the site involves four huge greenhouses using hydroponics.

Advantages
- **Supports more than 500 jobs.**
- **Produces food all year round.**
- **Provides UK with food security.**

Disadvantages
- **Money generated mostly goes to large companies not community.**
- **Requires a lot of energy.**
- **Causes visual & light pollution.**

C.S. NEE- Indus Basin Irrigation System

Largest irrigation scheme in the world. Involves large and small dams. Thousands of channels provides water to supports Pakistan's rich farmlands.

Advantages
- **Improves food security by adding 40% more land for farming.**
- **Increased yield & range of foods.**

Disadvantages
- **Few take an unfair share of water**
- **Water is wasted and demand is rising due to population growth.**
- **High cost to maintain reservoirs.**

Option 2: WATER

Water security is when people have good access to enough clean water to sustain well-being and good health. Water insecurity is when areas are without sufficient water supplies. Water Stress is when less than 1700m³ is available per person.

Human

- **Pollution caused** from human and industrial waste being dumped into peoples water sources.
- **Poverty prevents** low income families affording water.
- **Limited infrastructure** such as a lack of water pipes and sewers.
- **Over-abstraction** is when more water is taken than is replaced.

Physical

- **Climate** needs to provide enough rainfall to feed lakes and rivers. Droughts affect supply if water.
- **Geology** can affect accessibility to water. Permeable rock means sourcing water from difficult aquifers, whereas impermeable allows water to run-off into easily collected basins.

Impact of Water Insecurity

Food production

The less water available for irrigating crops the less food that will be produced. This could lead to starvation.

Industrial output

Manufacturing industries depend heavily on water. A severe lack of water can impact economic output.

Disease and Water Pollution

Inadequate sanitation systems pollutes drinking water causing diseases such as cholera and typhoid.

Water conflict

Water sources that cross national borders can create tensions and even war between countries.

Increasing Water Supply

Water diversion - Involves diverting water to be stored for longer periods. Often water is pumped underground to prevent evaporation.
Dams and Reservoirs - Dams control flow and storage of water. Water is released during times of water deficit.
Water transfer – includes schemes to move water from areas of surplus to areas of deficit.
Desalination – Involves the extraction of salt from sea water to produce fresh drinking water.

C.S. Lesotho Highland Water Project

Lesotho is a highland country dependent on South Africa. Lesotho has water surplus due to high rainfall.

Advantages
- **Provides 75% of Lesotho's GDP.**
- **Provides water to areas of drought in South Africa.**

Disadvantages
- **Dams displaced 30,000 people.**
- **Destruction to key ecosystems.**
- **40% lost through pipe leakages.**

Sustainable Water Supply

Ensures water supplies don't cause damage to the environment whilst also supporting the local economy.

Water conservation - Aims to reduce the amount of water wasted.
Groundwater Management - Involves the monitoring of extracting groundwater. Laws can be introduced.
Recycling and 'Grey' Water - Means taking water that has already been used and using it again rather than returning it to a river or the sea. This includes water taken from bathrooms and washing machines.

C.S. NEE - The Wakel River Basin

A project in India that aims to improve water use by encouraging greater use of rainwater harvesting techniques.

How does the project work?
- Provides 'taankas' that store water underground.
- Small dams called 'johed' interrupt water flow and encourages infiltration.
- Villages take turns to irrigate their fields so water is not overused.
- Maintained by farmers so it is entirely sustainable.
- Greater education for awareness.

Option 3: ENERGY

Energy security means having a reliable, uninterrupted and affordable supply of energy available. Energy insecurity can be experienced by countries with both a high and low energy consumption. Technology is increasing energy consumption.

Physical

- **Geology** determines the availability of fossil fuels.
- **Climate variations** will affect the potential use of renewable energy.
- **Natural disasters** can damage energy infrastructure.

Economic

- **Cost** of extracting fossil fuels is becoming costly and difficult.
- **Price of fossil fuels** are volatile to potential political changes.
- **Infrastructure** for energy is costly, especially for LICs.

Technology

- **New technology** is making once difficult energy sources now reachable/exploitable.

Political

- **Conflict** and turmoil in energy rich countries can affect exports.
- **Stricter regulations** over Nuclear.

Impact of Energy Insecurity

Sensitive environments

Exploration of energy resources threatens to harm sensitive areas such as the oil drilling in Alaska, USA.

Food production

Food production depends on the energy needed to power machinery and transport goods to different markets.

Energy conflict

Shortages of energy resources can lead to tensions and violence. Conflict can be caused by fear of energy insecurity.

Industry

Countries can suffer from shortfalls in energy leading to a decline in manufacturing and services.

Increasing Energy Supply

Non-renewables
Fossil Fuels - Conventional power stations can be made more efficient with carbon capture overcoming the environmental impacts.
Nuclear - Once a nuclear plant is built it can provide a cheap and long-term dependable source of energy.
Renewables
Wind, Solar, Biomass - These are examples of environmentally friendly renewable sources that can't run out but cost a lot to install.

C.S. UK Fracking

Fracking is used to extract natural gas trapped in underground shale rock. It is a method considered by the UK.

Advantages
- **Estimated to create 64,000 jobs.**
- **UK has large shale gas reserves.**
- **Is far cheaper than natural gas.**

Disadvantages
- **May cause groundwater pollution**
- **Is a non-renewable resource.**
- **May trigger minor earthquakes.**

Sustainable Energy Supply

This involves balancing supply & demand. It also includes reducing waste & supporting the environment.

Home design - Building homes to conserve energy. i.e. roof insulation.
Reduce demand - Changing attitudes towards energy used to save energy.
Efficient technology - Making cars more efficient by improving engine design and weight. i.e. Hybrid engines.
Transport - Using public buses & bikes.

C.S. NEE - Chambamontera

Chambamontera is an isolated community in the Andes of Peru. It introduced a micro-hydro to exploit water power as an energy source.

Benefits to the community
- **Provides renewable energy.**
- **Low maintenance & running costs**
- **Has little environmental impacts.**
- **Using local labour and materials.**
- **Businesses are developing.**
- **Less wood is needed to be burnt.**

Component 3: Health and Wellbeing Knowledge Organiser

Challenging texts

Scan the QR code for the specification document

Topic Content:

- You will learn to interpret indicators that can be used to measure physiological health and lifestyle data.
- You will learn how to design a health and wellbeing plan including SMART targets (long/short term)
- This unit combines and builds on everything from Components 1 and 2

Learning Objectives

A –Factors that affect health and wellbeing
B – interpreting health indicators
C- Person-centred approaches to improving health and wellbeing.

Health and Wellbeing

Holistic – looks at the whole person not just the part that needs treatment or care.

Abraham Maslow designed a hierarchy of needs – basic needs are constant however depending on life stages other needs can vary. E.g. a sense of belonging may look different in adolescence than in Middle Adulthood.

Physical Factors

Physical abilities – how well you can perform a physical action such as walking, doing buttons etc. can be hugely impacted if we experience any kind of temporary or permanent physical impairment.

Sensory impairments – The loss of one of the 5 senses can have a devastating ability on someone's ability to perform every day tasks. e.g. loss of vision could reduce someone's ability and confidence to socialise.

Lifestyle factors

Nutrition – A balanced diet is essential for a healthy body and mind.

People who eat poorly are more prone to illness, being over/under weight

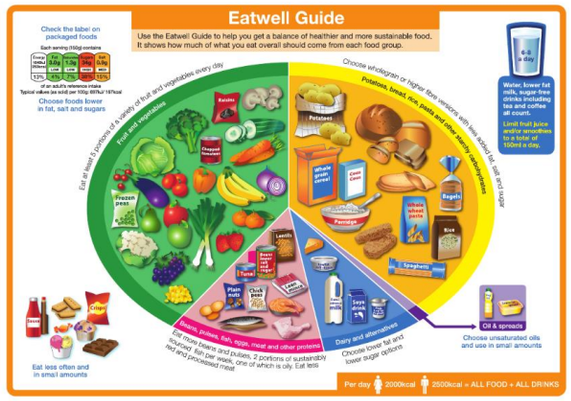


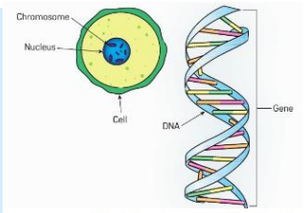
Figure 3.4: The *Eatwell Guide* recommends our diet contains these food items

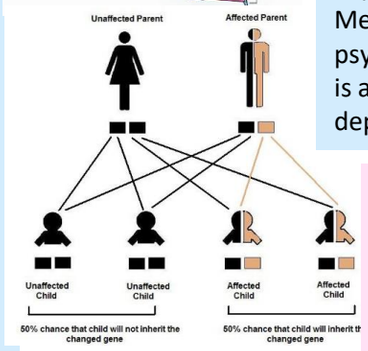
Physical Factors

Inherited conditions:
Most people have 23 pairs of chromosome in each of our cells.
One from each pair from Birth Mother
One from each pair from Birth Father.

There are two types of inheritance:
Dominant – only one parent needs to have/carry the condition for the child to inherit the condition e.g. Huntington's Disease.

Recessive – Both parents need to have/carry the condition for the child to inherit it e.g. cystic fibrosis.





Physical Factors

Mental Ill Health – Mental health determines how we think/feel and behave as well as how we cope with situations.
Mental ill health is when emotionally, psychologically and socially someone's wellbeing is affected by a condition such as anxiety, stress, depression etc.

Lifestyle factors

Physical Activity – Regular exercise is essential for our health and wellbeing

Lifestyle factors

Alcohol – Can have a detrimental impact one someone's PIES health. Excessive drinking can lead to addiction and increased risks of cancer.

Smoking – Cigarettes contain highly addictive Nicotine which can have huge impacts on a person's wellbeing and health.

Illegal drugs and misuse of prescribed drugs - can have a profound impact on your health and wellbeing

Physical Factors

Physical Ill health: - **can be acute, chronic or both.**
Acute = comes on quickly, is short-term and can be cured.
Chronic = Life long.

e.g. Asthma is a chronic condition impacting the lungs life long. There is no cure. HOWEVER … an asthma attack is an acute condition which can be remedied with medication.

Social Factors

Bullying – can take many forms physical, verbal, cyber, emotional and sexual – it is a repetitive intention to harm, coerce or intimidate.

Discrimination – treating someone differently because they are seen as different. This could be for lots of reasons. E.g. gender, age

Key terms –

- Holistic
- Disability
- Impairment
- Illness
- Sensory Impairments
- Dominant Genes
- Recessive Genes
- Nutrition
- Mental Ill Health
- Addictions
- Nicotine
- Hazards
- Supportive relationships
- Unsupportive relationships
- Social inclusion
- Social Exclusion
- Coerce
- Sexual Orientation
- Gender Identity
- Stereotypes
- Diversity
- Barriers to accessing care
- Formal support
- Informal Support
- Life style indicators
- BMI
- Pulse Rate
- Recovery Rate
- Blood Pressure
- Sphygmomanometer
- Person-Centred Approach
- SMART targets

Component 3: Health and Wellbeing Knowledge Organiser

Challenging texts

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Topic Content:

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Learning Objectives

A –Factors that affect health and wellbeing
B – interpreting health indicators
C- Person-centred approaches to improving health and wellbeing.

Cultural Factors

Religion – being part of a religious group can be positive for health and wellbeing. Many religious groups offer lots of support for individuals within their community.

Community Participation – belonging to a group with which someone identifies e.g. a street organising events together, or a member of the LGBTQIA+ community taking part in a Pride march.

Gender Roles and expectations – The roles and behaviours often stereotypically expected of men and women.

Gender Identity – how a person identifies. There are over 100 genders in the UK.

Sexual Orientation – The emotional, romantic or sexual attraction someone feels for another person/s

Economic Factors

Employment situation – whether someone is working can have a huge impact on their health and wellbeing

Financial Resources – the money and personal wealth at someone's disposal.

Environmental Factors:

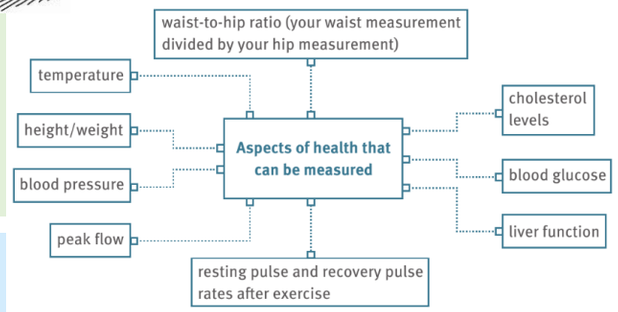
Housing needs, conditions and locations
The type of housing and the location of housing can hugely impact health and well-being. E.g. small flat in the city could lead to stress and ill-health due to air pollution.

Home environment – living with abuse or neglect can hugely impact health and wellbeing.

Pollution –

Air pollution can lead to life long health conditions.
Water Pollution can lead to illness.

Health indicators – Physical and measurable indicators of someone's' health.



Health indicators –

Pulse rate – Resting pulse rate compared to rate after exercise and recovery time. The quicker your pulse returns to normal the fitter you are.

Blood Pressure – The pressure exerted by your blood against the walls of your arteries. Long-term High blood pressure can have devastating consequences on the organs.

	Systolic (top number)	Diastolic (bottom number)
High blood pressure	140–190	90–100
Pre-high blood pressure	120–140	80–90
Ideal blood pressure	90–120	60–80
Low blood pressure	70–90	40–60

Health indicators –

BMI – Body Mass Index

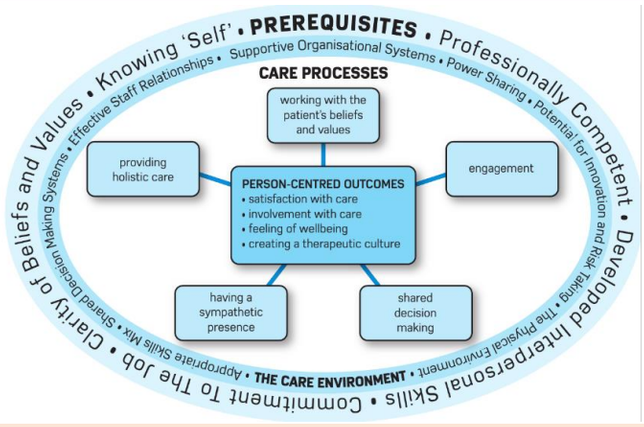
Used to determined if someone is overweight.

$$BMI = \frac{\text{Weight in kg}}{(\text{Height in m})^2}$$

BMI	Meaning
Less than 18.5	Underweight
Between 18.5 and 24.9	Healthy weight
Between 25 and 29.9	Overweight
Between 30 and 39.9	Obese
40 and above	Severely obese

Person-centred approach.

Recognising that each person is individual and therefore it is important to approach their care and needs in the individually. You place the person in the centre of their care and ensure that their care plan is developed specifically around their individual needs, wishes and circumstances.



SOURCES OF SUPPORT

Formal Support – Support from a professional. E.g. GP, Pharmacist
Informal Support – support from someone close the service user e.g. Family, Friends and Neighbours

Barriers to accessing care and support.
Things that prevent someone being able to easily access support for specific health and wellbeing needs.

- **Physical –** being physically unable to get to a health and social care setting e.g. no wheelchair access.
- **Sensory disability –** Being unable to communicate with or access a facility due to sensory limitations.
- **Social and Cultural –**limitations due to social or cultural background e.g. men being uncomfortable having a female practitioner due to cultural beliefs.
- **Language and speech-** a language barrier between service user and health care practitioners.
- **Geographical** –unable to access a service due to its location e.g. you live in a rural location.
- **Financial-** Limitations due to financial limitations e.g. being unable to access medication due to fees.

Life events

Physical events such as accidents, puberty etc. can have a profound impact on someone's health and wellbeing.

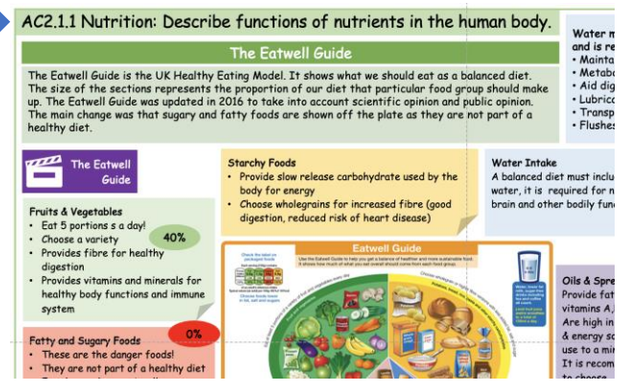
Relationships changes – both positive e.g. getting married or negative e.g. bereavement have a huge impact on someone's wellbeing.

Expected life events – things that are an accepted part of someone's life e.g. getting a job, going to school etc.

Unexpected life events – things that are not the norm e.g. being made redundant, going to prison etc.

UNIT 2: Controlled Assessment (10hrs)

In Slide Show Mode, click the unit title to return to the main menu (slide 1).



CONTENTS

In Slide Show Mode, you can click each of the unit titles (below) to take you to that section.

AC2.1 Nutrition and Cooking Methods

AC2.1.1
Function of nutrients

AC2.1.2
How cooking methods impact on nutritional value

AC2.2 Dish Proposal Factors

AC2.2.1
Factors affecting menu planning

AC2.2.2
Production plan of your chosen dishes

AC2.3 Practical Cookery Skills

AC2.3.1
Prepare and make dishes

AC2.3.2
Presentation techniques

AC2.3.3
Food safety practices

AC2.4 Evaluation

AC2.4.1
Evaluation of dishes

AC2.4.2
Evaluation of own performance

AC2.1.1 Nutrition: Describe functions of nutrients in the human body.

The Eatwell Guide

The Eatwell Guide is the UK Healthy Eating Model. It shows what we should eat as a balanced diet. The size of the sections represents the proportion of our diet that particular food group should make up. The Eatwell Guide was updated in 2016 to take into account scientific opinion and public opinion. The main change was that sugary and fatty foods are shown off the plate as they are not part of a healthy diet.

Water makes up just over 2/3 of the human body and is required for:

- Maintain body temperature
- Metabolise fat
- Aid digestion
- Lubricate organs
- Transport nutrients
- Flushes out waste and toxins

The Eatwell Guide

Fruits & Vegetables — 40%

- Eat 5 portions s a day!
- Choose a variety
- Provides fibre for healthy digestion
- Provides vitamins and minerals for healthy body functions and immune system

Starchy Foods

- Provide slow release carbohydrate used by the body for energy
- Choose wholegrains for increased fibre (good digestion, reduced risk of heart disease)

Water Intake

A balanced diet must include water, it is required for nearly all brain and other bodily functions.

Oils & Spreads — 1%

Provide fat soluble vitamins A,D,E & K
Are high in calories & energy so keep use to a minimum
It is recommended to choose unsaturated oils like olive oil.

Water rich foods

Fatty and Sugary Foods — 0%

- These are the danger foods!
- They are not part of a healthy diet
- Eat them only occasionally
- Eating too much fatty and sugary processed food is linked to increased risk of weight gain/obesity, diabetes, tooth decay and cardiovascular disease

8 Tips for healthy eating

1. Eat more fibre
2. Eat more fruits and Vegetables
3. Eat more oily fish
4. Eat less salt
5. Eat less fat
6. Eat less sugar
7. Choose wholegrains
8. Drink 6-8 glasses of water per day

Beans, Pulses, Eggs, Meat, Fish — 12%

- Provide protein for growth, repair and maintenance of body cells
- Choose a combination of plant proteins
- Avoid eating too much processed meat like bacon and sausages as these are linked with increased risk of bowel and stomach cancer

Dairy Foods — 8%

- Provide calcium for healthy bones, teeth and nails
- The body needs Vitamin D to absorb calcium effectively

Fibre in the diet

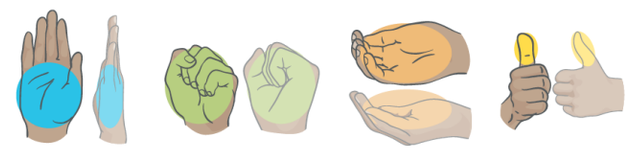
Soluble fibre dissolves in water and the insoluble kind doesn't. **Soluble fibre** helps reduce blood cholesterol and sugar.

Insoluble fibre helps absorb water and bulk up stools. It does not dissolve in water.

PORTION SIZES:

Healthy diets not only have the correct balance, but have the right portion sizes. Here is a 'handy' guide …

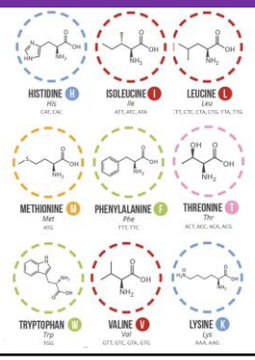
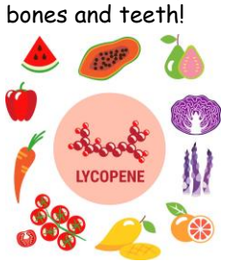
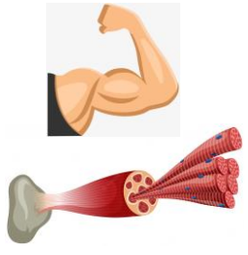
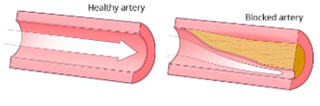
YOUR HAND IS YOUR PORTIONING TOOL



A serving of protein = 1 palm
A serving of vegetables = 1 fist
A serving of carbs = 1 cupped hand
A serving of fats = 1 thumb

Function of Nutrients in the Body

MACRONUTRIENTS

Nutrient	Types	Function	Effects too little (deficiency)	Effect of too much (excess)
Carbohydrates 4kcal per gram Click here for video 	**Starches (complex):** found in cereal grains such as rice, wheat, oats, plus starchy tubers (potatoes and sweet potatoes) and vegetables (carrots, beets, corn). Digest slowly, long lasting energy. ✓ **Sugars (simple)**: lactose found in milk and dairy, fructose found in honey, fruits and some vegetables (peppers, tomatoes). Digest and enter the bloodstream quickly for a burst of energy. ✗	Carbohydrate is the body's main source of **energy (fuel).** Carbohydrate breaks down to **glucose**, which is the only form of energy the brain recognises. Basically, without carbohydrate, your brain wouldn't function! All carbohydrates, no matter what type, provide **4kcal of energy per gram.** The difference is complex carbs take longer to break down and therefore satisfy hunger for longer, whereas simple sugars leave you feeling empty and wanting more. Complex carbs provide dietary bulk and fibre which makes us feel fuller for longer. **Dietary fibre:** complex carbohydrate found in the cell wall of fruits, vegetables and cereals. Aids with removal of waste from the body.	**Deficiency of carbohydrates is extremely rare in the UK as we have good access to carbohydrate rich foods.** Long term lack of carbohydrates in the diet can cause **ketosis** – a condition where the body switches to using protein as an energy source. **Visible symptoms:** Lack of energy and weight loss. **Non-visible symptoms:** Not enough fibre from wholegrains foods leads to constipation and other intestinal/bowel problems.	If not used for energy, excess carbohydrates are converted to glycogen and stored in the muscles and liver. **Visible symptoms:** Weight gain and obesity. **Non-visible:** Eating too much non-refined (white) carbohydrates leads to tooth decay, raised blood sugar levels and increased risk of developing type 2 diabetes. (See carbohydrates and glycemic index slides 7-8).
Proteins 4kcal per gram Click here for video 	**High Biological Value (HBV) protein:** Meat, fish, poultry, dairy foods (milk), eggs, soya. Contain all the **essential amino acids** the body cannot make itself. ✓ **Low Biological Value (LBV) protein:** Quorn, Tofu, peas, beans, lentils, nuts, seeds and cereals. ✓ **Missing one or more of the essential amino acids.** Mainly come from plant sources. Two or more LBV proteins can be combined to make a complete protein. This is called **protein complementation.** Example: beans on toast.	Protein is digested by the body into its component parts – called **amino acids.** There are 8 which are essential for adults and 10 for children. Protein is essential for the **growth, maintenance and repair of body tissue.** Protein is part of every living cell and some tissues like skin, muscle, hair and the core of bones and teeth!  	**Visible symptoms:** • Wasting of muscle & muscle loss • Oedema – build up of fluids in the body • Slow growth in children Severe deficiency leads to kwashiorkor (bloating of the stomach). **Non-visible symptoms:** Weaker immune system, as it needs protein to function properly. This can lead to prolonged recovery from illness or getting ill more frequently. 	**Visible symptoms:** Excess stored as fat, which can lead to weight gain and obesity. **Non-visible symptoms:** Increased protein consumption leads to hyperfiltration – a state in which the kidney faces increased pressure in order to filter and remove waste from the body. Over the long term, hyperfiltration may lead to **kidney damage.** 
Fats 9kcal per gram Click here for video Click here for info 	**Monounsaturated Fat:** Avocado, many nuts and seeds, olive oil, almond oil, sunflower oil. ✓ **Polyunsaturated Fat:** Vegetable oil, corn oil, safflower oil, nuts, oily fish. ✓ **Saturated Fat:** Mainly from animal sources. Meat, butter, cream, eggs. ✗ **Omega 3, 6 and 9 Fatty Acids:** Oily fish, seeds and oils, flax seeds, pumpkin seeds, walnuts, soya beans, dark green vegetables, vegetable oils, margarines (polyunsaturated). ✓	• Protection of internal organs • Thermoregulation (temperature control) • Insulation of nerve cells (conduct electrical messages) • Uptake of fat soluble vitamins (A, D, E & K) • Growth, development and repair of body tissues • In women, storage and modification of reproductive hormones (oestrogen) • Forms a vital part of cell membranes • Supports mental health • Improves heart health • Supports health weight management • Shown to reduce inflammation • Supports infant brain development • Promotes brain health	**Visible symptoms:** Weight loss over time as the body uses stores of fat. Person feels cold as fat under skin acts as insulator. **Non-visible symptoms:** Bruising of the bones as they are not protected. Lack of fat in the diet can lead to deficiencies of fat soluble vitamins A, D, E & K. Fat deficiency can also lead to impaired in fertility in women due to anovulation. *Anovulation - happens when an egg (ovum) doesn't release from the ovary during the menstrual cycle. An egg is needed to have a pregnancy.	**Common issue in the UK:** Over consuming foods high in fat can raise the blood cholesterol levels (fat in the blood). **Cholesterol** is a fatty substance that is needed for the body to function properly, however there are two types, **LDL (bad) and HDL (good).** LDL cholesterol comes from saturated fats, such as meat and cheese. Eating too much saturated fat can lead to obesity and higher 'bad' cholesterol levels as well as an increased risk of developing type 2 diabetes and heart disease. Unsaturated plant sources of fats are much healthier for us.

Fat Soluble Vitamins

Click here for video

A vitamin that can dissolve in fats and oils. Vitamins are nutrients that the body needs in small amounts to stay healthy and work the way it should. Fat-soluble vitamins are absorbed along with fats in the diet and are **stored in the body's fatty tissue and in the liver.**

Key Words

Deficiency	A shortage of a substance (such as a vitamin or mineral) needed by the body.
Absorb	Nutrients are taken into the body and (absorbed) and transported by the bloodstream to other parts of the body for use or storage.

	Fat Soluble Vitamin	Needed For	Found In	Deficiency/Excess
MICRONUTRIENTS	**A** Adults aged 19 to 64 need (per day): 700mcg men 600mcg women	• helping your body's natural defence against illness and infection (the immune system) work properly • helping vision in dim light • keeping skin and the lining of some parts of the body, such as the nose, healthy	• cheese • eggs • oily fish • fortified low-fat spreads • milk and yoghurt • liver and liver products such as liver pâté Liver is a particularly rich source of vitamin A, so you may be at risk of having too much vitamin A if you have it more than once a week (pregnant women should avoid eating liver or liver products).	**Deficiency** – Night blindness. Xerophthalmia the eyes may become very dry and crusted, which may damage the cornea and retina. Frequent skin irritations. **Excess** Having more than an average of 1.5 mg (1,500 µg) a day of vitamin A over many years may affect your bones, making them more likely to fracture when you're older. This is particularly important for **older people, especially women**, who are already at increased risk of osteoporosis, a condition that weakens bones.
	Beta-Carotene	You can also get vitamin A by including good sources of beta-carotene in your diet, as the body can convert this into retinol.	• yellow, red and green (leafy) vegetables, such as spinach, carrots, sweet potatoes and red peppers • yellow fruit, such as mango, papaya and apricots	
	D Adults aged 19 to 64 need: 10mcg per day	• keep bones, teeth and muscles healthy.	• oily fish – such as salmon, sardines, herring and mackerel • red meat • liver • egg yolks • fortified foods – such as some fat spreads and breakfast cereals	**Deficiency** - A lack of vitamin D can lead to bone deformities such as rickets in children, and bone pain caused by a condition called osteomalacia in adults. **Excess** - Taking too vitamin D over a long period of time can cause too much calcium to build up in the body (hypercalcaemia). This can weaken the bones and damage the kidneys and the heart.
	E Adults aged 19 to 64 need: 4mg men 3mg women	• helps maintain healthy skin and eyes and strengthen the body's natural defence against illness and infection (the immune system).	• plant oils – such as rapeseed (vegetable oil), sunflower, soya, corn and olive oil • nuts and seeds • wheatgerm – found in cereals and cereal product	**Deficiency** - Any vitamin E your body does not need immediately is stored for future use, so you do not need it in your diet every day. **Excess** – N/A
	K Adults aged 19 to 64 need: 1 microgram per kg of body weight.	• a group of vitamins that the body needs for blood clotting, helping wounds to heal.	• green leafy vegetables – such as broccoli and spinach • vegetable oils • cereal grains • small amounts can be found in meat and dairy foods.	**Deficiency** - Taking 1mg or less of vitamin K supplements a day is unlikely to cause any harm. **Excess** – Rare, however vitamin K can interact with several common medications, including blood-thinners, anticonvulsants, antibiotics, cholesterol-lowering drugs, and weight-loss drugs.

Water Soluble Vitamins

A vitamin that can dissolve in water. Vitamins are nutrients that the body needs in small amounts to stay healthy and work the way it should. Water-soluble vitamins are carried to the body's tissues but **are not stored in the body.**

	Water Soluble Vitamin	Needed For	Found In	Deficiency/Excess
MICRONUTRIENTS	**C** **Antioxidant** Adults aged 19 to 64 need 40mg of vitamin C per day.	• helping to protect cells and keeping them healthy • maintaining healthy skin, blood vessels, bones and cartilage • helping with wound healing	• citrus fruit, such as oranges and orange juice • peppers • strawberries • blackcurrants • broccoli • brussels sprouts • potatoes	**Deficiency** - Scurvy, very rare symptoms include bleeding gums, wounds not healing properly, tiredness. Lack of vitamin C effects absorption of iron. **Excess** Taking large amounts (more than 1,000mg per day) of vitamin C can cause: • stomach pain • diarrhoea • Flatulence **Vitamin C is water soluble so excess can easily be excreted by the body.**
	B1 **Thiamin** Adults aged 19 to 64 need: 1mg men 0.8mg women	• helps the body break down and release energy from food • keep the nervous system healthy	• peas • some fresh fruits (such as bananas and oranges) • nuts • wholegrain breads • some fortified breakfast cereals • liver	**Deficiency** - Beri-beri (disorder of the nervous system). **Excess** - body excretes it.
	B2 **Riboflavin** Adults aged 19 to 64 need: 1.3mg men 1.1mg women	• keep skin, eyes and the nervous system healthy • release energy from food	• milk • eggs • fortified breakfast cereals • mushrooms • plain yoghurt UV light can destroy riboflavin, so these foods should be kept out of direct sunlight.	**Deficiency** - Dry cracked skin around the mouth and nose. **Excess** - body excretes it.
	B3 **Niacin** Adults aged 19 to 64 need: 16.5mg men 13.2mg women	• release energy from food • keep the nervous system and skin healthy	• meat • fish • wheat flour • eggs Niacin cannot be stored in the body, so you need it in your diet every day.	**Deficiency** - disease pellagra. Symptoms can include dermatitis, dementia and diarrhea. **Excess** - body excretes it.
	B9 **Folate** Adults aged 19 to 64 need: 200mcg In pregnancy: 400mcg	• form healthy red blood cells • reduce the risk of birth defects called neural tube defects, such as spina bifida, in unborn babies	• broccoli • Brussels sprouts • leafy green vegetables, such as cabbage, kale, spring greens and spinach • peas • chickpeas and kidney beans • liver (but avoid this during pregnancy) • breakfast cereals fortified with folic acid	**Deficiency** - can lead to folate deficiency anaemia. Symptoms can include insomnia, depression and forgetfulness. **Excess** - Taking doses of folic acid higher than 1mg can mask the symptoms of vitamin B12 deficiency, which can eventually damage the nervous system if it's not spotted and treated. This is particularly a concern for **older people** because it becomes more difficult to absorb vitamin B12 as you get older.
	B12 **Cobalamin** Adults aged 19 to 64 need: 1.5mcg	• make red blood cells and keeping the nervous system healthy • release energy from food • use folate	• meat • fish • milk • cheese • eggs • some fortified breakfast cereals	**Deficiency** - If you eat meat, fish or dairy foods, you should be able to get enough vitamin B12 from your diet. Vitamin B12 is not found naturally in foods such as fruit, vegetables and grains, vegans may not get enough of it. **Excess** - body excretes it.

Minerals

A vitamin that can dissolve in water. Vitamins are nutrients that the body needs in small amounts to stay healthy and work the way it should. Water-soluble vitamins are carried to the body's tissues but are not stored in the body.

	Mineral	Needed For	Found In	Deficiency/Excess
MICRONUTRIENTS	**Iron**	Iron is important in making red blood cells, which carry oxygen around the body. • 8.7mg a day for men over 18 • 14.8mg a day for women aged 19 to 50 • 8.7mg a day for women over 50	• liver (but avoid during pregnancy) • meat • beans • nuts • dried fruit – such as dried apricots • wholegrains – such as brown rice • fortified breakfast cereals • soybean flour • most dark-green leafy vegetables – such as watercress and curly	**Deficiency – Iron Deficiency Anaemia** • tiredness and lack of energy • shortness of breath • noticeable heartbeats (heart palpitations) • pale skin **Excess** Side effects of taking high doses (over 20mg) of iron include constipation, feeling sick, vomiting, stomach pain. Very high doses of iron can be fatal, particularly if taken by children.
	Calcium Adults aged 19 to 64 need: 700mg See older adults (slide 13) for more info.	• helping build strong bones and teeth • regulating muscle contractions, including heartbeat • making sure blood clots normally	• milk, cheese and other dairy foods • green leafy vegetables – such as broccoli, cabbage and okra, but not spinach • soya beans • tofu • soya drinks with added calcium • nuts • bread and anything made with fortified flour • fish where you eat the bones – such as sardines and pilchards	**Deficiency** A lack of calcium could lead to a condition called rickets in children and osteomalacia or osteoporosis in older adults. **Excess** Taking high doses of calcium (more than 1,500mg a day) could lead to stomach pain and diarrhea.
	Sodium/Salt **Riboflavin** Adults aged 19 to 64 need: No more than **6g per day**	The human body requires a small amount of **sodium** to conduct nerve impulses, contract and relax muscles, and maintain the proper balance of water and minerals. Salt is also called **sodium chloride.** Sometimes, food labels only give the figure for sodium. There is a simple way to work out how much salt you are eating from the sodium figure: **Salt = sodium x 2.5** Adults should eat no more than 2.4g of sodium per day, as this is equal to 6g of salt. **Children aged:** • 1-3yrs no more than 2g salt a day (0.8g sodium) • 4-6yrs no more than 3g salt a day (1.2g sodium) • 7-10yrs no more than 5g salt a day (2g sodium) • 11+yrs no more than 6g salt a day (2.4g sodium)	• anchovies • bacon • cheese • gravy granules • ham • olives • pickles • prawns • salami • salted and dry-roasted nuts • salt fish • smoked meat and fish • soy sauce • stock cubes • yeast extract **Other high salt products:** • bread products such as crumpets, bagels and ciabatta • pasta sauces • crisps • pizza • ready meals • soup • sandwiches • sausages • tomato ketchup, mayonnaise and other sauces • breakfast cereals	**Deficiency** Hyponatremia is a condition that occurs when the sodium in your blood falls below the normal range. In severe cases, low sodium levels in the body can lead to muscle cramps, nausea, vomiting and dizziness. Eventually, lack of salt can lead to shock, coma and death. **Excess** Too much salt can raise your blood pressure, which puts you at increased risk of health problems such as heart disease and stroke. You don't have to add salt to food to be eating too much – 75% of the salt we eat is already in everyday foods such as bread, breakfast cereal and ready meals.

Carbohydrates and Glycemic Index

Types

- **Carbohydrates**
  - **Simple Sugars**
    - **Monosaccharides**
      - Glucose → Sultanas, honey, jam, breakfast cereal, tinned fruits
      - Fructose → fresh fruits
      - Galactose
    - **Disaccharides**
      - Lactose (milk) → Cakes, biscuits, dark chocolate, beetroot, carrots
      - Maltose
      - Sucrose
  - **Complex Carbohydrates**
    - **Polysaccharides**
      - Starch → Bread, pasta, rice, cereals, potatoes, sweet potatoes, chickpeas
    - **Non-starch Polysaccharides**
      - Fibre (NSP) → Blackberries, pears, melon and oranges. Vegetables such as broccoli, carrots and sweetcorn. Peas, beans and pulses. Nuts and seeds. Potatoes with skin.
      - Wholegrain breakfast cereals, wholewheat pasta, wholegrain bread and oats, barley and rye.

What should I eat?

Healthy Fibrous Carbohydrates

- Vegetables
- Cucumbers
- Asparagus
- Broccoli
- Carrots
- Peppers
- Tomatoes
- Beans

Healthy Starchy Carbohydrates

- Grains generally
- Whole grains
- Whole grain pasta
- Beans
- Whole grain bread
- Potatoes
- Sweet potatoes

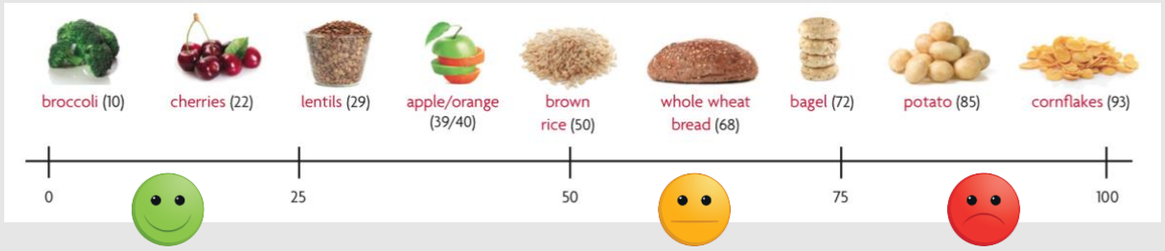
Healthy Simple Carbohydrates

- Fruit generally
- Apples
- Oranges
- Bananas
- Pineapple
- Berries
- Avoid non-fresh fruit juices!

Glycemic Index Explained

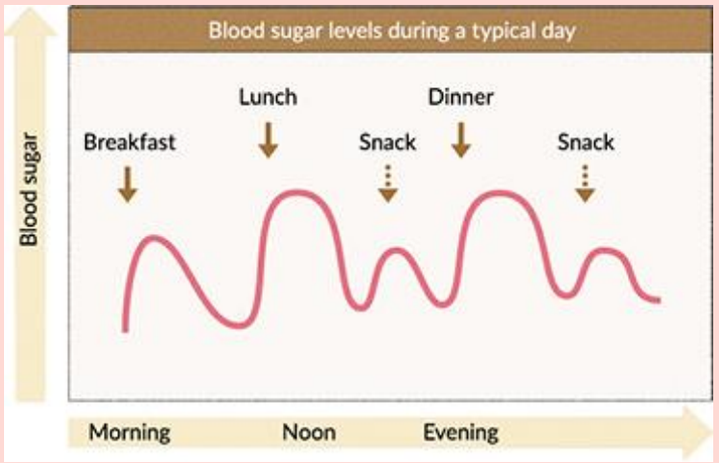
The glycemic index (GI) is a scale that rates carbohydrate-carrying foods from 0 to 100 based on their direct effect on blood-sugar levels.

Foods that are high on the GI scale are digested quickly and spike sugar levels in the blood; low-GI foods take longer to digest and allow sugar to leak slowly into the bloodstream, providing a more constant and even source of energy.

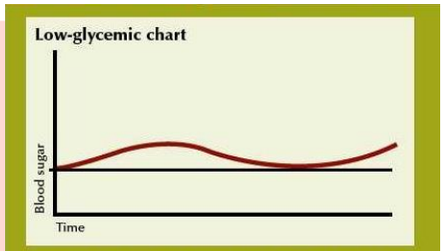


Most veggies, fruits, nuts, legumes, and healthy grains are low to medium on the scale, while white bread, white rice, and sweetened foods (like sweets or fizzy drinks) are much higher.

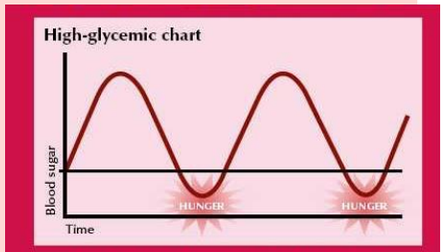
Effect on Blood Sugar



Every time we eat our blood sugar levels rise, depending on the amount of carbohydrate we consume and the type (low or high GI). High GI foods cause peaks and troughs in blood sugar levels, which makes us feel hungry sooner.



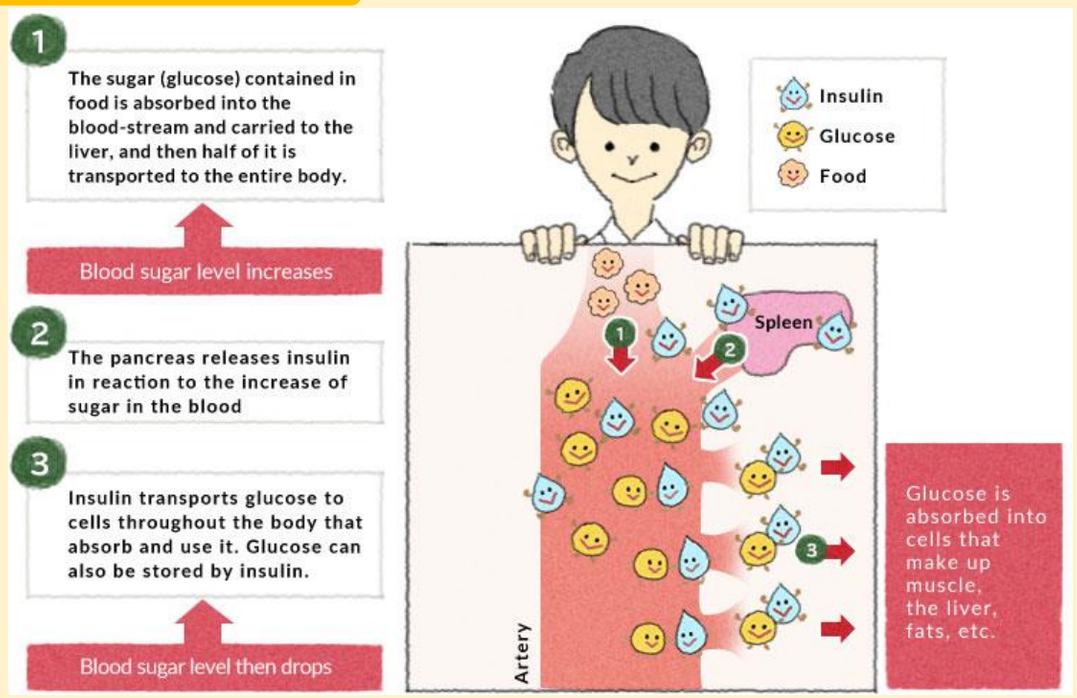
RELEASE ENERGY SLOWLY
↓
FEEL FULL LONGER
↓
EAT LESS



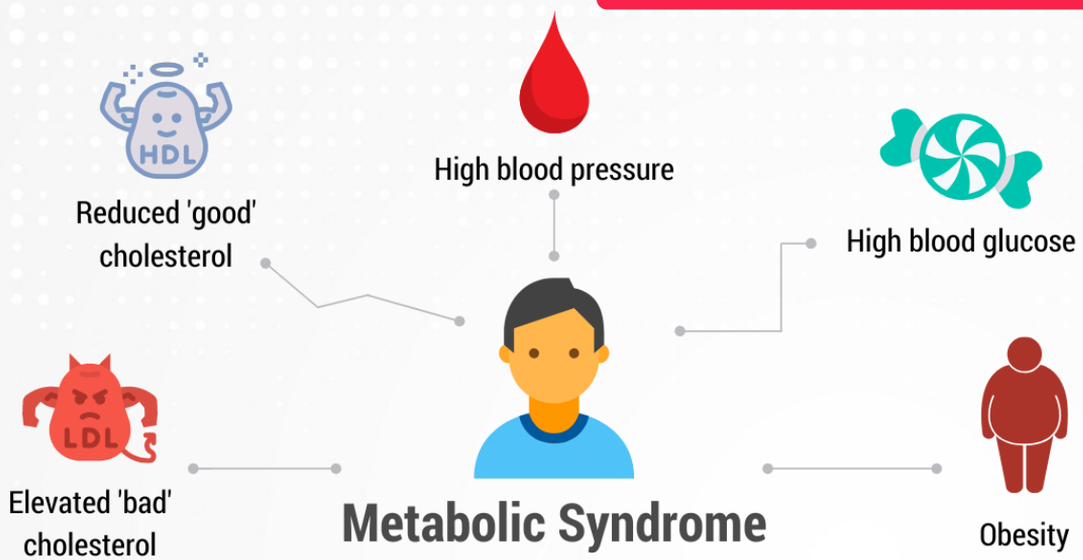
RELEASE ENERGY QUICKLY
↓
FEEL HUNGRY SOONER
↓
EAT MORE

Carbohydrates and Insulin

Insulin Response

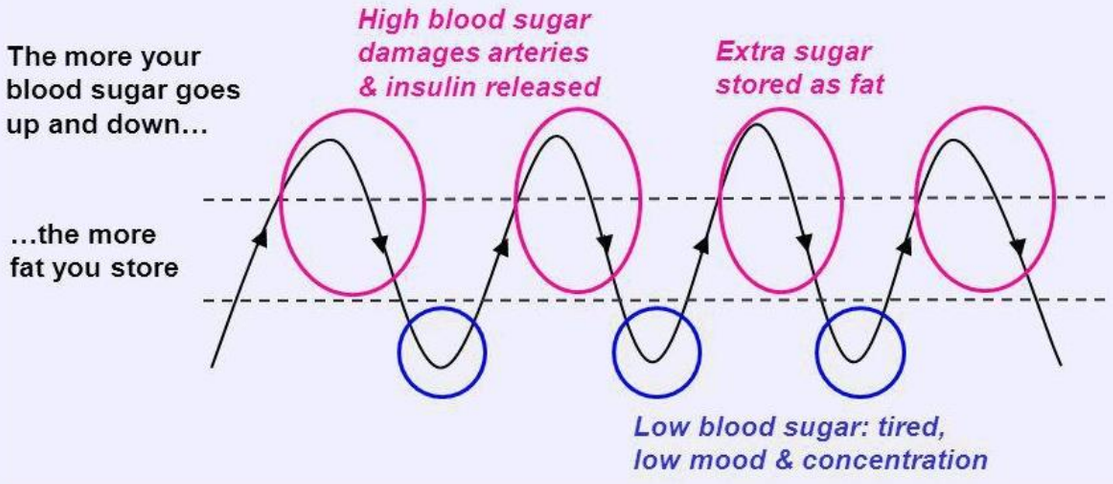


Metabolic Syndrome



Metabolic Syndrome can compromise your immune system and put you at greater risk of stroke, heart disease and type 2 diabetes

Blood Sugar Levels Explained



Metabolic Syndrome Explained

Metabolic syndrome is the medical term for a combination of diabetes, high blood pressure (hypertension) and obesity.

It puts you at greater risk of getting coronary heart disease, stroke and other conditions that affect the blood vessels.

On their own, diabetes, high blood pressure and obesity can damage your blood vessels but having all 3 together is particularly dangerous.

They're very common conditions that are linked, which explains why metabolic syndrome affects an estimated 1 in 3 older adults aged 50 or older in the UK. Metabolic syndrome is often associated with being overweight or obese, and a lack of physical activity.

It's also linked to insulin resistance, which is a key feature of type 2 diabetes. Blood sugar levels are controlled by a hormone called insulin. If you have insulin resistance, too much glucose can build up in your bloodstream.

Nutritional Needs: Adults

Following a healthy, balanced diet helps make sure that adults get all the nutrients needed to work well from day to day and can also reduce the risk of diseases like heart disease, stroke, type 2 diabetes and some types of cancer in the longer term.

The NHS recommends the average healthy adult has the following intakes of each nutrient per day.

Nutrient	Amount	Calories per gram
Energy (calories) Male Female	 2,500kcal 2,000kcal	
Carbohydrate **of which sugars**	At least 260g **90g**	4kcal
Protein	50g	4kcal
Fat **of which saturates**	Less than 70g **Less than 20g**	9kcal

What is a calorie?

What are carbohydrates?

Protein and muscles

What is fat?

Micronutrients are vitamins and minerals needed by the body in very small amounts, however a deficiency in any of them can cause severe and even life-threatening conditions! Notice males and females require different amounts of some nutrients.

Nutrient	Males	Females
Vitamin A	700mcg	600mcg
Vitamin D	10mcg	
Vitamin E	4mg	3mg
Vitamin K	1mcg per kg of body weight	
Vitamin B	Thiamin: 1mg Niacin: 16.5mg Riboflavin: 1.3mg Vitamin B12: 1.5mcg	Thiamin: 0.8mg Niacin: 13.2mg Riboflavin: 1.1mg Vitamin B12: 1.5mcg
Vitamin C	40mg *Vitamin C cannot be stored in the body, so you need it in your diet every day.	
Sodium (Salt)	Less than 6g	
Iron	All (M) 8.7mg	(F) 19-50yrs 14.8mg / 50yrs+ 8.7mg
Calcium	700mg	

How do vitamins work?

What are vitamins?

The main principles of a health balanced diet for an adult are:
- including plenty of a range of fruit and vegetables – at least 5 A DAY
- including plenty of fibre-rich foods, especially wholegrains
- including a range of protein-sources especially beans, peas and lentils
- including some dairy foods or fortified alternatives
- choosing mainly unsaturated fats and oils, and
- minimising foods and drinks that are high in fat, salt and sugars.

Fruit and vegetables provide a range of essential nutrients and fibre, as well as chemical compounds that occur naturally in plants that may have health benefits.

Different types and colours of fruits and vegetables contain different combinations of important nutrients like:

- **vitamin C** - important for maintaining healthy body tissues.
- **vitamin A** - important for maintenance of normal vision, skin and the immune system.
- **folate** - important for normal and healthy blood formation.
- **fibre** – helps to maintain a healthy gut.
- **potassium** – helps to maintain a healthy blood pressure and is also important for the normal functioning of the nervous system

Key Words

Healthy diet	A diet low in fat, salt and sugar but high in fibre.
Energy needs	The average amount of energy required from food by individuals. Measured in calories (kcal). This can be different for different life stages and activity levels.
Reference intakes (RIs)	Guidelines about the approximate amount of particular nutrients and energy required for a healthy diet. Provided by the NHS.
Macronutrients	Nutrients needed by the body in large amounts.
Micronutrients	Nutrients needed by the body in smaller amounts.

Nutritional Needs: Children

Like adults, children should follow a healthy balanced diet to support their growth and development. However, there are some nutrients children should consume in smaller amounts to prevent becoming overweight, e.g., fat.

Children 3-7yrs	
Males	**Female**
Calories per day 1,300kcal increasing to 1,600kcal	**Calories per day** 1,250kcal increasing to 1,500kcal
Carbohydrate: 130g	**Carbohydrate:** 130g
Protein: 20g	**Protein:** 20g
Fats: 50g **Saturates:** 15g	**Fats:** 50g **Saturates:** 15g
Vitamins and Minerals **Iron:** 6.1mg/d **Calcium:** 450mg/d **Sodium:** 700mg/d	**Vitamins and Minerals** **Iron:** 6.1mg/d **Calcium:** 450mg/d **Sodium:** 700mg/d
Fibre: **Male:** 20g	**Fibre:** **Female:** 20g

Children need lots of:
- Protein for growth and development
- Calcium and vitamin D for growth of bones and teeth
- Food containing lots of energy such as wholegrain foods
- Vitamin C to help release iron from foods and for clear skin and to fight infections
- Milk to provide calcium and fats
- Many children diets vary but it is recommended they eat 1300kcal per day made up of the right balance of nutrients
- Avoid sweets as these can cause tooth decay
- Avoid fatty foods as this will cause children to consume too many calories
- Build up good eating habits in early life.

Children 7-10yrs	
Males	**Female**
1,649kcal	1,530kcal
1,745	1,625kcal
1,840	1,721kcal
2,032	1,936kcal

Children aged 7 to 10 years old need **lots of energy** and nutrients because they're **still growing**. Children in this age group need **slightly more calories** than children aged 3-7yrs. **A healthy, balanced diet for children aged 7 to 10 should include:**

- 5 portions of a variety of fruit and veg per day
- meals based on starchy foods, such as potatoes, bread, pasta and rice
- some milk and dairy products or alternatives
- some foods that are good sources of protein, such as meat, fish, eggs, beans and lentils

Carbohydrate Function: For energy. Starchy carbohydrates are the best source of energy for a growing child and will encourage healthy eating habits for life.

Food sources:

✓ **Complex carbohydrates:** potatoes, bread, rice, pasta, breakfast cereals, oats, couscous and other grains.

✗ **Simple carbohydrates:** fizzy drinks, juice drinks, sweetened drinks chocolate, sweets, cakes, breakfast cereals and biscuits.

Protein Function: For **growth, maintenance and repair** of the body. Protein foods also provide other important nutrients, such as iron, omega 3s, zinc, B vitamins, vitamin D, calcium and selenium. **Plant-based proteins** are a great addition and contain vitamins and minerals as well as extra **fibre.** Examples include beans, lentils and pulses such as chickpeas.

Food sources:

✓ **HBV Protein:** lean meat, fish, dairy products, eggs and soya products.

✗ **Some HBV proteins** are also high in saturated fat, such as red meat.

✓ **LBV Protein:** peas, beans, nuts, lentils, cereals (rice, oats, barley, rye) and cereal products (bread, pasta), seeds. Protein alternatives are manufactured food products, with a high protein content, e.g. mycoprotein (Quorn), tofu, TVP and tempeh. They are used instead of meat in meals.

Fats Function: Some fat is needed in the diet, but it needs to be the right type of fat and in the right amount. Unsaturated fats are healthier than saturated fats, which are linked to long term ill health such as heart disease and obesity. Unsaturated fat is also a good source of Omega 3 and 6 fatty acids.

Children need fats to **fuel** the body and help **absorb** some **vitamins**. They also are the building blocks of **hormones** and they **insulate** the body.

Food Sources:

✓ **Unsaturated fats:** olive, rapeseed, sunflower and corn oils, oily fish, nuts and seeds.

✗ **Saturated fat:** animal products such as fatty meats, butter, lard, ghee, and dairy products and foods made with these such as cakes, biscuits and

Omega 3 and 6 Fatty Acids Function: Function: Long chain omega 3's are essential for normal brain development. Our bodies cannot make this type of fat, so it is important we get it from the diet.

✓ **Food sources:** Oily fish such as salmon, mackerel, trout and sardines.

Nutritional Needs:

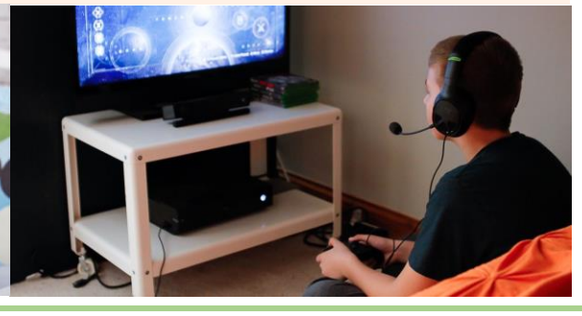
Teenagers require more energy from food than adults because they are growing and often very active. Puberty is a time of rapid growth and changing energy requirements and therefore a risk period for developing obesity.

Teenagers often struggle to meet their daily recommended intake of **iron, calcium, vitamin D, and zinc**, so it's important to eat foods that are rich in these. Teenagers should also remember to eat foods containing **vitamin C and protein**, which are essential for supporting their immune system and muscles.

Teenagers 13-19yrs	
Nutrient	**Food Source**
Iron	Meats (including beef, chicken, and pork), legumes and nuts, dried fruit, green leafy vegetables, and beans.
Vitamin C	Most fruits and vegetables, particularly citrus fruits, leafy greens, red and green peppers, tomatoes, and broccoli.
Calcium	Milk, cheese, tinned fish (such as sardines), green leafy vegetables, tofu, and beans.
Vitamin D	Egg yolks, oily fish, beef liver, and fortified foods (such as margarine and breakfast cereals).
Zinc	Shellfish, red meats, dairies, legumes (such as chickpeas and lentils), and fortified foods.
Protein	Meats, fish, poultry, eggs, beans and legumes, seeds and nuts, and tofu.

Teenagers need lots of:

- **Protein** for growth and repair
- **Calcium** and **vitamin D** to reach peak bone mass
- **Girls** especially need **iron** to replace that lost during their **periods.**
- **Vitamin C** to help absorb **iron** from foods and for clear skin and to fight infections
- Many teenagers vary their diet, but it is recommended they eat **1800kcal** per day made up of the right balance of nutrients.
- **Boys** need **extra iron** initially for growth and muscles, but this need decreases after age 19.
- Boys need more **protein** and **energy** than girls due to their later growth spurt
- Many **UK teenagers** are lacking in calcium, iron and vitamin A.



Vegetarian Teenagers
Teenagers who follow a vegetarian or vegan diet may experience a lack of iron, which is needed for healthy red blood cells, so it is important to find good alternatives.

Vegetarian sources of iron include:

- Leafy green vegetables
- Dried fruit
- Fortified cereal
- Beans
- Lentils

However, vegetarian sources of iron aren't absorbed by the body as well as animal sources. To help with this, a glass of vitamin
C-rich orange juice could be taken at mealtimes to help the body absorb iron.

Vegetarians and vegans also need to make sure they get enough Omega 3, a fatty acid essential for keeping the brain and cells healthy, as the body cannot produce it on its own. Good food sources include a handful of walnuts, tofu or soya.

Healthy Hormones
Zinc is needed in the diet for making many enzymes and hormones, including growth hormones, insulin and testosterone. This is particularly important for teenagers who are developing fast and need the best nutrition they can get.

Zinc can be found in red meat, seeds, spinach, cocoa, mushrooms and oysters.

B-vitamins and Omega 3 can be found in oily fish, wholegrain bread, eggs, milk and vegetables and help to balance hormone production, which is particularly supportive for girls suffering with negative symptoms of PMS.

Alcohol, sugar, saturated fat and caffeine intake have a strong impact on the amount of testosterone in a teenage body, which can easily cause acne breakouts. Consumption of these types of food should be limited to improve skin conditions and mood swings.

20% of teenagers in England are currently overweight

Nutritional Needs: Older

Like adults, older adults should follow a healthy balanced diet to support the maintenance and proper function of the body. Many older adults experience a lowering or loss of appetite, and may need some nutrients in more or less amounts.

Diabetes
Elderly diabetics find it **difficult to control their blood sugar levels**, so they need to eat starchy foods at regular intervals. **They should avoid foods high in sugar**.

Low fat diets
Older adults **do not need as many calories** due to being less active. This could be due to retirement or from lack of mobility because of medical conditions such as arthritis.

Low salt diet
Older adults should **avoid foods high in salt** as this can cause heart problems.

The Elderly 65+yrs	
Males	**Females**
Calories per day **Inactive males:** 2,000kcal **Somewhat active males:** 2,200kcal	**Calories per day** **Inactive females:** 1,600kcal **Somewhat active females:** 1,800kcal
Carbohydrate: 130g – 260g	**Carbohydrate:** 130g – 260g
Protein: 50g	**Protein:** 50g
Fats: 70g **Saturates:** 20g	**Fats:** 70g **Saturates:** 20g
Vitamins and Minerals **Iron:** 8.7mg/d **Calcium:** 1,000 - 1200mg/d **Sodium:** 1600mg/d	**Vitamins and Minerals** **Iron:** 8.7mg/d **Calcium:** 1,000 - 1200mg/d **Sodium:** 1600mg/d
Fibre: **Males:** 30g	**Fibre**: **Females:** 21g

Women reach **peak bone mass** around the age of **25 to 30 years,** when the skeleton has stopped growing and bones are at their strongest and thickest.

The female hormone, **oestrogen**, plays an important role in maintaining bone strength. **Menopause** (the natural ending of periods that usually occurs between the ages of **45 and 55**) can increase your risk of developing osteoporosis, a condition in which bones become thin (less dense) and may fracture easily.

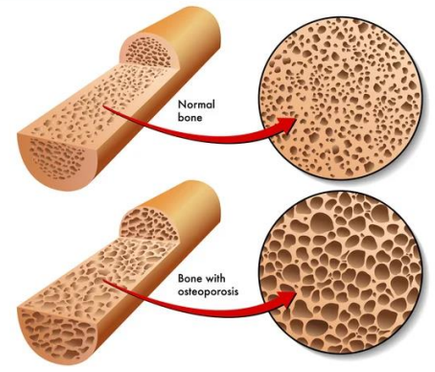
The **drop in oestrogen levels** that occurs around the time of menopause results in **increased bone loss.** It is estimated that, on average, women lose up to **10 per cent of their bone mass in the first five years after menopause.**

To reduce the risk of osteoporosis, post-menopausal women should eat a diet **rich in calcium** and do regular weight-bearing exercise.

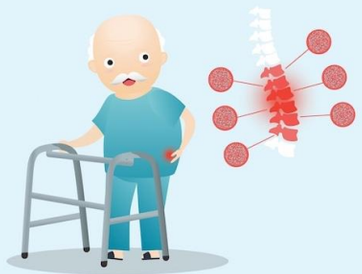
Before menopause, older female adults should have **1,000 mg of calcium daily.**

After menopause, older female adults should have up it **to 1,200 mg of calcium daily.**

Vitamin D is also very important for **calcium absorption** and bone formation.



Although **osteoporosis** is perceived as a female disease, **1 in 8 men over 50 years** will experience a fragility fracture during his lifetime;



SUMMARY

- Loss of appetite
- **Diabetes** - need to eat starchy foods at regular intervals. They avoid foods high in sugar.
- Need **less calories** – dishes should be **low in saturated fat.**
- **Low salt diet** - elderly people avoid foods high in salt as this can cause medical problems such as **high blood pressure.**
- Regular **exercise and activity** helps boost appetite, which some elderly people cannot manage.
- Many older adults **don't get enough fluids and** become **dehydrated** more easily because of age-related changes or **medications** they're taking.

Nutritional Needs:

Because the body becomes **more efficient at absorption during pregnancy**, normal nutritional requirements apply until the **last trimester of pregnancy**, when some **extra energy and calcium is required**. Pregnant and lactating women should eat a varied diet rich in fresh fruit and vegetables and wholegrains **(in line with the Eatwell Guide)**.

High Risk Foods to Avoid:
•Unpasteurised milk products and undercooked meats/cured meat products – they may contain listeria which is harmful to unborn babies
•Pate, liver and liver products – due to high vitamin A content (Vitamin A is harmful to unborn babies if eaten in large quantities)
•Swordfish, marlin and shark as they are high in mercury which can be harmful to unborn baby

Differences to non-pregnant women	Possible deficiencies when pregnant:
Avoid high risk foods when pregnant: • raw or undercooked meat • liver and liver products • all types of pâté, including vegetarian pâté • game meats such as goose, partridge or pheasant • any other foods made from unpasteurised milk, such as soft ripened goats' cheese • pasteurised or unpasteurised soft blue cheeses • unpasteurised cows' milk, goats' milk, sheep's milk or cream • raw or partially cooked hen eggs that are not British Lion or produced under the Laid in Britain scheme • raw or partially cooked duck, goose or quail eggs • smoked fish, such as smoked salmon and trout • alcohol • no more than 200mg caffeine per day • **More calories in 2nd and 3rd trimester** 	• Iron • Vitamin B12 • Folate • Iodine • Zinc • Vitamin D • Vitamin C • Calcium • Fibre • Water 

FOLIC ACID IN PREGNANCY
It's recommended to take:
• 400 micrograms of folic acid every day – from before pregnancy until 12 weeks pregnant
This is to reduce the risk of problems in the baby's development in the early weeks of pregnancy.

VITAMIN D IN PREGNANCY
Pregnant women need 10 micrograms of vitamin D each day and should consider taking a supplement containing this amount between September and March.

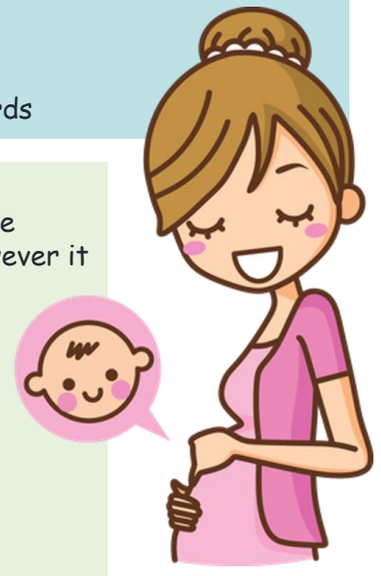
Vitamin D regulates the amount of calcium and phosphate in the body, which are needed to keep bones, teeth and muscles healthy.
Vitamin D can be found in the following foods:
- oily fish (such as salmon, mackerel, herring and sardines)
- eggs
- red meat
- Vitamin D is added to some breakfast cereals, fat spreads and non-dairy milk alternatives. The amounts added to these products can vary and might only be small.

Having more than 100 micrograms (4,000 IU) of vitamin D a day as it could be harmful.

IRON IN PREGNANCY
During pregnancy, a woman's blood volume increases to support the growing baby. This means more red blood cells are needed and therefore more iron to make them. Not having enough iron to meet this demand could lead to **tiredness and anaemia.** Lean meat, green leafy vegetables, dried fruit, and nuts contain iron.
Many breakfast cereals have iron added to them.

CALCIUM IN PREGNANCY
Calcium is vital for making the growing baby's bones and teeth.
Sources of calcium include:
- milk, cheese and yoghurt
- green leafy vegetables, such as rocket, watercress or curly kale
- tofu
- soya drinks with added calcium
- bread and any foods made with fortified flour
- fish where you eat the bones, such as sardines and pilchards

VEGETARIAN and VEGAN DIETS IN PREGNANCY
A varied and balanced vegan or vegetarian diet should provide enough nutrients for mother and baby during pregnancy, however it might be more difficult to get enough **iron and vitamin B12.**
Iron-rich foods for vegetarians and vegans include:
- lentils
- cannellini beans
- tofu
- fortified cereals
- dark chocolate
- baked potatoes
- spinach



Nutritional Needs: Activity

We need energy for:
- Breathing
- Organ function
- Digesting food
- Activities such as walking, running and even sitting down

The amount of energy we need depends on our age, gender, activity level, health and body mass (size).

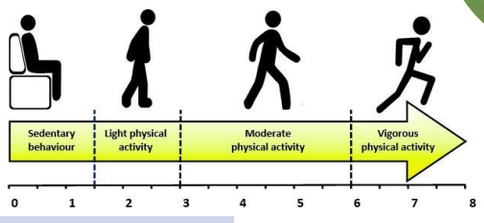
What is BMR?
BMR is the number of calories your body uses to maintain vital functions, such as breathing, heart rate, and brain function. It is the rate at which we use energy when we are resting. Basically, BMR is a calculation of how much energy (calories) the body needs just to stay alive! You can use the formulas below to calculate your own BMR.

BMR = 88.362 + (13.397 x weight in kg) + (4.799 x height in cm) – (5.677 x age in years)

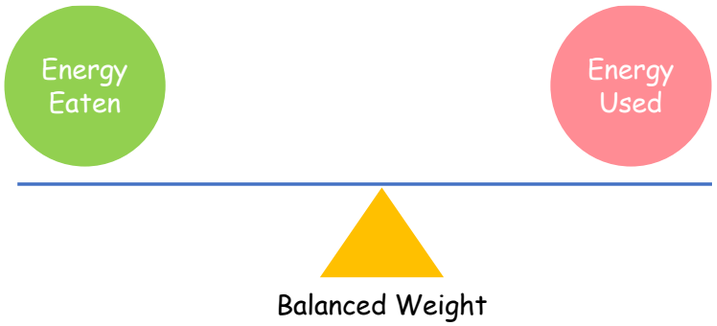
BMR = 447.593 + (9.247 x weight in kg) + (3.098 x height in cm) – (4.330 x age in years)

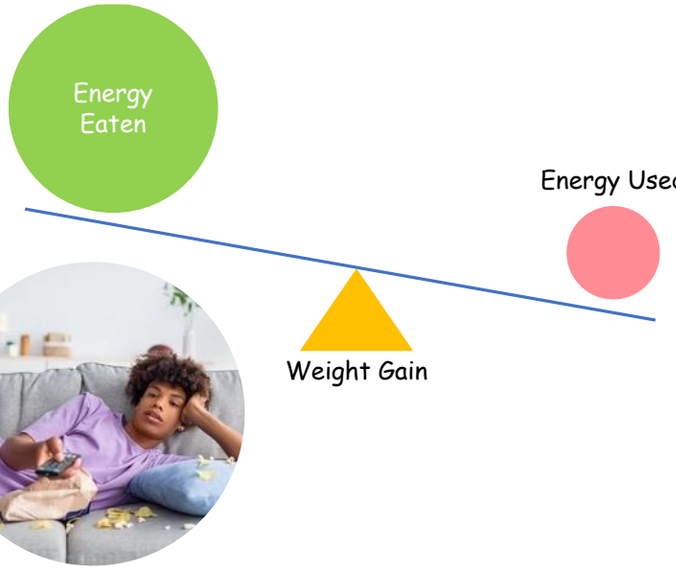
Activity Levels
Basal Metabolic Rate (BMR) is determined by age, gender, weight and height however, this number increases the more active you are.
Active people require more calories than sedentary (non-active) people. People who are sedentary are more likely to gain weight and develop chronic conditions such as obesity, diabetes and heart disease.

Multiply your BMR by your activity level	Multiply BMR by	Exercise Level
Sedentary	1.2	No exercise
Light Activity	1.375	1-3 x per week
Moderate Activity	1.55	3-5 x per week
Very Active	1.725	6-7 x per week
Athlete	1.9	2 x per day or very active job



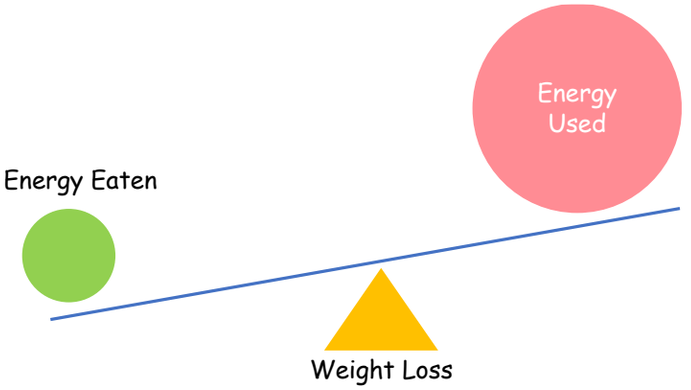
If we eat the right amount of foods for our energy needs, then our body weight is maintained (stays the same).





If we eat more food than we need and do not use the excess energy (in the form of calories) the body will convert the left-over energy and store it as fat in the body. This will lead to weight gain over time.

If we eat less food than we need but still require more energy (calories) the body will convert stored energy (fat) for use, and we would lose weight.

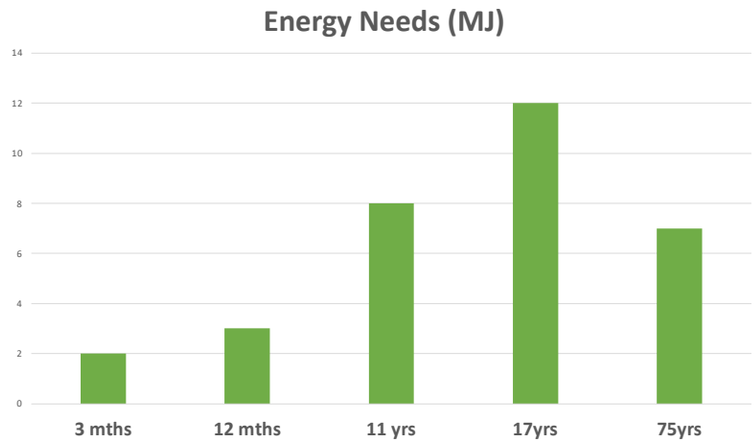


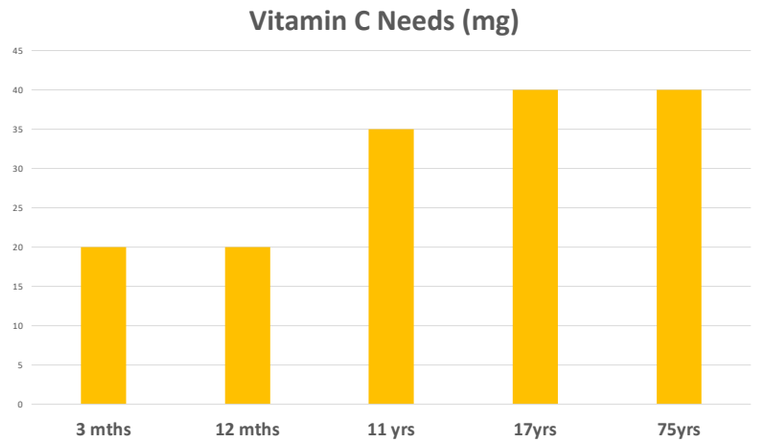
Key Words

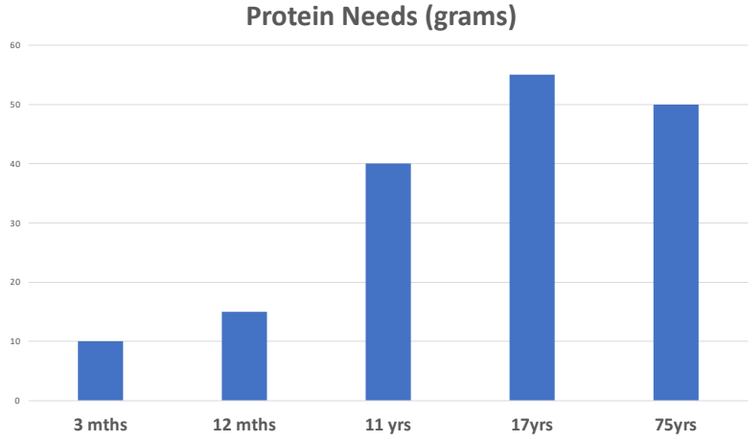
BMR – Basal metabolic rate	The minimum amount of energy we need to function and stay alive.
Consume	To eat
Chronic	Long term
Sedentary	Inactive

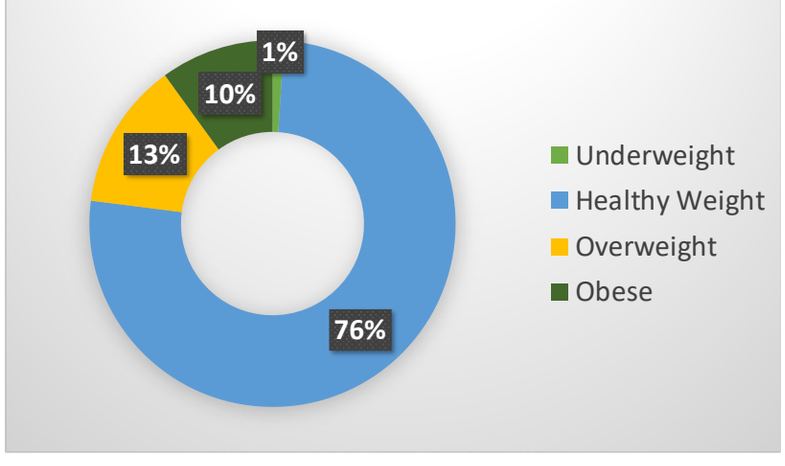
Nutritional Needs:

Analysing data can be very helpful when comparing nutritional needs of different groups of people. The graphs below show how much of each nutrient the body requires at different ages. Statistics are also useful when justifying your points.







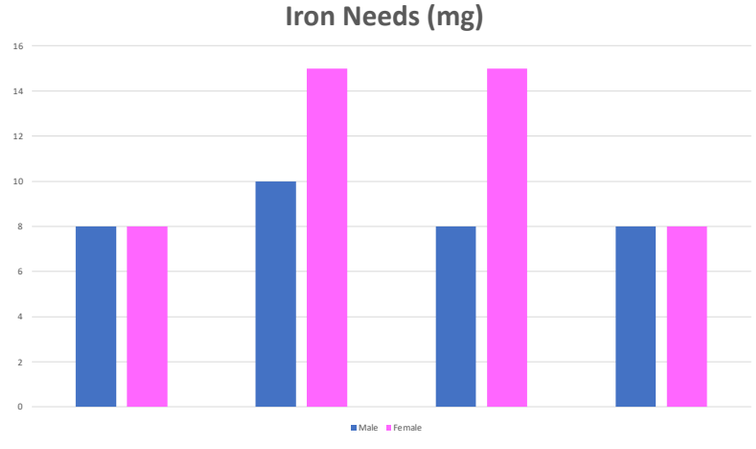


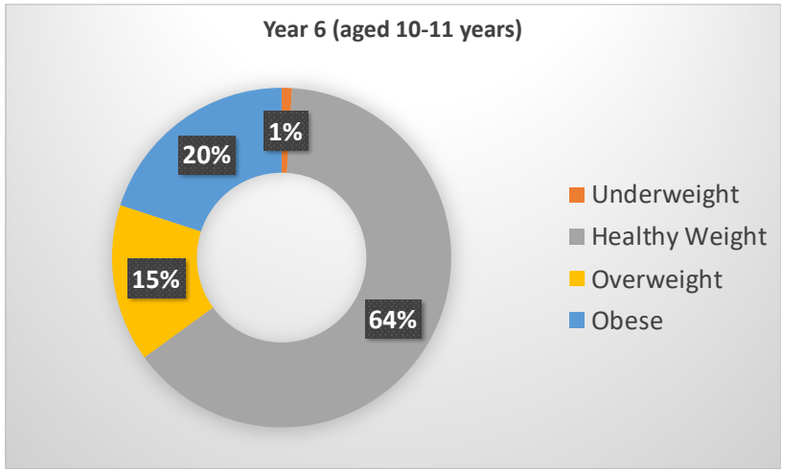
Obesity costs the NHS 5.1 billion pounds per year

1 in 4 adults are obese

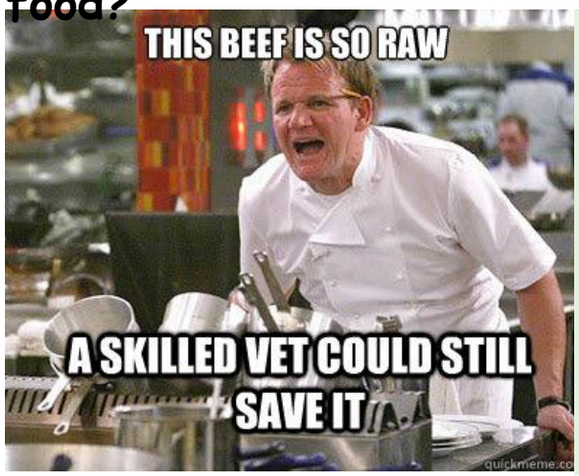
By 2050 it is estimated 60% of men and 50% of women will be obese

Obesity in children under 16yrs will increase by 25%





Why do we cook food?



Cooking food **improves digestion** and **increases the absorption of many nutrients.** Different cooking methods alter the nutritional composition of foods and can degrade some nutrients, while enhancing the availability of others. For example, the protein in cooked eggs is **180% more digestible** than that of raw eggs. This is also true of vegetables, as cooking **breaks down the thick cell walls of many plants**, releasing the nutrients stored in them. A great example of this is cooked tomatoes, which have a higher lycopene (an amino acid) content than raw tomatoes.

We also cook foods to make them safer to eat. For example, eating raw potatoes would give you **stomach ache!** Uncooked meat could give you **food poisoning.** Cooking food **kills bacteria** and can make food look and taste **more appealing** by altering the colour and texture of it.

INTERESTING FACT!

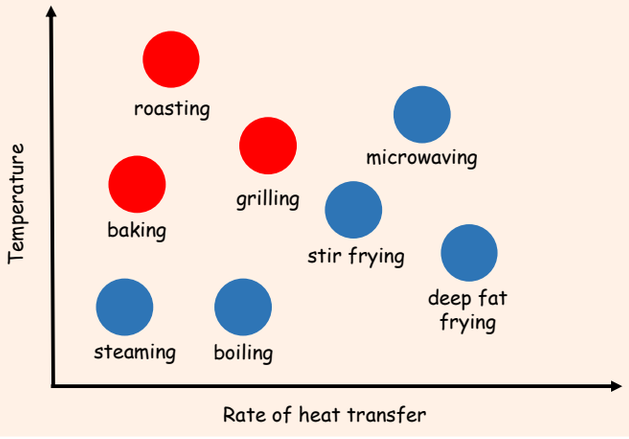
Virtually all **minerals** are unaffected by heat. Cooked or raw, food has the same amount of calcium, phosphorus, magnesium, iron, zinc, iodine, selenium, copper, manganese, chromium, and sodium.

The main foods affected by moist cooking methods are **fruit and vegetables which contain water soluble vitamins, B and C.** The **B Group** of vitamins, (B1, B2, B3, B5, B6, B7 and B8) and **vitamin C** are also sensitive to heat and can be destroyed by high cooking temperatures.

The **longer** fruit and vegetables cook, the **more nutrients are lost.**

Chopping and **slicing** up fruit and vegetables causes loss of nutrients, so cut up these foods just before you need them.

The longer food is heated, and the higher the temperature, the greater the nutrient loss.



Fat soluble vitamins A, D, E and K are also **destroyed with heat.**
Cooking methods such as frying and roasting that use fat **increase** the **fat content and total calories** in food cooked this way.

When animal sources of protein are cooked slowly, any connective tissues present in the meat are likely to **dissolve.** **Heat does not destroy the protein in food, but it may reduce the overall content.**

Protein that is exposed to **hot temperatures**, shrinks and loses moisture. This usually occurs at temperatures between **70°C - 85°C.**

Nutrient Content Comparison by Cooking Method

Type of potato	Amount of fat per 100g
Potato, baked flesh only	7g
Potato, mashed with butter	4g
Potato wedges, baked	7.7g
Potato, roasted	4.5g
Chunky chips deep fat fried	5.2g

Vegetable	Amount of vitamin C per 100g
Raw spinach	26mg
Boiled spinach	8mg
Raw peas	24mg
Boiled peas	16mg
Canned peas	1mg

Moist Cooking Methods

Boiling and Simmering

Boiling reduces vitamin C content more than any other cooking method. As vitamin C is water soluble and sensitive to heat it can leach out of vegetables when they are immersed in hot water, such as in boiling. Broccoli and spinach may lose up to 50% or more of their vitamin C when boiled! B vitamins are similarly heat sensitive. Up to 60% of thiamine, niacin, and other B vitamins may be lost when meat is simmered and its juices run off.

However, when the liquid containing these juices is used to make stocks and gravies, 100% of the minerals and 70–90% of B vitamins are retained. Interestingly, boiling fish can preserve omega-3 fatty acid content significantly more than frying or microwaving.

Boiling is most suitable for cooking dry, starchy ingredients such as pastas, rice and grains. The rapidly boiling liquid is needed to keep the ingredients moving so they do not stick together. Starch (carbohydrate) is gelatinised when cooked in liquid making it easier for the body to digest and therefore use for energy.

Boiling is also used for blanching many vegetables (to kill bacteria for food safety requirements). Prolonged boiling is never recommended because it can damage the flavour and ingredients.

Poaching

Poaching is a cooking technique that involves cooking by submerging food in a liquid, such as water, milk, stock or wine. Poaching is differentiated from the other "moist heat" cooking methods, such as simmering and boiling, in that it uses a relatively low temperature.

Delicate foods such as fish and eggs are often cooked this way as they are less likely to break apart during the cooking process and retain their shape.

As this cooking method involves submerging food in water, water soluble vitamins B and C are lost in the process.

When acidic liquid such as wine is used to poach foods, such as fruit, the acidity can also destroy vitamins and minerals.

Steaming

Steaming is one of the best cooking methods for preserving nutrients, including water-soluble vitamins, which are sensitive to heat and water.

Steaming broccoli, spinach and peas reduces their vitamin C content by only 9–15%. The downside is that steamed vegetables may taste bland. However, this is easy to remedy by adding some seasoning and oil or butter after cooking.

Microwaving

Microwaving is an easy, convenient, and safe method of cooking. Short cooking times and reduced exposure to heat preserve the nutrients in microwaved food.

Microwaving is the best method for retaining the antioxidant activity of garlic and mushrooms. Meanwhile, about 20–30% of the vitamin C in green vegetables is lost during microwaving, which is less than most cooking methods.

Dry Cooking Methods

Grilling

Grilling is a method of cooking with dry heat. Grilling is one of the most popular cooking methods because of the great flavour it gives food. Unfortunately, up to 40% of B vitamins and minerals may be lost during grilling or broiling when the nutrient-rich juice drips from the meat. There are also concerns about polycyclic aromatic hydrocarbons (PAHs), which are potentially cancer-causing substances that form when meat is grilled and fat drips onto a hot surface.

Roasting and Baking

Roasting and baking are both dry heat methods of cooking. Roasting is typically used for meat while baking is used for bread, muffins and cakes. Most vitamin losses are minimal with this cooking method, including vitamin C. However, due to long cooking times at high temperatures, the B vitamins in roasted meat may decline by as much as 40%. The meat juices could be used to make stocks and gravy after cooking to retain B vitamins and minerals lost.

Stir frying

With sautéing and stir-frying, food is cooked in a saucepan over medium to high heat in a small amount of oil or butter. Cooking for a short time without water prevents the loss of vitamins B and C, and the addition of fat improves the absorption of plant compounds and antioxidants. In fact, beta carotene was 6.5 times greater in stir-fried carrots than in raw ones. On the other hand, stir-frying significantly reduces the amount of vitamin C in broccoli and red cabbage.

Shallow frying

Frying involves cooking food in a large amount of fat — usually oil — at a high temperature. Food is often coated with batter or bread crumbs, such as fish and chips or deep fried chicken. When the skin makes contact with the very hot oil it forms a seal, which ensures that the inside remains moist and cooks evenly. However, not all foods are appropriate for frying. Fatty fish (source of omega-3 fatty acids) is very delicate and prone to damage at high temperatures. For example, frying tuna has been shown to degrade its omega-3 content by up to 70–85%, while baking causes only minimal losses. In contrast, frying preserves vitamin C and B vitamins, and it may also increase the amount of fibre in potatoes by converting their starch into resistant starch.

SUMMARY

- Water-based cooking methods cause the greatest losses of water-soluble vitamins, they have very little effect on omega-3 fats.
- Grilling provides great flavour but also reduce levels of B vitamins. Grilling generates potentially cancer-causing substances (PAHs).
- Microwaving is a safe cooking method that preserves most nutrients due to short cooking times.
- Roasting or baking does not have a significant effect on most vitamins and minerals, except for B vitamins.
- Sautéing and stir-frying improve the absorption of fat-soluble vitamins and some plant compounds, but they decrease the amount of vitamin C in vegetables.
- Frying can provide some benefits when healthy oils are used. It's best to avoid frying fatty fish.
- Steaming is one of the best cooking methods for preserving nutrients, including water-soluble vitamins.

HOW TO RETAIN NUTRIENTS WHEN PREPARING AND COOKING FOOD

- Use as little water as possible when poaching or boiling.
- Use the liquid left in the pan after cooking vegetables.
- Add back juices from meat that drip into the pan.
- Leave skin on vegetables to increase fibre content.
- Cook vegetables in smaller amounts of water to reduce the loss of vitamin C and B vitamins.
- Eat cooked vegetables within a day or two, as their vitamin C content may continue to decline when the cooked food is exposed to air.
- Cook vegetables for only a few minutes whenever possible.
- When cooking meat, poultry, and fish, use the shortest cooking time needed for safe consumption.
- Some chefs use baking soda when cooking vegetables to help them retain their colour, however vitamin C will be lost in the alkaline environment produced by baking soda.

Seasonal Foods

Seasonal food is fresh food that is ready to eat during its preferred season. For example, English strawberries are juicy and delicious in the summer and early autumn. They do not grow wild in England during winter as it is too cold. Some foods are not seasonal. Meat and dairy are available all year round. Cows are milked and chickens produce eggs from January all the way to December.

Cheaper
Seasonal produce that is locally sourced is often cheaper than buying out of season food that's been brought in. Seasonal food is cheaper to harvest, transport and sell as it's in abundance – driving down the market price. A good tip is to look for the Red Tractor logo; this symbol shows that the food is "traceable (back to a UK farm), safe and farmed with care".

Tastes Better
Seasonal produce will be at its peak for both flavour and health benefits. It's harvested at exactly the right time, so the taste is riper, sweeter, and generally more delicious. The chef/cook won't need to use seasonings such as salt or spices. Out of season food gets picked before it's ripe and then gets spoilt during transport. This compromises freshness and flavour of the food, so the chef gets lower quality at a higher cost.

Local Economy
As well as getting food at its prime, you'll also be supporting your local economy. Money spent in local businesses is normally reinvested into other local stores; helping to generate jobs and support local producers. Buying directly from the farmer or producer also means you no longer have to wonder where your food came from.

Easter: Easter is the most important festival in the Christian calendar. It celebrates Jesus rising from the dead, three days after he was executed. An egg is a symbol of new life. For Christians, Easter eggs are used as a symbol for the resurrection of Jesus. Easter is often celebrated with the giving and receiving of chocolate eggs.

Environment
Seasonal food is often grown/reared much closer to you. Reducing the environmental damage done by carrying and shipping foods long distances and keeping them cold. This is called 'food miles'. Food grown locally will also need fewer fertilisers and pesticides. which lessens water, air, and soil pollution, supporting a healthier community.
Buying seasonal food will help to reduce your own carbon footprint and support a more sustainable food economy.

Eid: Celebrated worldwide by Muslims to mark the end of **Ramadan**. Eid ul-Fitr takes place on the first day of the tenth month of the Islamic lunar calendar, and Muslims are not permitted to **fast** on that day.

Ramadan: During the month of Ramadan, Muslims won't eat or drink during the hours of daylight. This is called fasting. Children are not expected to fast until they reach puberty, usually around the age of 14.

Christmas: Christmas is a Christian holy day that marks the birth of Jesus, who Christians believe to be the Son of God. Christmas dinners are an important part of the celebrations. Families and friends will share food together, eating traditional foods, such as turkey, mince pies and Christmas puddings.

Healthier
Foods grown out of season can't follow normal growing and ripening cycles, which our bodies are naturally in sync with. But by altering the menu to follow the seasons, dishes will have a better nutrient value. This is a great selling point for a food establishment, especially those catering to a wide variety of customers such as the young and elderly.

Produce that is flown thousands of miles also loses some of its nutritional and vitamin value. Fruit and vegetables that have been blanched, tinned or dehydrated to enhance the lifespan lose nutrients as well.

Disadvantages
Some disadvantages of using seasonal foods are that your may have to change your menu according to the seasons, this might push customers away who prefer certain dishes. This is a similar challenge to the chef, who may struggle to make the dishes interesting with limited ingredients. The skills required to be able to prepare and cook seasonal food may be a disadvantage to a business as staff costs may be higher. Employing high skilled staff may create an increase in food costs.

Skills of Chefs

Catering jobs are available at various levels, ranging from trainee and apprenticeships to executive level. Here are a few examples of the different types of jobs that are available in the catering industry:

EXECUTIVE CHEF

An executive chef manages the kitchen. He or she is responsible for monitoring and maintaining the quality of all dishes that leave the kitchen, creating menus and inventing new dishes, and supervising the kitchen staff. Except in small establishments, an executive chef will generally spend more time on administrative and managerial tasks than on food preparation.

QUALIFICATIONS

- Formal culinary training
- Previous restaurant experience
- Extensive food and beverage knowledge
- Restaurant industry knowledge
- Knowledge of restaurant regulations

Because the executive chef is the most senior person in the kitchen, he or she is often required to have a minimum of 5 – 8 years of relevant experience.
+ The qualifications listed under Section Chef.

SKILLS

- Cooking skills
- Menu planning skills
- Communication skills
- Leadership skills
- Time management skills
- Attention to detail
- Organisational skills
- Problem solving skills
- Work well under pressure
- Self-motivated
- Customer service skills
- Positivity
- People management skills
- Numerical skills

SOUS CHEF

Works alongside head chef to manage daily kitchen activities, including overseeing staff, aiding with menu preparation, ensuring food quality and freshness, and monitoring ordering and stocking. Provides meal quality and consistency by following designated recipes.

QUALIFICATIONS

- Formal culinary training
- Previous restaurant experience
- Extensive food and beverage knowledge
- Restaurant industry knowledge
- Knowledge of restaurant regulations

+ The qualifications listed under Section Chef.

SKILLS

- Cooking skills
- Communication skills
- Numerical skills
- Leadership and teamwork skills
- Organisational skills
- Problem solving skills
- Work well under pressure
- Self-motivated
- Customer service skills
- Positivity
- People management skills
- Attention to detail

SECTION CHEF

The chef de partie or section chef preps, cooks and assembles dishes and makes sure that they go out on time. They are in charge of a specific section of the kitchen such as sauces, fish or pastry, so need to have a sound knowledge of cooking. The chef de partie also assists the sous chef or head chef in developing menus.

QUALIFICATIONS

- City & Guilds 706/1 | 706/2 Catering
- NVQ Level 2
- Level 1 and 2 Food Safety Awards
- Minimum 1 years relevant experience
- Awareness of manual handling techniques
- Awareness of Control of Substances Hazardous to Health Regulations (COSHH) and chemical safety

SKILLS

- Cooking skills
- Work independently
- Manage Commis Chefs
- Communication
- Team management
- Communication skills
- Attention to detail
- Numerical skills
- Adaptability
- Positivity
- Team player

Skills of Chefs

COMMIS CHEF

A Commis Chef assists a section chef (Chef de Partie). The commis chef is the first rung of the ladder to becoming a great chef. In most kitchens the commis chef will do food preparation work and basic cooking under the supervision of a chef de partie or section chef, rotating through sections such as sauce, vegetables, fish and butchery roughly every six months.

QUALIFICATIONS

- Level 1 and 2 Food Safety Awards
- Minimum 6 months relevant experience
- Awareness of manual handling techniques
- Awareness of Control of Substances Hazardous to Health Regulations (COSHH) and chemical safety
- Experience of kitchen equipment
- Experience of dangerous equipment such as knives
- Competent level of English spoken and written

SKILLS

- Communication skills
- Teamwork skills
- Working quickly and efficiently
- Stamina
- Willingness to learn
- Patience
- Attention to detail
- Passion for food
- Work well under pressure

CATERING ASSISTANT

The purpose of this role is to provide general assistance to the catering manager. The catering assistant will be required to assist with performing administrative tasks, preparing and serving food, and communicating with guests.

QUALIFICATIONS

Formal qualifications are not required. However, a basic certificate in nutrition, catering, or food safety management will count in your favour when applying for a job. The level of experience required will differ from one job to another. An entry-level job in this field will usually require little to no experience, and will allow you to learn on the job.

SKILLS

- Communication skills
- Problem solving skills
- Ability to work in a team
- Ability to work under pressure

There are no fixed educational requirements for becoming an executive chef. While it may be possible to work your way up to this position through on-the-job training and practical experience, it is recommended that you study towards a relevant qualification, such as a restaurant management certificate, hospitality management certificate, culinary arts degree, or hospitality management qualification.

Equipment

Chef's Knives

Chef's Knife

All purpose knife generally used for cutting meat, dicing vegetables, disjointing some cuts, slicing herbs, and chopping nuts.

Bread Knife

The serrated edge cuts through the crust without flattening the bread.

Pairing Knife

Very versatile, often used to peel or cut fruit and vegetables into small pieces, or to carry out other similar precision work.

Carving Knife

Used for carving large roasts, poultry, and filleting large fish. The blade edge of a a carving knife is either smooth or bevelled. The blade should be large enough to carve across the cut of meat, poultry, or fish in one sweep.

Cleaver/Butcher Knife

A cleaver is a large knife that varies in its shape but usually resembles a rectangular-bladed hatchet. It is largely used as a kitchen or butcher knife and is mostly intended for splitting up large pieces of soft bones and chopping through thick pieces of meat.

Boning Knife

Boning knives have long, thin, flexible blades with a sharp tip to make piercing meat easier and safer. The blade is designed to cut through ligaments and connective tissue to remove raw meat from the bone. Boning knives have to be extremely sharp.

Filleting Knife

A filleting knife gives good control and aids in filleting fish. It is a very flexible member of the boning knife family. Fillet knife blades are typically 15 to 28 cm.

Salmon Knife

A salmon knife is used to slice, fillet and remove the skin from larger fish, like salmon. They're slender enough to fit between the skin and flesh without damaging the delicate fish, allowing the chef to create clean, tidy fillets.

Santoku Knife

Santoku bocho knives, which translates as 'three uses', are ideal for mincing, dicing and slicing, as they feature a straight edge with a narrow sheep's foot blade. These knives have evolved from the traditional Japanese vegetable knife which has a rectangular blade.

Tomato Knife

The serrated edge allows the knife to penetrate the tomato skin quickly and with a minimum amount of pressure without crushing the flesh.

Peeling Knife

A peeling knife is primarily used to peel vegetables, potatoes and fruit, and it's also sharp enough to easily slice through tough skins.

Cheese Knife

The blades of cheese knives are usually made of a material such as stainless steel, which is resistant to the stickiness of cheese. Another design feature often found is the presence of holes in the blade to help to prevent the cheese from sticking to it.

Other Cutting Equipment

Food processors, mincer, mandolins, graters, peelers, corers, cutters, can openers, scissors, shears and gravity feed slicer.

Large Scale Equipment

Combi Oven

Simple and quick operation, all at the touch of a button. This oven allows pre-prepared settings, has a wide range of cookery options and even cleans itself. These functions support the chef in their daily duties.

Commercial Range

Many commercial ranges have boost burners which generate 25% more power. They have semi-sealed hobs and drip trays to facilitate ease of cleaning. These ovens allow the chef to prepare and cook large scale operations due to the power and size.

Deep Fat Fryer

Free standing fryers are extremely large and allow large batch cooking as well as the option to cook separately in either basket. Training must be given before they can be used as they can be extremely dangerous.

Blast Chiller

Blast chilling is a method of cooling food quickly to a low temperature that is relatively safe from bacterial growth. By reducing the temperature of cooked food from +70°C to +3°C or below within 90 minutes, the food is rendered safe for storage and later consumption.

Commercial Fridge/Freezer

Large scale fridges and freezers allow you to safely store food at the correct temperature and comply with HACCP 2006.
Fridge temperature: 1-5°C
Freezer temperature: -18°C

Four Pot Bain Marie

Perfect for safely holding sauces, gravy and pre-cooked foods for up to two hours at serving temperature above 63°C. These are very useful when wanting to serve customers quickly or store foods safely without fear of them burning. You have most likely seen this piece of equipment in your school's canteen!

Rotisserie Oven

Rotisserie grilling produces superb duck, crisping the skin and melting out the fat. Rib roast comes out dark and crusty on the outside, red and juicy inside, with a live fire flavour better than that of a roast cooked in the oven. Poultry produces good results when cooked in a rotisserie.

Powered Equipment

Mincer

A meat mincer is a small kitchen appliance used to grind meat into a smooth, uniform soft mass without the need of any other accessory.
A meat mincer machine is a clean, effective and safe way of obtaining minced meat.

Portable Induction Hob

Portable induction hobs are much safer to use, as most will feature a boil dry detection as well as switching off automatically when a pan is removed and resume when pan is returned. They are ideal for indoor or outdoor cooking. These are extremely energy efficient and support the environment. These cookers also don't heat the surface of the cooker, so are much safer to use.

Food Processor

A food processor is a motorised appliance that quickly performs food prep tasks traditionally carried out by hand. Some food processors can chop vegetables; some can blend ingredients into soups, pastes and sauces; and others can mix things like batter and cream.

Electric Whisk

Electric hand mixers – sometimes called beaters – really speed up whisking egg whites, creaming butter with sugar and whipping cream. They are less powerful than stand mixers, so are perfect for mixing small quantities, and for when you want more direct control over the mixture.

Blender

Produces smoothies, cocktails, fruit purées, velvety smooth soups and sauces in seconds.

Standing Mixer

Great for multi-tasking, a standing mixer is perfect for mixing large batches of dough or batter whilst you concentrate on other tasks.
A standing mixer is also good for tougher mixing tasks such as bread kneading and pastry making.

Handheld Equipment

Melon Ball Scoop

A sharp-edged scoop or cup-shaped, half sphere implement used for cutting fruits and vegetable into small balls. Normally used by the Garde Manger Chef.

Cook's Fork

Cook equipment used for lifting and turning meat and other items must be strong enough to hold heavy loads.

Palette Knife

A 2 to 3 cm wide, flexible handled blade with a rounded, unsharpened end used for manipulating foods such as spreading and for smoothing icings on cakes and for mixing and scraping bowls.

Offset Spatula

Used for turning and lifting eggs, pancakes and meat on the griddle, grills, sheet pans, and so on. It can also be used as a scraper to clean bench or griddle.

Rubber Spatula

A broad, flexible plastic or rubber scraper, that is rectangular in shape with a curve on one side, used to scrapping bowl and pans—also used for folding in eggs foam or whipping cream.

Bench Scraper

A broad, rectangular stiff piece of metal with a wooden handle on one edge used to cut pieces of dough and to scrape workbenches.

Pizza Wheel

A round, rotating blade plain or plated with a handle used to cut rolled out dough pastries, and baked pizzas.

Spoons

Used for stirring, mixing, and serving. Slated and perforated spoon is used when liquid must be arranged from solid materials.

Skimmer

Used for skimming froth from liquid and for removing solid pieces from soup, stock and other liquids.

Tongs

Used to pick up and handle food in the kitchen.

Handheld Equipment

Balloon Whisk

Balloon whisks have many flexible wires and are used for whipping egg, cream, hollandaise, and for mixing thinner liquids.

Conical Strainer

Is used for straining stocks, soup, sauces, and other liquids. Pointed shapes allow cooks to drain liquid through a relatively small opening.

Sieve

A screen- type mesh supported by a round metal frame used for sifting dry ingredients like starch and flour.

Colander

A perforated bowl of varying sizes made of stainless steel, aluminium or plastic used to drain washed or cooked vegetables, green salad, pasta, and other foods.

Grater

A four-sided metal box with grids of varying sizes. Used for shredding and grating vegetables, cheese, citrus rinds, and other foods.

Zester

A small fine-toothed metal grater often mounted on a wooden or plastic handle to remove the zest or coloured portions of citrus peels in thin strips.

Pastry Bag and Nozzles

A funnel-like or cone-shaped cloth or plastic bag with an open end that can be fitted with metal or plastic tubes or tips of varying sizes and designs.

Food Mill

A device with hand-turned blade that forces food through a perforated disk that is interchangeable with different coarseness or fineness reduce a solid to small, fine pieces or powdery particles like vegetables, coffee, pepper, spices, etc.

Colour Coded Chopping Boards

White: bakery and dairy products
Yellow: cooked meat
Brown: root vegetables
Red: raw meat
Blue: raw fish
Green: salad, fruit and fresh vegetables

Chip Scoop

Featuring a tubular handle, the scoop remains cool to the touch when in use, ensuring the safety and comfort of staff. Made with a perforated head, the scoop allows residue to easily drain away to ensure chips are not soggy or too oily.

Handheld Equipment

Pestle and Mortar

This tool is ideal for mashing, grinding, muddling and bashing. By mashing ingredients, you can release all the natural oils and flavours from herbs and spices.

Fish Slice

Features a wide, flat blade with long holes in it, used for lifting and turning food while cooking. It was originally a serving implement for fish, usually made of silver, antique examples of which commonly appear at auction.

Bamboo Steamer

A bamboo steamer is a versatile cooking tool often used to steam dumplings but can in fact be used in the same way as a 3-tier steamer, used to steam cook meat, fish and vegetables.

Steak Hammer

Tenderising meat with the mallet softens the fibres, making the meat easier to chew and to digest. It is useful when preparing particularly tough cuts of steak, and works well when grilling or frying meat.

Peeler

A peeler (vegetable scraper) is used to remove the outer layer (the "skin" or "peel") of some fruits and vegetables such as potatoes and carrots, apples and pears.

Digital Scales

Used to measure ingredients accurately. Ingredients can be measured in kg, g, ml, lbs, oz and fl.oz.

Measuring Jug

Used to measure liquids accurately.

Lifter/Spider

A spider is ideal for lifting and draining foods from hot oil, soups, stocks and boiling water. It is the perfect tool for skimming stocks, blanching vegetables and deep frying foods. This kitchen utensil is most often used to retrieve foods that are being cooked in pots or pans of hot water.

Stick Blender

Used to quickly blend soups, stews and sauces in the pot without having to transfer back and forth to a blender or food processor.

Potato Ricer

Ricers are often used to puree food, most notably mashed potato. A ricer can be used to remove excess water from foods such as cooked greens that are to be added to quiche, thawed frozen spinach, and sliced or grated potatoes to improve the quality of potato chips or hash browns made from them.

Handheld Equipment

Saucepan

- Reheating soups
- Smaller volumes of sauces
- Ideal smaller portions

Deep Boiling Pot

- Cooking larger stews and soups
- Making larger volumes of sauces
- Ideal for bulk cooking where multiple portions are to be served

Stainless Steel Sauté Pan

- Stir fries, vegetables, braising and finishing dishes

Non-Stick Sauté Pan

- Cooking eggs and fish
- Allows cooking at lower temp.
- Don't use metal instruments as they will scratch the Teflon surface

Cast Iron Pan

- Grilling meats, fish and vegetables
- Can take high heat and go in oven
- Cast iron won't tarnish and is easy to clean

Cast Iron Griddle Pan

- Has grooves in the bottom for searing meat
- Fat stays below in the grooves
- Make sure to season and clean between the grooves

Training and Safe Use

Points to Consider

Is your equipment suitable for your provision?

It goes without saying that you should never use domestic equipment in commercial kitchens. Not only are such appliances unable to keep up with the day-to-day demands of professional kitchens, but understandably, most manufacturers won't honour warranties for products designed for domestic use when used for commercial purposes.

Are your kitchen appliances fit for purpose?

Will your catering equipment be able to meet demand and produce food in the quantities you require?

As well as the size and quality of the kit, also consider its power capabilities. Less powerful equipment is unlikely to be able to keep up.

Do appliances meet food safety requirements?

There are more than a million cases of food poisoning a year in the UK. Many of these cases are the result of eating food prepared in a professional kitchen.
It is an offence to 'render food injurious to health' or to sell food that does not meet safety requirements - with severe penalties, including unlimited fines, or even imprisonment for failure to comply. Specially designed catering equipment such as blast chillers can help ensure this legislation is met, reducing your exposure to risk, looking after the health of your customers, and protecting your hard-earned reputation.

Food Standards Agency

Using Equipment Safely

- Do not use electrical equipment when your hands or wet or use near water.
- Do not put electrical equipment in water to clean it.
- Switch electrical equipment ff at the socket when you have finished using it.
- Do not put your hands or spoons into a an electrical mixing bowl or processor while in use.
- Wash equipment carefully – sharp equipment such as knives should never be submerged in soapy water where they cannot be seen.
- Do not use metal spoons in a saucepan as they conduct heat.

Can your appliances cope with emerging food trends and dietary requirements?

- The food and catering industry in the UK has changed dramatically over the last few years in the face of changing dietary requirements, allergies, and food intolerances.
- As such, today's commercial kitchens must be structured in a way to avoid cross contamination and cater for broader customer tastes.
- Today's commercial kitchens should have a layout that means you can avoid cross contamination when using ingredients like nuts, eggs, wheat and other common allergens.
- Fryers carry a particularly high risk of allergen cross-contamination, and it only takes a minuscule amount of an ingredient to cause an allergic reaction.

Type of Provision

Different occasions suit different types of menu. For example, if you go to a wedding you would expect a sit down meal, often silver service. If you go to a party you would probably expect a buffet. Most importantly, the style of service, menu and event needs to suit what the **customer expects and wants.**

When planning your menu you should consider:
Time of year, weather, types of customer, time available, price, portion control, ability of the cook, ability of the waiting staff, equipment available (for preparation, serving, cooking), balance (colour, flavour, texture, shape, variety of ingredients), presentation.

Children's Menus
Should be fun and include healthy alternatives to children's favourites, e.g. potato wedges instead of chips. Children could have more choice by offering smaller portions of main meal dishes from the adult menu. Children's menus should not be excessively high in fat, salt and sugar and demonstrate smaller portion sizes.

Breakfast
Breakfasts usually offer a choice of hot (bacon, egg, sausage, tomato etc.) and cold continental (rolls, croissants, cheese, cold meats, fruits and yoghurts). Hot and cold drinks and a tasty selection of preserves are also often offered.

Specials
Many restaurants have 'specials boards', which is a good way of adding seasonal dishes to the menu.

Lunch
Often needs to be served quickly for customers who have limited time. Sandwiches, wraps and baguettes are ideal. An ideal menu will offer a variety of breads with a selection of hot and cold fillings, together with snack items such as jacket potatoes, salads, pastries, cakes and muffins.

Evening meal
Vegetarian and healthy choices should be offered as well as dishes using a variety of cooking methods. In the UK, the most popular menus offer hot and cold starters, a variety of main courses and a selection of desserts that include chocolate and fruit.

Menu Type	Description	Advantages	Disadvantages
Table d'hôte or set-price menu	A fixed or set-price menu with a limited selection of dishes for every course.	Faster service and less wastage as less items on the menu for the chef team to prepare.	Limited choice
A la Carte menu	All dishes are individually priced. Menu comprises of starters, mains, desserts and side dishes. A type of menu often used in restaurants.	Wide variety and choice. Food items and dishes listed and priced individually so the customer can make their own meal from a selection of dishes.	Creates longer wait times for customers as dishes are cooked to order, slowing down the chef team. Can generate a lot of waste for the establishment if a dish is not popular.
Rotating menu cycle	Often used in schools and hospitals. A fixed pattern of menus is used to cover a fixed number of days. The minimum number of days is eight, so that menus are never repeated on the same day each week.	Chef/catering team will be familiar with the menus and therefore able to cook to a high standard consistently.	Food is often made with cheaper ingredients, resulting in poorer quality as focus is not on awards or reviews.
Ethnic or Specialty menu	Can be fixed price or A La Carte. Some offer dishes from particular countries, e.g. China, Italy. Others offer specialised food, e.g. fish or vegetarian dishes.	Chefs who are familiar with the type of cuisine are often employed, therefore dishes cooked to a high standard. Very popular in modern dining.	Limited choice other than the theme of menu on offer. Menu may not suit a wide variety of customers.
Fast-Food menu	This is similar to a specialty menu. Food tends to have 'themes' such as burgers, chicken or baked potatoes. Items are priced individually.	Low skilled staff can be employed to cook food as it is often prepared and delivered from a larger manufacturer. Makes staff wages lower, saves money.	Food is seen as 'cheap' and therefore prices must reflect this. Restaurant would have to sell in high volumes to make a profit.
Party or Function menu	Usually a fixed-price menu offered for parties or functions such as wedding receptions. Some party's menus offer a limited choice. Price is set per head (per person) rather than by dish.	Costing the menu per person helps the chef to budget for ingredients and staff. Food can be prepared and chilled ahead of time as menu items are already decided.	Limited choice, especially for customers with allergens and intolerances.

Type of Provision

When an planning your menu you must consider the following factors:

- Type of function/event
- Date and time
- Type of venue
- Number of guests
- Risk Assessment (allergens and intolerances)

Type of function: The most important factor to consider is what type of event are you planning? Common functions/events in the hospitality industry are: weddings, charity fundraisers, school proms, awards nights (the Oscars), business networking, opening of a new business, staff Christmas party, christenings, birthdays, confirmations, bar mitzvah, sporting events e.g. football hospitality (private boxes), horse racing (The Grand National). The menu may have to suit the theme, sports club, company or brand. If the event is a special occasion/luxury a silver service may be expected, however work parties and discos may only require a buffet service. The type and purpose of the event will determine every other factor and decision.

Date: Time of year, e.g. Christmas, Easter, Summer, Spring. The time of year might have an impact on the theme you choose or ingredients that are in season. The date may be specific to the client, e.g. a wedding day, date of the school prom, that cannot be changed.

Time: Morning = Breakfast Dishes such as cooked breakfast (Full English), light snacks, fruit, pastries, Danishes, yoghurt.
Daytime = Lunch/Snacks such as sandwiches, baked potatoes, wraps, salads, pasta dishes.
Evening = 2 or 3 course dinner, starters, mains, desserts, vegetarian options.
The time may dictate the type of food you serve or style of service, e.g. in the evening guests would not expect a breakfast course, in the morning, guests probably don't expect a 3-course meal. When planning a menu always think about the time of **day or year!**

Venues

Once you have chosen your brief, you can begin to think about the style of menu that will suit the occasion. For example, children's' parties may take place at a soft play area where a small buffet style meal would be suitable. You could even create a dinosaur or superhero themed menu with set items. The menu would have to consider the equipment available at a soft play area, which is unlikely to have a fully functioning commercial kitchen onsite. An adult's party may take place at a restaurant where a wider variety and choice is expected. You may even be asked to design a menu for a holiday park bistro, where all ages must be catered for!

Number of Guests

The number of guests is **VERY important!** The catering manager/chef needs to make sure that if 60 guests are expected, 60 guests are catered for, plus some extra in case people turn up unexpectedly. A wedding is a great example of where the number of guests must be correct, as the cost per person is often expensive (around £70 per guest)! If an event expected lots of guests (over 200) the chef may suggest serving a buffet as a 3-course meal for over 200 people may be time consuming (unless there are many chefs and wait staff employed for the event). All these things must be considered so the event runs smoothly, and everyone is catered for.

Portion Control

Portion control is extremely important. Customers need to feel they are getting **'value for money'** and having the same size portion as everyone else.

It helps the caterer when planning to know how many portions the ingredients will make? The caterer can then determine a selling price (how much should be charged to cover costs and make a profit?) and avoids waste.

Using standard recipes can help a caterer by determining how many ingredients will make 10, 20, 30 or more portions. **Equipment can also be used to control portions:**

Costing

Food costs are large percentage of costs for most hospitality businesses. When planning menus chefs must calculate how much dishes will cost per portion to be able to justify keeping it on the menu. Expensive dishes that are not ordered often may lead to wasted ingredients that are unused, which result in less profit. Chef's must design dishes that generate a profit to stay operational.

Ingredient	Grams per recipe	Weight bought	Cost of food bought	Actual Cost	
For the béarnaise sauce (serves 4)					
Tarragon vinegar	30ml	355ml	£5	42p	
White wine	50ml	75cl (750ml)	£5	33p	
1 tsp white pepper corns	5g	105g	£2	10p	
1 small banana shallot, finely diced	20g	300g	75p	4p	
4 eggs yolks only	68	240g	89p	25p	
Lemon, juice only	15ml	60g	28p	7p	
Butter melted	200	250g	£1.45	£1.16	
Chopped tarragon leaves	2.5g	5g	£1.60	80p	
For the chateaubriand (serves 4)					
Chateaubriand, fully trimmed	1600g	2kg	£42	£63.20	
Olive oil	15ml	750ml	£4	8p	
Butter	75g	250g	£1.45	44p	
4 small stems cherry tomatoes on the vine	220g	220g	£1.35	£1.35	
4 large potatoes	600g	600g	£2	£2	
Bunch watercress	10g	40g	24p	6p	Cost per portion = £70.30 / 4
			TOTAL	£70.30	= £17.56 per portion

To keep costs of your dishes reasonably low you could suggest …

- Buy **food in season** so it is not imported and expensive
- Buy **food locally** so that you don't have to travel too far to buy it and reduces carbon footprint e.g. support local business.
- **Minimise the waste** produced in both food and resources.
- **Control the portion** size so that you do not waste food that people are not going to eat and everyone gets the same size portion.
- **Not buying ready prepared** ingredients because it is cheaper to prepare them from scratch.
- **Buying cheaper** cuts of meat, this can effect the quality and fat content.
- Buy **non branded** food- supermarket own brands are cheaper.
- **Freeze left** over foods or use in other dishes.
- Store the ingredients at the **correct temperature** so they don't spoil.
- **Buying organic, free range, fair trade** foods will cost more but is better for the environment and improved taste e.g. free range eggs, chicken, chocolate, bananas.

To work out the minimum cost per portion for the business to make a profit, businesses use the following formula:

$$\frac{\text{Cost per portion} \times 100}{40}$$

The cost would be rounded up so the number ends in a 5 or 0 so it is more realistic.

Based on the per portion being **£17.56**, calculate the minimum cost of the dish to make a profit:

£17.56 x 100 = 1,756

1,756 / 40 = £43.90

Environmental Considerations

When planning your menu, you must consider the impact your choice of dishes and preparation methods will have on the environment.

Environmental issues you must consider also include:

- Conserving energy and water when preparing food
- 3 Rs Reduce, Reuse, Recycle
- Food sustainability and provenance

REUSE
REDUCE
RECYCLE

Buying ingredients – what to consider?

- Have the ingredients travelled from far away by environmentally damaging transport?
- Have the ingredients been processed and purified using a lot of energy carbon footprint
- Ingredients locally produced – saving food miles and environmental damage
- Organic ingredients not using excess fertiliser, pesticide or artificial hormones for animals
- Animal welfare e.g. free range or barn eggs, free range meats, organic meats
- Fruits and vegetables and meat produced locally or sustainably
- Ingredients such as cocoa, coffee, syrup produced by fair trade farmers.

Food miles/Carbon footprint

The distance the food or ingredients travel from production/growing to where it is consumed or sold. Transporting food long distances is harmful to the environment. Some foods can't be grown in this country due to the climate and therefore must be transported overseas to reach us.

Visit foodmiles.com to calculate the food miles of your chosen ingredients:

foodmiles.com

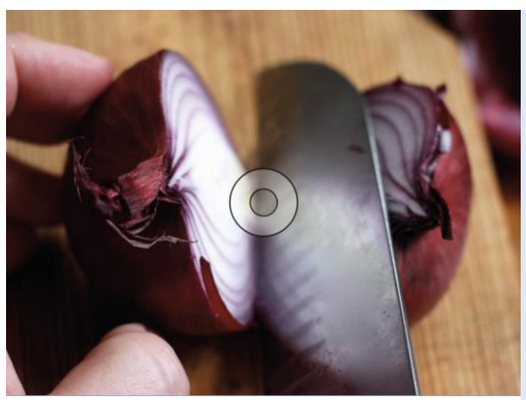
Click here for video

Choose **sustainable food**. By this we mean buy local, seasonal and environmentally friendly food. For example, try local farmer's markets, choose products with a Fairtrade stamp, select fish that has been sustainably farmed. By buying locally your ingredients will travel less miles to reach the kitchen, reducing carbon footprint.

Using **organic foods** is also extremely environmentally friendly as these products don't use any pesticides and fertilisers. However, many supermarkets reject these due to their shape and size being 'non-uniform'. These are often wasted or used as animal feed.

To conserve energy, it's best to keep your pans covered while cooking. Covering your pans will require less cooking time. This is also a good way to prevent grease splatters that will require you to use additional water or cleaning products to remove. While cooking, you can lift the covers briefly to stir or flip over food so that it doesn't burn. **This style of cooking speeds the foods cooking time by 25%.**

As induction hobs are more energy efficient than gas hobs, a chef could consider switching to induction hobs, however gas hobs allows better control over cooking temperatures.
You could plan your menu around faster cooking methods such as sautéing and stir frying to minimise the amount of energy used.



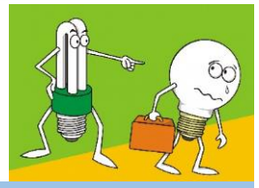
Cutting your food into smaller pieces has long been an effective green cooking method. Smaller meat and vegetable pieces can be heated faster so that **less energy** will have to be used. This will also make it easier for you to see how well your food is cooking so that you can manage your cooking time more effectively without burning anything.

Cutting meat into smaller portions can also **reduce the chances of food borne illness** from raw or undercooked meat dishes. Additionally, if you use this method on meat, you should also be able to avoid overcooking and **therefore prevent food wastage**.

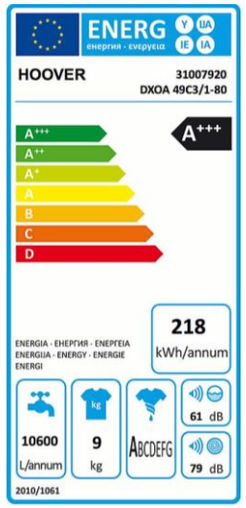
Key Words

Reduce	lowering the amount of waste produced
Reuse	using materials repeatedly
Recycle	using materials to make new products
Sustainable	able to be maintained or continue

Environmental Considerations



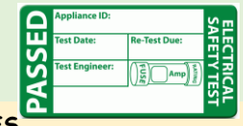
Each time that you cook, you should prepare a larger food portion so that you can use it again. Since reheating will require less energy use, preparing a larger portion will save you from having to use more heating power to prepare new meals. This can also help you reduce your clean up times and cut down on your water use. A great example of this is to make 20 portions of lasagne and once cooled, you can portion, freeze and reheat when required.



Energy Efficient Equipment

Energy efficiency simply means using less energy to perform the same task – that is, eliminating energy waste. Energy efficiency brings a variety of benefits:

- reducing greenhouse gas emissions,
- reducing demand for energy imports
- lowering our cost



When using water to boil anything in a pan, make sure that you only use as much water as is needed to cover the amount of food you're cooking - one of the most common forms of energy wastage is the energy it takes to boil water you don't need. Use the kettle to boil water quickly and transfer to a pan on the hob for steaming and boiling vegetables or pasta. Always use a pan which is the right size for the amount of food you are cooking to ensure that you use less energy in heating a bigger surface area when you don't necessarily need to.
Use a double steamer to cook vegetables so you can layer vegetables on top of each other and still use one ring. Turn down the level of the ring or burner once the cooking temperature or state is reached; most dishes need to simmer, not boil.

ENERGY SAVING TIPS FOR CHEFS

- **STAFF INVOLVEMENT**

Raise energy awareness among kitchen and waiting staff and appoint "Energy Champions", staff members responsible for turning off lights, ovens and equipment when not in use and making sure that heating and hot water are set at the right temperature.

- **REFRIGERATION**

Fridges and freezers should be located away from the hot kitchen. Ensure refrigeration temperatures are set correctly and review the condition of the door seals. Keep fridge doors closed as much as possible – install door closers or alarms to prevent staff members accidentally leaving the fridge/freezer doors open.

- **REVIEW EQUIPMENT**

A new machine could save money and energy. A combi oven, for example, which offers convection, steam and combination cooking, can save energy, while induction hobs are more energy efficient than a traditional electric hob.

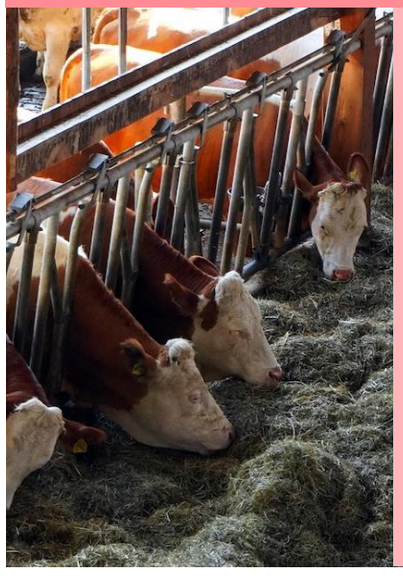
- **REVIEW YOUR DISHWASHER**

Don't set the dishwasher away half full, wait until a full load is ready to save water and energy.

Check your fridge regularly to see what food you have, what's going off soon, what can be frozen, what vegetables are on the turn that can be made into a quick side dish? Or even cook to destroy spoilage bacteria and preserve the foods shelf life. By also checking that food has been stored correctly you can prevent food wastage by preventing food spoilage.

Avoid over purchasing ingredients, buy ingredients with your menu in mind and the number of customers you are likely to serve. Avoid serving large portions to prevent food wastage by customers. Don't forget, food waste can be composted and used to grow more crops. You could even serve some fruits and vegetables with the skin on to prevent waste and increase the fibre content of the dish!

Cattle Farming



Reduce how much meat and dairy you use! By using less beef and dairy products you can reduce health risks and greenhouse gases. Beef's environmental impact exceeds that of other meat including chicken and pork, experts believe that eating less red meat would be a better way for people to cut carbon emissions than giving up their cars.
The heavy impact on the environment of meat production, research shows a new scale and scope of damage, particularly for beef. **The popular red meat requires 28 times more land to produce than pork or chicken, 11 times more water and results in five times more climate-warming emissions.** When compared to staples like potatoes, wheat, and rice, the impact of beef per calorie is even more extreme, requiring 160 times more land and producing 11 times more greenhouse gases, in particular 'methane'.

Over Fishing

Occurs when humans take fish from the marine and freshwater sources at a rate faster than fish can repopulate. It's the reason seafood is expected to be depleted from the oceans by 2048.
Overfishing is a result of modern advancements in the fishing techniques such as trawling and dredging, which disrupt the physical habitat and biologic structure of ecosystems in the ocean. Fish such as cod, salmon and tuna are in danger as these make up the vast majority of species fished for.

Conserving Energy

Conserving energy by:

- Keep equipment clean and maintained so it uses less energy including filters on ventilation and refrigeration
- Descale equipment used for boiling
- Keep lids on saucepans
- Energy efficient lighting, auto switch off
- Turn off equipment and lights when not in use
- Don't put hot food in fridges, uses more energy to cool down
- Energy efficient boilers etc for hot water, don't have water too hot (above 55°C for legionella)
- Replace old equipment with more energy efficient models
- Gas heats up and cools down more rapidly but needs ventilation

Conserving water by:

- Taps that disperse only short bursts of water
- Motion sensor taps
- Only use minimum water to cook food
- Use a steamer instead of boiling in water
- Reduce flow of taps, use a spray head for washing
- Have taps which turn themselves off
- Use a bowl, keep the plug in when washing up
- Full loads for washing machines and dishwashers
- Serve water on tables at customer's request
- Reduce flow rate to equipment such as potato peelers
- Water metering

REDUCE

- Only **buy** what is needed for preparation
- **Storage** - check temperatures, use airtight containers label food with dates, use first in first out for ingredients
- **Preparation** - do not over trim, use carcasses and trimmings to make soups, stocks and sauces
- **Portion sizes** - do not offer excessive portion sizes people will leave lots of food, wastes energy in preparing food that is not going to be eaten
- **Write menus** that consider using offcuts such as chicken trimmings used to make a pie
- **Turn dry fruit and veg** into powders and seasonings
- **Turn excess fruit and veg** into chutneys, sauces, jams, pickles
- **Freeze** leftover food for later use in dishes.

REUSE

- Keep food in **reusable** containers
- **Serve** water in glass bottles or carafes
- Use **refillable containers** for condiments, salt and pepper, sauces etc instead of single serve
- **Use food not served to make new meals** e.g., bubble and squeak with left over potato and green veg, stir fries with small pieces of veg, trifle with left over cake, meringue with left over egg white, soup with veg and meat leftovers, Bread and butter pudding or croutons with bread.

RECYCLE

- **Recycle sturdy containers** for food storage
- Send food waste to be used for compost or animal feed instead of throwing it away
- **Recycle used cooking oil**. Some companies collect it for free and then turn it into bio diesel
- **Recycle paper, cardboard, cans, glass bottles and jars**. Councils will collect for recycling.
- **Buy recycled** glass, food grade plastic containers, recycled paper
- Use the correct recycling bins – **train staff**

Packaging

Most food items sold in shops and in bulk to catering establishments have some form of packaging. This packaging is often made from plastic, which contributes to the release greenhouse gases in their manufacture. Whilst plastic can be recycled, when contaminated with food it cannot be recycled, and ends up in landfill. Today, the biggest concern is how much plastic ends up in the World's oceans, where it can be harmful to aquatic life.

Alternatives to Polystyrene

With the banning of chemical-filled & non-biodegradable polystyrene due to health and environmental concerns being demanded, eco-friendly materials for restaurants and caterers recycling products are in more demand than ever. There are many alternatives to polystyrene boxes and food containers such as:

Compostable containers

Compostable containers are made up of peat fibre, palm fibre, insulated paper board, wheat stocks and corn starch that are easy to break down in to compost. However, there is a need to protect palm groves from becoming extinct, from over-use.

Reusable containers

A more expensive alternative to polystyrene or plastic containers, but it can have the **most advantages for the planet,** consumer and the business that uses reusable containers to avoid waste.

These non-disposable food-wares made of metal, qualitative plastics & ceramics which puts **less of a strain on waste disposal systems.** A customer could rent a mug or glass, for instance, and they would pay an additional deposit, which would be refunded upon return. Just like returning empty glass milk bottles for refills!

The total amount of waste, including food, packaging and other 'non-food' waste, 2.87 million tonnes

1.3 million tonnes of packaging and 0.66 million tonnes of other 'non-food' wastes are also discarded, that includes items such as disposable kitchen paper and newspapers.

Buying in Bulk

Reduce Waste
By shopping at bulk food stores, you will reduce both your packaging and your food waste. Buying in bulk eliminates the need for fancy packaging and single-use plastic, meaning that you are only buying the delicious food, and not the unnecessary packaging.

Reduce Transport Miles
Bulk goods require less overall transportation because there are less packaging components that must be produced and transported prior to being filled. The transportation of bulk products is more efficient because they can be packed more densely on a truck in large sacks and boxes as opposed to individually packaged items.

It's Cheaper
Generally speaking buying in bulk is cheaper than shopping in a traditional mass supermarket because you aren't paying for the excess packaging. Without the fancy branding that companies charge for, buying in bulk means you are getting nothing but the product.

You Can Buy Exactly How Much You Need
When you buy in bulk you can scoop out exactly how much you need so there is no food waste. Because you can buy exactly what you need, you will no longer have old packets of half-used products sitting in the kitchen store cupboard! You can therefore benefit from the freshest produce.

Edible food containers

Edible food containers were first trialed by KFC for their Rice Bowlz using tortilla bowls for their rice, vegetable and chicken dishes.

Edible cups

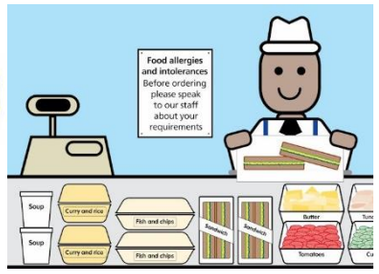
Edible cups have been trialed by KFC in the UK. They used alternative coffee cups made of biscuit, sugar paper and heat resistant white chocolate. Coming up with replacements for large quantities of polystyrene cups used every day is now a possibility for caterers everywhere.

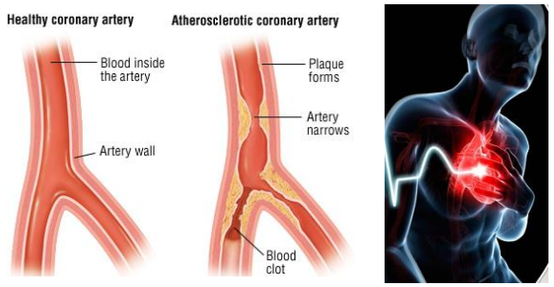
62% of packaging and other 'non-food' waste is recycled. The highest level of recycling is for glass and cardboard.

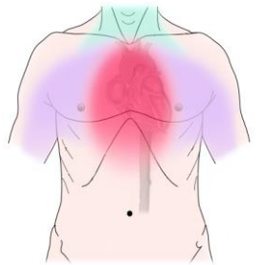
56% of packaging and other 'non-food' waste that is thrown away could have been readily recycled.

Customer Needs

Menu Planning is an essential part of the hospitality industry. Chefs, restaurant managers, establishment owners must plan menus to meet the needs of a wide range of people, as we are not all the same. Not only is this good business practice, it is also a legal requirement, especially for food allergies and intolerances.
Below are some of the factors a menu planner **MUST** consider:







Allergies
Some people may develop an allergy to peanuts or to the gluten in wheat. If they eat foods containing these, they may become very ill, and possibly die.

The 8 most common food allergies include:
Cow's milk, Eggs, Tree Nuts, Peanuts, Shellfish, Wheat, Soy and Fish.

Symptoms can occur anywhere from a few minutes after exposure to a few hours later, and they may include some of the following:
Swelling of the tongue, mouth or face, Difficulty breathing, Low blood pressure, Vomiting, Diarrhea, Hives, Itchy rash.

Cow's Milk Allergy
Foods found in:
Milk, Milk powder, Cheese, Butter, Margarine, Yogurt, Cream, Ice Cream

Nut Allergy
Foods found in:
Brazil nuts, Almonds, Cashews Macadamia nuts, Pistachios Pine nuts, Walnuts

Seafood Allergy
Foods found in:
Shrimp, Prawns, Crayfish, Lobster, Squid, Scallops

You can alert customers of allergies by printing information on your menus. In UK we use recognisable logos for nut, lactose and gluten containing products to make it easier for the customer to make an informed choice. Servers should also be knowledgeable to answer any guest queries on allergens.

Coeliac Disease
This is intolerance to gluten which is found in wheat, rye and barley. Coeliacs cannot absorb nutrients if they eat gluten. Corn rice and potatoes do not contain gluten. You can use the following alternatives in recipes instead of wheat: brown, white and wild rice, buckwheat, almond flour, coconut flour, corn, corn flour

Lactose Intolerance
Can't digest lactose (because they don't produce the lactase enzyme). Milk, milkshakes and other milk-based beverages, whipping cream and coffee creamer, ice cream, cheese, butter, puddings, custards, cream soups, cream sauces, foods made with milk. Lactose free alternatives include soya milks, yoghurts and some cheeses, rice, oat almond, hazelnut, coconut, quinoa and potato milks.

Ethical Diets

Some people avoid meat due to environmental issues or health risks. Some people avoid beef due to concerns over BSE. Some avoid chicken and turkey due to the bird flu issues. Some people avoid fish due to the overfishing. Or prawns because this fishing is very energy expensive and wasteful. Producing unnecessary greenhouse gases. Some people just don't like the thought of harming animals.

Types of Vegetarian:
Vegetarians: Do not eat meat or fish.
Lacto-vegetarians: Do not eat the flesh of any animal but they will eat eggs, milk, cheese, honey etc.
Vegans: Do not eat any animal products (including honey).
Pescetarians: Do not eat chicken or red meat but do eat fish.
Demi or Semi Vegetarians: Often choose to eat a mainly vegetarian diet because they don't eat red meat. They sometimes eat poultry and fish and eggs, milk and cheese.

Some people may choose or be advised to eat a low saturated fat (often comes from animal fats such as meat and butter) diet for health reasons:

Coronary Heart Disease (CHD) is a build up of fatty deposits in the coronary arteries. Should avoid high saturated fat foods and foods that have been deep fat fried. More fruit, vegetables and fibre in diet.
High Blood Cholesterol is high level of cholesterol in the blood. Should avoid high saturated fat foods. Consumption of healthy fats (unsaturated) can help lower cholesterol.
High Blood Pressure (BP) is higher force than normal pushing against the artery walls (caused by having fatty deposits in the arteries which narrows the artery, increasing the force against the walls). Should avoid high salt foods and foods that have been processes, e.g., ready meals and high salt snacks.

Religious Diets

Muslim Diet: Do not eat pork . Only eat Halal meat (which is killed in the same way as Kosher). Sea food without fins or scales (such as crabs, prawns and squids) considered undesirable by some Muslims. Muslims also avoid alcohol.

Jewish Diet (Judaism): Do not eat shell-fish or pork. They do not eat dairy and meat in the same meal (this is because they do not eat mother and child together – so you can not have chicken and egg together or milk and beef). They only eat Kosher meats (where the blood is drained from the body through a slit in the throat before the meat is soaked or salted). Kosher houses should have different sinks for dairy and meat along with different plates, cutlery and utensils: this is taken very seriously within the Jewish religion.

Hindu Diet (Hinduism): Do not eat beef or any beef product – this is because the cow is a sacred animal and is treated as such, this includes the use of leather for clothes and furniture. Milk is permitted as no animal is killed during the collection. Often vegetarian, which comes from the principle of Ahimsa (not harming). Most Hindus don't drink alcohol.

Nutritional

The choice of ingredients and methods used to cook foods can greatly alter their nutritional content. For example, chips baked in the oven will contain less fat than chips that have been deep fat fried. Steamed cod is incredibly healthy, however battered cod is not. Whilst it is not a legal requirement to create all healthy dishes on your menu, it is important to offer customers some healthier options, especially if they are keeping saturated fat intake low for medical reasons.

Unhealthy Cooking Methods

Some cooking methods can actually increase the fat content in dishes, especially methods that use fat such as oil or butter as the cooking medium. High saturated fat dishes are linked to increase risk of high cholesterol and heart disease, therefore, their use should be limited and not used for all dishes.

The unhealthiest cooking methods are:

- Deep fat frying
- Shallow frying
- Roasting

Ingredient Alternatives

Avoid saturated fats such as butter, lard and dripping. Use heart healthy unsaturated fats such as olive oil, rapeseed and avocado oil.

Use wholegrain or brown flours where possible to increase fibre and B vitamin content. Avoid processed and refined flours (white) as these contain less nutritional benefits and digest like sugars.

Leave the skin on vegetables for extra fibre and vitamin C.

Replace cream in recipes with reduced fat crème fraiche.

Rather than adding free sugars to dishes, use naturally sweet ingredients instead, such as fruit. Honey is a great source of sweetness and also contains antioxidants.

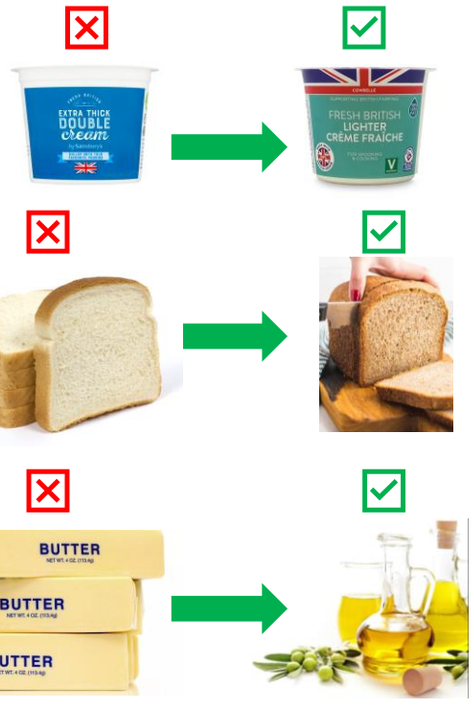
Bulk meals out with vegetables for added fibre, for example in lasagne and pies. Vegetables could be pureed and added to sauces for 'fussy eaters' too! Add fresh fruits as side dishes to desserts rather than ice cream or sorbet.

Healthy Cooking Methods

Healthier cooking methods use very little or no fat to coat the pan/food, however this can sometimes make food taste bland. Therefore, herbs and seasoning are needed to add flavour. Some of the healthiest methods of cooking are water based, however, this does mean there can be some loss of water soluble nutrients, vitamins B and C.

The healthiest cooking methods are:

- Stir frying
- Poaching
- Boiling
- Steaming
- Grilling
- Baking
- Stewing
- Casseroling
- Braising



Low Fat Cooking

- Use less oil, try cooking sprays or apply a small amount of oil with a pastry brush.
- Cook in liquids (such as stock, wine, lemon juice or water) instead of oil.
- Use low-fat yoghurt, low-fat milk, evaporated skim milk or corn flour instead of cream in sauces or soups.
- An alternative to browning vegetables by pan-frying is to cook them first in the microwave, then crisp them under the grill for a minute or two.
- Use pesto, salsas, chutneys and vinegars in place of sour creams, butter and creamy sauces.

In Preparation

When preparing food, excess visible fat can be trimmed from meat, for example the fat rind from bacon.

When boiling foods such as pasta, adding salt can dramatically increase the sodium content of the dish. We only need 6g per day, so be careful when adding salt to cooking water.

When creating marinades, sugar is often used to achieve a sweet and sticky glaze. Use sugar sparingly, as it is a source of empty calories and not beneficial in our diet.

When preparing fruit and vegetables, prepare as close to the time needed as possible, as once cut and exposed to oxygen nutrient loss begins.

Try not to add more fat/oil than needed when frying food. Spray oils are good for controlling the amount of fat added to the pan, or use measuring spoons.

Retaining Nutrients

Water-soluble vitamins are delicate and easily destroyed during preparation and cooking. To minimise nutrient losses:

- Scrub vegetables rather than peel them, as many nutrients are found close to the skin.
- Microwave or steam vegetables instead of boiling them.
- If you like to boil vegetables, use a small amount of water and do not overboil them.
- Stir-fried vegetables are cooked quickly to retain their crunch and nutrients.

Sensory

The average person has about **10,000 taste buds** and they are replaced every 2 weeks or so. But as a person ages, some of those taste cells don't get replaced. **An older person may only have 5,000 working taste buds.** That's why certain foods may taste stronger to children than they do to adults. Organoleptic means the qualities of food that people experience with their senses. There are 5 senses: sight, smell, taste and sound. To enable people to enjoy their food, it is important that the menu planning, preparation, cooking serving food is carried out well so that food is appetising.

When writing your 4-dish proposal, it's important to follow a consistent approach as well as covering all of the content required. Using CATFLAPS will help you achieve this. **CATFLAPS** is a mnemonic and stands for:

C OLOUR
A PPEARANCE
T EXTURE
FL AVOUR
A ROMA
P ROBLEMS
S UITABILITY

Sight: Appearance and presentation of the meal

Adding vegetables to a dish to increase fibre, vitamins and minerals may also affect the colour of the dish.

Adding greens such as green peppers or green beans will create a fresher, more vibrant look.

Adding tomatoes/red peppers to a dish will make it look brighter.

Remember – contrast in colours within a dish is good, makes dishes look more appealing and delicious!

Changing carbs to wholegrain or skin-on versions may also change the colour of the dish, however this may increase the presence of brown in the dish, which is considered a 'dead' or dull colour, and will need brightening up in other ways.

Taste: The flavours

There are 5 basic flavours: **salty, sweet, bitter, sour and umami (savoury)**

Reducing fat content in recipe may alter the taste – it can reduce creaminess aka 'mouth feel'.

Reducing the fat content of baked goods can also alter the taste – making them taste less rich.

Adding vegetables to dishes can alter the taste in many ways depending on what fruit/vegetables is added – e.g. red peppers will bring sweetness, adding kale will bring an earthy taste, adding broccoli will add a fresh taste.

Texture: Mouth feel

Use fresh food - stale food loses texture e.g. fruit, vegetables and fish.

Prepare food well to remove edible parts e.g. shell, bones, stalk, tough skin.

Cook food well to avoid unexpected textures e.g. lumps in a sauce, under cooked egg white, under cooked cake.

Cook food at correct temperature and for correct time to allow textures to develop e.g. when melting chocolate, baking cake or bread, frying chicken.

Reducing fat content in recipe may alter the texture, making it drier or more brittle.

Adding vegetables or fruits to dishes can bring crunchiness, softness, chewiness.

Changing the cooking method will also alter the texture – frying or roasting food in fat creates crispy crunchy textures, whereas replacing frying/roasting with the healthier methods of steaming, boiling, stewing etc will create soft textures. Grilling and barbecuing will also create chewy/crispy textures.

Adapting the cooking method may also change the taste of a dish:

Steaming or poaching will preserve the flavours of the original food whereas barbecuing or grilling food will also impart charred flavours.

Sautéing vegetables in butter or oil bring out the flavour.

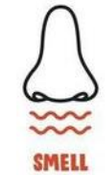
Sound: Snap, Crackle and Pop!

The sound of food can make it more appealing.

Certain foods you expect to sound in a particular way e.g. crisp to crunch, biscuits to snap and food being fried to make a sizzling sound.

To preserve these sounds food needs to be cooked and stored correctly to maintain its texture.

Aroma: How food smells



Use fresh ingredients - stale ones lose ability to produce aromas and can smell 'off'.

Using natural foods that produce a strong aroma e.g. fresh/dried herbs and spices, garlic, orange and lemon zest and cooking methods that develop aromas e.g. grilling, roasting, baking and frying.

Plan and select combination of foods to produce a mixture of aromas, but avoid using too many, as the overall effect will be spoiled.

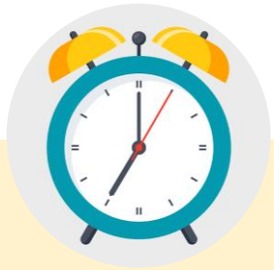
Garnish desserts using fresh mint to cut through the rich/sweet aromas.

Making stock from meat, poultry or fish bones plus vegetables, herbs and spices.

Roasting root vegetables intensifies their flavour by evaporating water and caramelising the natural sugars they contain.

Using natural flavours e.g. citrus fruit zest, fresh herbs and spices.

Production Plan



Your production plan must include all of the following:

- Ingredient lists (including amounts in grams, millilitres)
- Equipment needed
- Mise en place - (getting ready and organised before you start preparing and cooking the food)
- Timing — for preparing, cooking, decorating, etc.
- Sequencing - the order in which you prepare and cook the food (including dovetailing)
- Cooling food down - where, how and for how long you will do this, and at what temperature?
- Hot holding - how you will keep food hot and at what temperature?
- Completion - how you will know your dish is finished?
- Serving/presentation - describe how the plate will look, what will you decorate the plate with and serve your food with e.g. salad, bread, ice cream?
- Removal of waste - especially if handling raw meat/fish
- Contingencies — e.g. what will you have ready in case something goes wrong?
- Health, safety and hygiene points – e.g. washing up, using oven gloves etc.
- Quality points – how will you make sure you achieve a professional dish?
- Storage of the food during the practical assessment so that it stays safe to eat - e.g. chilled food kept in fridge, dry food kept sealed off the floor.

Health and Safety Points

- Use bridge and claw technique to prevent injury
- Make sure knives cleaned separately to prevent cuts
- Use oven gloves to prevent burns
- Use a blue plaster if you cut yourself
- Warn others of hot pans
- Stand back when opening ovens (risk of scalds from steam)

Mise en pace (preparation)

- Tie up hair/hair net, remove all jewellery
- Wash hands in hot soapy water, put a clean apron on
- Collect ingredients from the fridge, freezer, store cupboard.
- Weigh and measure using digital scales
- Wash vegetables, especially soil vegetables
- Peel and chop fruit/vegetables needed first
- Have recipes printed and a pen to tick steps
- Setting preparation area up by ensuring the ovens are pre-heated and the area is clean
- Checking ingredients for quality points and weighing ingredients
- Collecting equipment/getting serving dishes ready

Logical Sequence

- Things that need to set in a fridge or cook for a long period of time are prepared first
- Use of specialist equipment such as ice cream machines/pasta machines
- State correct preparation terms e.g. chopping carrots into small dice: slice potatoes thinly: fillet the fish
- Simmer the sauce, sauté the beef, and glaze the pastry with egg wash
- State the required oven temperatures and length of cooking time
- State when dish goes in oven for how many minutes
- Remember to take dish out at correct time on the time plan

Hygiene

- Allow time to wipe clean sink/cooker at the end of the assessment
- Ensure ALL equipment is cleaned in hot soapy water and dried with a clean towel. Placed back into the correct cupboards.

Completing the dishes

- EACH dish should be allocated a colour as well as the special points and contingencies. This will support you when dovetailing the time plan.
- Discuss the use of specialist equipment and terminology e.g. bloom the gelatine for the panna cotta.
- Include as much hand washing/washing up as possible.
- Try and include HACCP at all times e.g. store the prepared fish fillets until required, on the bottom shelf of the fridge/in a sealed container.
- Make sure every section has at least one special point and contingency.
- List both the equipment required and ingredients
- (this will assist you when completing the assessment).
- Include garnishing and decoration time on your time plan.
- Allow time to arrange food on serving dishes and present on the table.
- Set time aside during the time plan for wiping surfaces/clearing up before starting the next dish.

What is a special point?

- Wear clean apron and remove all jewellery
- Wash hands after handling raw meat to reduce the risk of cross contamination
- Use bridge and claw when using knife to reduce the risk of cutting yourself
- Do not put knives in the sink, clean them as you go, place back in secure and safe place
- Pan handles facing inwards to reduce the risk
- of spillages
- Use oven gloves to reduce the risk of burning your hands (ensure gloves are clean and dry)
- Safety points for using electrical equipment
- Use colour coded chopping boards: cooked meats (yellow), salad and fruit (green), raw meat (red), vegetables (brown), bakery and dairy products (white)
- High risk foods to be stored in fridge until needed
- Cook food to core temp of 75°C
- Wash all equipment after using high risk ingredients (raw meat, eggs) to prevent cross contamination
- Wash hands after using high risk ingredients to prevent cross contamination
- Cool food rapidly, keep out of danger zone (5-63°C)
- Check meat is cooked thoroughly to prevent food poisoning

Production Plan

What is a contingency point?

- A contingency plan is usually put into place to allow a business to find solutions if problems arise.
- When completing your production plan and assessment you might come up against these types of problems, so it's vital that you have a selection of effective and manageable 'PLAN Bs'.

These contingency points can be broken down into several sections:

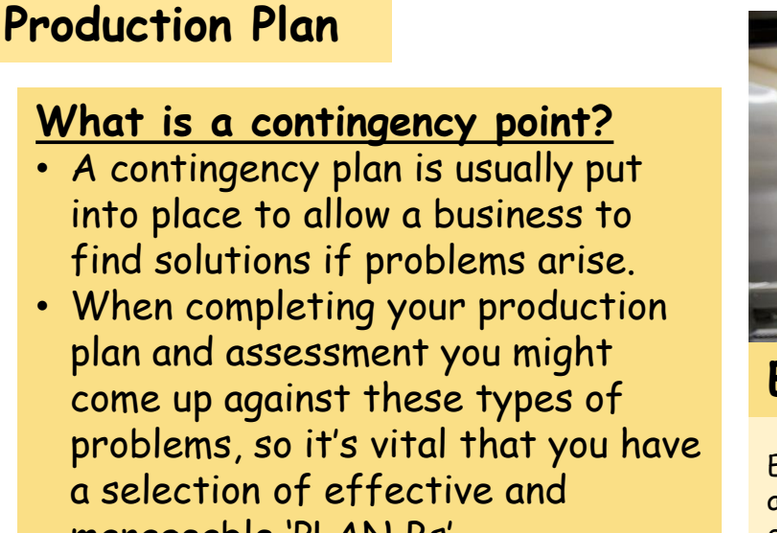
- Equipment
- Ingredients
- Special diets
- Timings

Equipment

Equipment could break at any moment during the assessment, if this happened how would you complete the dish? Look at alternatives when completing your plan, for example if the pasta machine broke whilst using it, what would you use? The contingency point could be a rolling pin.

Ingredients

Ingredients can spoil, mistakes may happen, and the ingredient is ruined. If this was the case how could you continue to produce the dish? A great example is lasagne, if you ran out of beef mince what could be used as a substitute? Quorn mince? Turkey mince? Vegetables?



Timings

Timings are always a guide depending on your equipment such as your oven. If you remove your dish from the oven and it isn't cooked, simply place it back in for more time. A great example would be to probe the food, if it doesn't reach the required temperature, place it back into the oven.

Final Points to Consider

- Could you alter the cookery methods to save on time?
- Can you make the dish healthier? Cooking methods?
- How would you cook this dish in higher volumes?
- What would you do if you didn't have a certain piece of equipment? How would you adapt the recipe?
- How would you adapt the recipe for: allergies, intolerances, religious diets, vegan, vegetarians?
- How can you prevent cross-contamination of PHYSICAL, MICROBIOLOGICAL, ALLERGENIC and CHEMICAL contaminants?
- How will you store food throughout the preparation/cooking process?
- How will you control portion size to reduce waste?
- How will you present and serve dishes to meet customer needs?
- Have you mentioned personal hygiene and health and safety measures throughout your production plan?

Special Diets

Special diets also need considering when completing your time plan. If a customer has a special diet, as a chef you should have the knowledge to be able to amend the dish to suit their needs, for example using gluten free flour in pasta.

Production Plan Example

Dish 1: Lasagna

Ingredients	Equipment
For the meat sauce 2 tbsp olive oil 1 celery stick, finely chopped 1/2 onion, finely chopped 1/2 carrot (about 100g), finely chopped 2 garlic cloves, crushed 500g beef mince 1 x 400g cans chopped tomatoes 2 tsp mixed Italian herbs 2 beef stock cubes **For the pasta sheets** 200g '00" flour 2 large eggs 50g parmesan, finely grated **For the white sauce (béchamel)** 500ml milk 50g butter 50g plain flour Good grating of nutmeg	Digital scales Green chopping board Sharp vegetable knife Grater Saucepan x 2 Wooden spoons Measuring jug Lasagna pots/ramekins Pasta machine Spiral whisk Tin opener Rolling pin

Don't forget to give amounts in grams (g) or millilitres (ml).

Dish 2: Panna Cotta

Ingredients	Equipment
2 ½ sheets gelatine 150ml milk 400ml double cream 60g caster sugar 1 vanilla pod, split lengthways fresh strawberries, to serve strawberry compote, to serve	Digital scales Mixing bowls Saucepan Wooden spoon Dariole molds Green chopping board Sharp vegetable knife

Don't forget to be specific with your equipment, e.g. don't just say 'chopping board'. State which colour you will use to show you know your food safety and hygiene.

Do the same for knives and equipment. Stating the specific or specialist equipment needed demonstrates greater knowledge of equipment and preparation.

Time	Method	Special points & contingences
8.30	**Mise en place:** Tie long hair up or wear a hair net. Wash hands in hot soapy water and dry with a paper towel. Wear a clean apron. Gather equipment and set work area up. Attach pasta machine to bench. Gather ingredients and weigh out ready using a digital scale or measuring spoons. Switch on blast chiller and pre-heat oven (180°C).	Refrigerate perishables (beef mince and dairy) until needed. Hand washing water should be **35-43°C** Use a disposable towel to dry hands to prevent cross-contamination – NOT A TEA TOWEL!
8.45	Panna Cotta: Bloom gelatine by soaking in a bowl of cold water for 5 minutes. Whilst it blooms, split the vanilla pod lengthways with a sharp knife on a green chopping board and remove seeds. Pour the milk and cream into a saucepan with the sugar and vanilla seeds. Stir to combine and bring to a simmer, then remove from the heat. Take the gelatine out of the cold water and squeeze out the excess, then add to the milk mixture. Stir until completely dissolved. Tip into four ramekins and place in the blast chiller to set for at least a couple of hours.	Scrape the vanilla pod with the back of the knife to remove seeds. Use knife safety skills to slice vanilla pod. Use powdered agar agar and coconut milk instead of cream for vegan/lactose free alternative. Use the blast chiller to speed up setting.
9.00	Lasagna: Whilst the panna cotta sets, start the lasagna. Add tbsp oil and 500g beef mince to a saucepan and mix with a wooden spoon until browned over a medium heat. Finely chop the celery and carrot and add to the pan along with the crushed garlic. Sprinkle in the stock cubes and stir. Add the can of chopped tomatoes and leave to simmer for at least 30 minutes. Check on the panna cotta, it should have a slight wobble.	Swap beef mince for Quorn for vegetarian option. Turn pan handles in when using the hob. Visual checks of beef mince for spoilage before using and check the 'use by' date.
9.20	Make the pasta sheets by combining 200g '00' flour and 2 eggs. Add a drop of cold water and knead to make a smooth dough. Knead for at least 15 minutes. Once smooth, roll out using a rolling pin, then pass through the pasta machine starting with the widest setting. Check and stir the mince in the saucepan.	The pasta is the right thickness when you can almost see your hand through it. Don't make it too thin as it won't hold the weight of the layers. Use gluten free flour and xanthan gum for coeliacs.
9.45	Make the Bechamel sauce by making a roux from the butter and flour. Then gradually add the milk, whisking in each addition to prevent lumps. Once all the milk has been added, add the nutmeg.	Soya milk and cornflour can be used to make a lactose free sauce. Melt the butter gently to avoid burning.

What skill level can you work at?

Preparation Techniques		
High	**Medium**	**Low**
crimping	creaming	blending
laminating (pastry)	dehydrating	beating
melting using bain-marie	folding	grating
unmoulding	kneading	hydrating
whisking(aeration)	measuring	juicing
piping	skinning	marinating
shaping	toasting(nuts/seeds)	melting
	weighing	mashing
	mixing	sieving
	puréeing	tenderising
	Rubbing in	zesting
	rolling	proving
		shredding

Knife Techniques		
High	**Medium**	**Low**
julienne	bâton	chopping
mincing	chiffonade	peeling
deboning	brunoise	trimming
filleting	dicing	
segmenting	slicing	
	deseeding	
	spatchcock	

Open Baked Alaska

Tropical Panna Cotta

Neapolitan Parfait

Baked Toffee Alaska

Vanilla custard tart served with mint sorbet and orange panna cotta

Mini éclairs with strawberry ravioli

Classic Lemon Tart

Strawberries and Cream

Brownie Tart

What skill level can you work at?

Cooking Techniques		
High	**Medium**	**Low**
baking blind	baking	basting
caramelising	blanching	boiling
deep fat frying	braising	chilling
emulsifying	deglazing	cooling
poaching	frying	dehydrating
tempering	griddling	freezing
	pickling	grilling
	reduction	skimming
	roasting	toasting
	sautéing	
	setting	
	steaming	
	stir-frying	
	water-bath (sous-vide)	

Open Seabass Lasagne

Seared mackerel salad with pesto

Classic Fish and Chips

Seared seabass, squid ink risotto with tomato salad

Grilled Salmon Niçoise

Salmon and squid ink lasagne with sweetcorn purée and vanilla foam

Grilled trout fillet on a bed of pea purée with tomato reduction

Seabass with tomato cannelloni squid ink emulsion and sweetcorn fritter

Poached cod loin, puff pastry hamper, pea velouté and seasonal vegetables

Cream cheese and asparagus ravioli

Classic carbonara

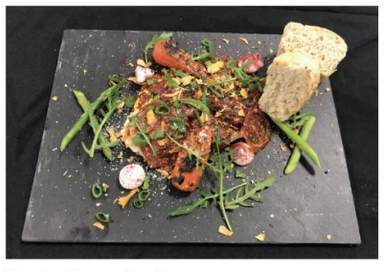
Salmon and squid ink ravioli with vegetable pearls

Beetroot noodles served with tempura king prawns

Classic Meatballs

Pasta Arribiata

Squid ink pasta served with seasonal greens



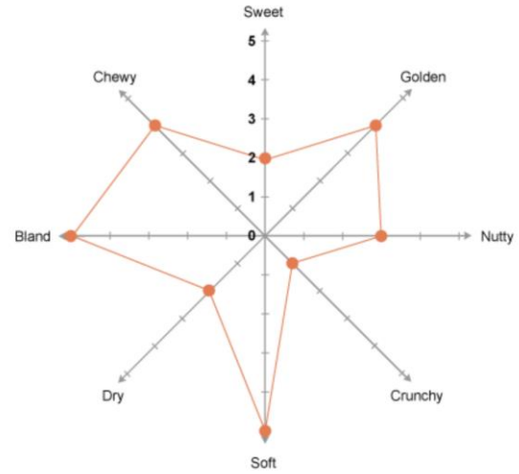
Pasta Bruschetta

Chicken, Lemon and Thyme Ravioli

Star diagrams and sensory analysis

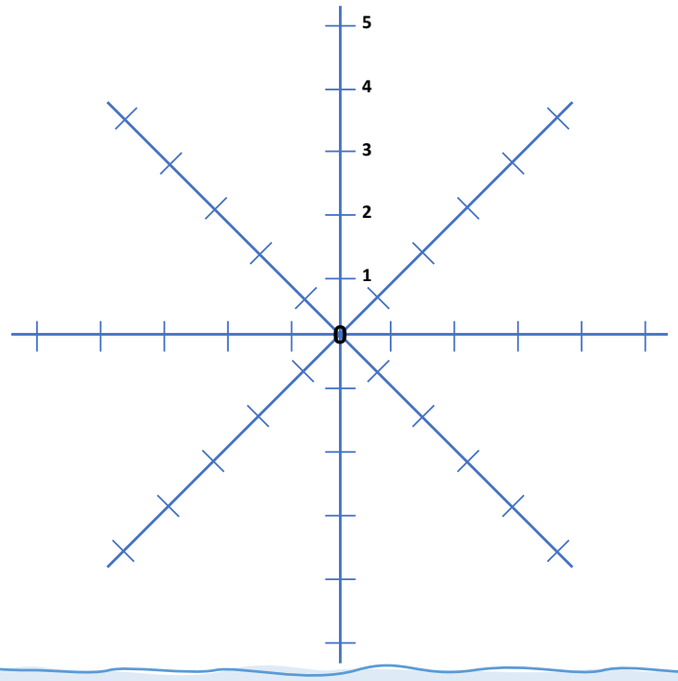
Sensory evaluation is a scientific process that analyses and measures human responses to food and drink, e.g. appearance, touch, odour, texture, temperature and taste.
Each desired aspect is rated according to this scale.
1. dislike a lot
2. dislike a little
3. neither like or dislike
4. like a little
5. like a lot

It is then put onto a star diagram like the one right.

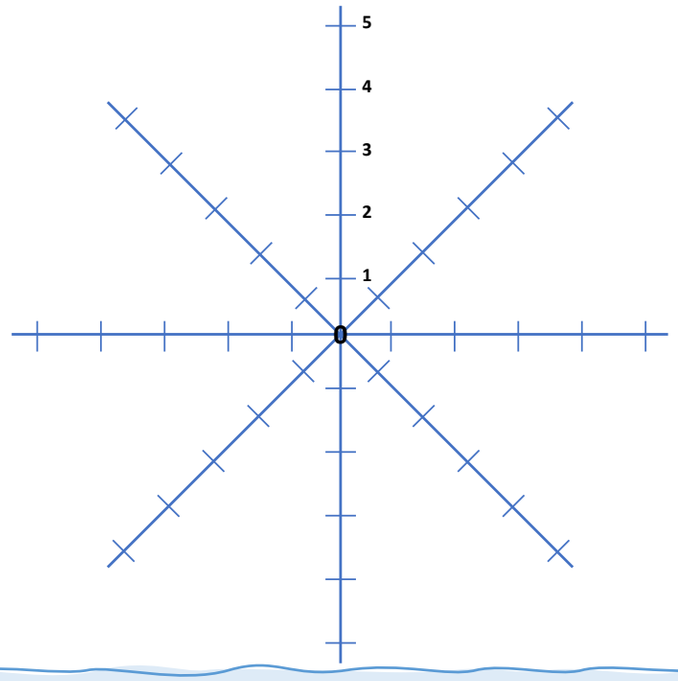


Taste test both dishes and plot your results on the blank star profile diagrams below. You will need to decide the criteria for each axis of the diagram:

DISH 1:



DISH 2:



DISH 1
Use the sensory analysis descriptors (next slide) to fill this box with words to describe your dishes. This will help you when you come to write your evaluation:

DISH 2
Use the sensory analysis descriptors (next slide) to fill this box with words to describe your dishes. This will help you when you come to write your evaluation:

Sensory Descriptors

C	olour
A	ppearance
T	exture
FL	avour
A	roma
P	roblems
S	uitability

Colour: even, golden, slightly dark, pale, rich, burnt, contrasts with.., deep, creamy, vibrant, fresh, dull

Appearance: well risen, evenly browned, well sealed, smooth, rough, slightly lumpy, grainy, glossy, dull, appetising, unappealing, burned, even thickness, consistent

Texture: crisp, soft, doughy, spongy, gritty, short, chewy, greasy, creamy, crumbly, runny, rubbery, fibrous, pleasant, unpleasant, firm

FLavour: salty, sweet, strong, contrasts well with, good balance of, delicate, combines well with, weak, bitter, sour, sharp, bland

Aroma: strong, delicate, highly fragranced, appealing, savoury, sweet fruity, appetising, unappetising, burnt

Problems: unsuitable method, amounts/balance of ingredients, wrong/missing ingredients, oven temp or time, complicated method.
How would you do it differently next time? Who is the dish not suitable for?

Suitability: Who is the dish suitable for? Does it meet the brief? Is the portion size correct - too big/ too small? Can it be stored/reheated – how? Can the dish be easily adapted for allergies and intolerances – how?

Example: Quiche

The quiche was a **rich golden colour,** slightly **browned** on top. The flecks of mixed herbs were visible and some pieces of onion had just **over coloured** where they stuck out from the egg filling.

The pastry was **crisp and buttery**, of a **uniform thickness** and there was no **sogginess** in the base. The egg filling was **light and moist.**

On tasting, I found the onion flavour to be rather strong and **overpowered** the herbs. I could **reduce** the amount if I made it again.

The overall aroma was of onion and herb, and they **combined well.**

There was no problem with the base as I **blind baked** the case before adding the filing to ensure it was **crisp**. The pastry was **difficult to handle** and **broke up** on rolling. I could put it in the **fridge for 20 minutes** to relax before rolling which might help.

The **slightly burned** onions may have been because the pieces were large and stuck out of the egg mixture before it was baked. I **should chop the onion finer** in future.

This quiche is suitable for serving 4 as a main course with vegetables or salad. **It is not suitable for freezing** as the egg mixture may separate, but it can be kept refrigerated for up to 3 days. **Reheating** works better in the oven rather than microwaving to keep the **pastry crisp.**

Sentence Starters

My…….. worked well because…

I worked well in the lesson because…

The aroma was…

The taste was …

If I made this again I would…

It would look better if…

The colour could be better by…

The colour was …

The texture was…

It tasted …

It would be better if…

The texture was…

I had a problem with…

The size could be better because…

I was very happy with my work because…

I needed help with…

I found the practical work hard because…

I found it easy because…

Key Questions

How can food waste be reduced? **Link to 2.2.1**
How did you manage portion control? **Link to 2.2.1**
How can the dish be adapted for special diets? **Link to 2.1.1/2.2.1**
How could you serve your dish differently to reduce cost/wastage/improve customer appeal? **Link to 2.2.1**

Evaluate yourself against the following criteria …

Decision Making	Organisation/Time Management	Advantages/Disadvantages
Do the chosen dishes meet customer needs?	Did you work to your time plan?	What are the advantages of your chosen dishes to the customer?
How did you come to your decision?	Did any dishes take longer than expected? How could this time be shortened?	Do the dishes meet their needs?
Would you choose these two dishes again?	What did you do to manage your time well? E.g. mise en place	Can dishes be produced in bulk to speed up service time?
		Have you or could you include seasonal ingredients (better for the environment)?

Could your dishes be adapted to be:		
allergen free	gluten free	dairy free
low fat	low salt	low sugar
halal friendly	kosher friendly	vegan/vegetarian

Knowledge Organisers and Practice questions

North East Learning Trust

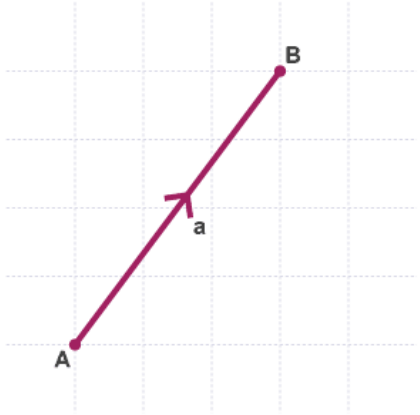
Year 11 Foundation Topic 1 – Expressions - Student Knowledge Organiser

Key words and definitions

Magnitude – the length of a vector
Vector – a quantity that is described by a magnitude and a direction.
Scalar – a quantity that is described by a magnitude (or numerical value) alone.
Direction – the direction along which it acts.
Scalar Multiple – the amount by which a vector's magnitude is changed.
Parallel – Vectors acting in the same direction will be parallel (side-by-side).

Column Vectors

A vector between two points A and B is described as: $\overrightarrow{AB}$, a or $\underline{a}$.



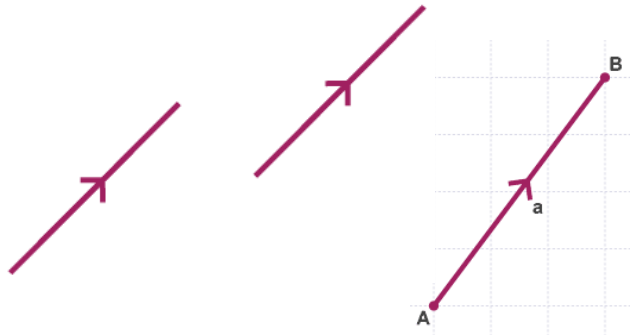
The vector can also be represented by the **column vector** $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$.

The top number tells you how many spaces or units to move in the positive x-direction and the bottom number is how many to move in the positive y-direction.

Vectors are equal if they have the same magnitude and direction regardless of where they are.

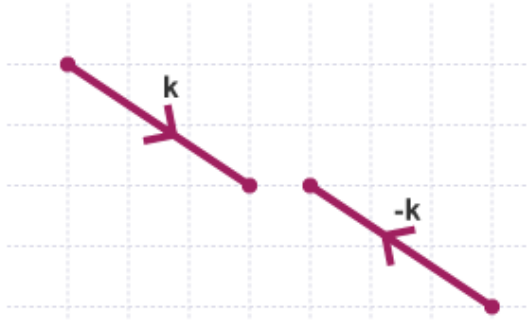
Drawing Vectors

A vector can be represented by a **line segment** labelled with an arrow.



A vector between two points A and B is described as: $\overrightarrow{AB}$, a or $\underline{a}$.

A negative vector has the same magnitude but the opposite direction.



Vectors can be multiplied by a **scalar** which changes the size of the vector but not the direction.

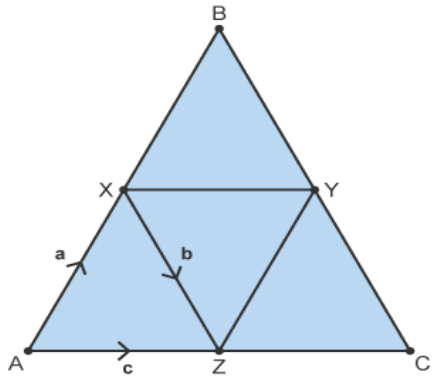
$$k = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$$

The vector $2k$ is twice as long as the vector k. Double each number in k to get $2k$.

Vectors around a Shape

Example

Write, in terms of a, b and c, the vectors $\overrightarrow{ZY}$, $\overrightarrow{YC}$, $\overrightarrow{ZA}$ and $\overrightarrow{BX}$.



$\overrightarrow{ZY} = a$

$\overrightarrow{ZY}$ and $\overrightarrow{AX}$ are equal vectors, they have the same magnitude and direction.

$\overrightarrow{YC} = b$

$\overrightarrow{YC}$ and $\overrightarrow{XZ}$ are equal vectors, they have the same magnitude and direction.

$\overrightarrow{ZA} = -c$

$\overrightarrow{ZA}$ has the same magnitude as $\overrightarrow{AZ}$ but the opposite direction.

$\overrightarrow{BX} = -a$

$\overrightarrow{BX}$ has the same magnitude as $\overrightarrow{AX}$ but the opposite direction.

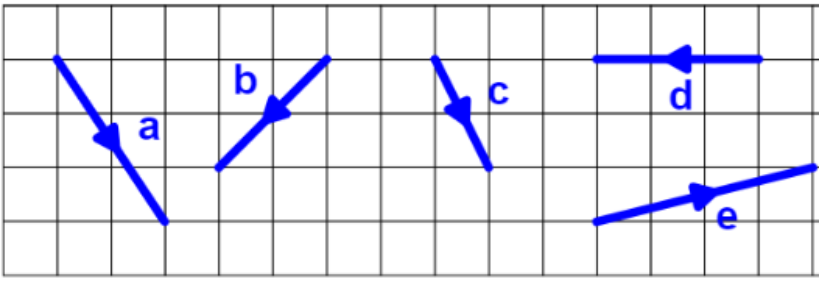
Hegarty Maths Links

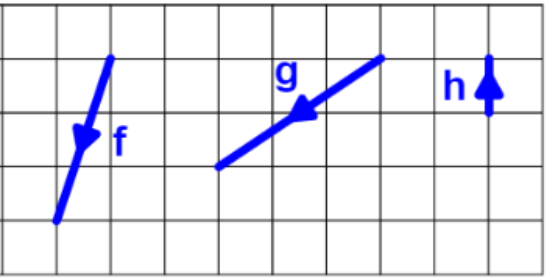
622-Vectors & Scalars
623-Column Vectors
624-Negative Vectors
625-Combining Vectors
626-Multiplying by Scalars
627-Magnitude of a Vector
628-Geometry 1

Year 11 Foundation Topic 1 – Expressions - Student Knowledge Organiser

Column Vectors

Write a column vector for each vector shown in the diagram.





Given that $\boldsymbol{p} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$, write a column vector for:

a) $3\boldsymbol{p}$ b) $-\boldsymbol{p}$ c) $-2\boldsymbol{p}$ d) $\frac{1}{3}\boldsymbol{p}$ e) $-\frac{2}{3}\boldsymbol{p}$ f) $0.1\boldsymbol{p}$

Which of the following are parallel to the vector $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$? Select all that apply.

a) $\begin{pmatrix} 6 \\ 15 \end{pmatrix}$ b) $\begin{pmatrix} -6 \\ 15 \end{pmatrix}$ c) $\begin{pmatrix} -3 \\ 6 \end{pmatrix}$ d) $\begin{pmatrix} 4 \\ -10 \end{pmatrix}$ e) $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$ f) $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$

Which of the following are parallel to the vector $\begin{pmatrix} 6 \\ 9 \end{pmatrix}$? Select all that apply.

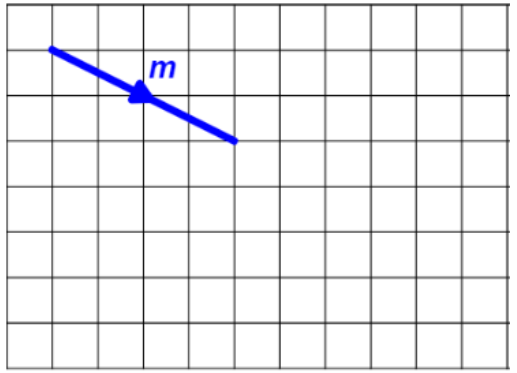
a) $\begin{pmatrix} 8 \\ 12 \end{pmatrix}$ b) $\begin{pmatrix} -6 \\ 9 \end{pmatrix}$ c) $\begin{pmatrix} 9 \\ 6 \end{pmatrix}$ d) $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$ e) $\begin{pmatrix} -6 \\ -9 \end{pmatrix}$ f) $\begin{pmatrix} 9 \\ 12 \end{pmatrix}$

Drawing Vectors

The vector $\boldsymbol{m}$ is shown on the grid. Draw each of these vectors on the same grid:

a) $2\boldsymbol{m}$ b) $-\boldsymbol{m}$

c) $-2\boldsymbol{m}$ d) $\frac{1}{2}\boldsymbol{m}$



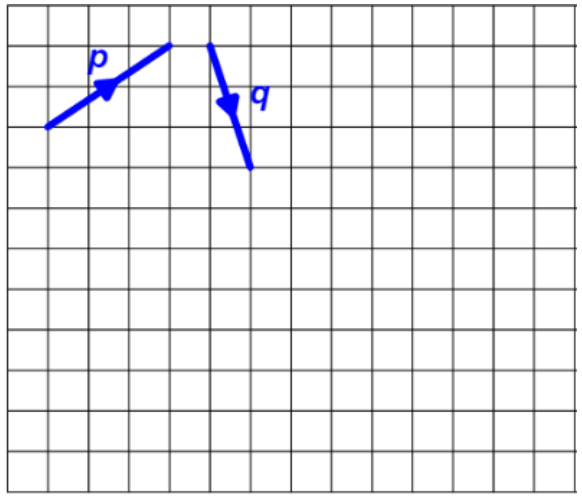
The vectors a and b are shown on the square grid.

Draw the vectors:

a) $-2\boldsymbol{p}$

b) $\boldsymbol{p} + \boldsymbol{q}$

c) $\boldsymbol{p} - \boldsymbol{q}$

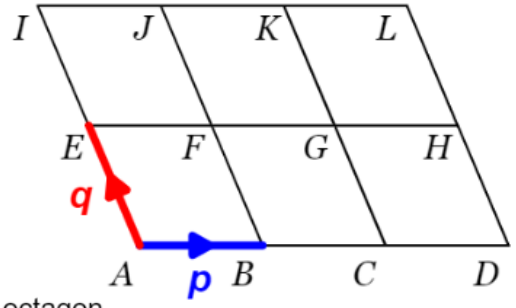


Vectors around a shape

The grid contains six congruent parallelograms.
$\overrightarrow{AB} = \boldsymbol{p}$ and $\overrightarrow{AE} = \boldsymbol{q}$.
Write in terms of $\boldsymbol{p}$ or $\boldsymbol{q}$:

a) $\overrightarrow{FJ}$ b) $\overrightarrow{KL}$ c) $\overrightarrow{GC}$

d) $\overrightarrow{AI}$ e) $\overrightarrow{LD}$ f) $\overrightarrow{HE}$



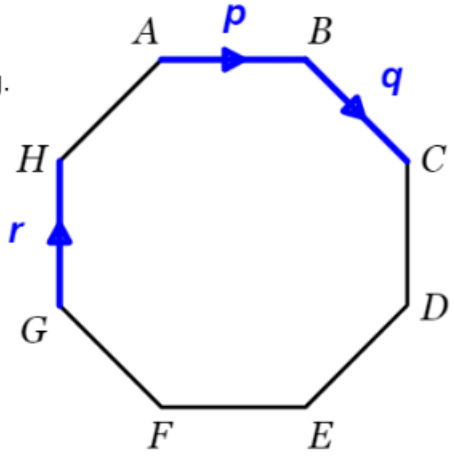
$ABCDEFGH$ is a regular octagon.
$\overrightarrow{AB} = \boldsymbol{p}$, $\overrightarrow{BC} = \boldsymbol{q}$, and $\overrightarrow{GH} = \boldsymbol{r}$.

a) Write in terms of $\boldsymbol{p}$, $\boldsymbol{q}$ or $\boldsymbol{r}$:

i) $\overrightarrow{GF}$ ii) $\overrightarrow{CD}$

iii) $\overrightarrow{FG}$ iv) $\overrightarrow{FE}$

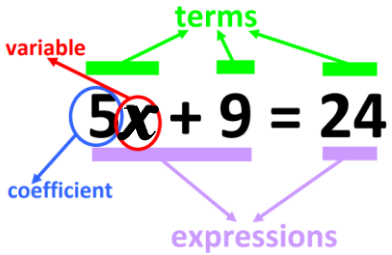
b) Sam writes: $\overrightarrow{AH} = \boldsymbol{q}$
Explain why Sam is wrong.



Year 11 Foundation Topic 2 – Equations - Student Knowledge Organiser

Key words and definitions

Word	Definition
Variable	A symbol for an unknown value. Usually a letter, such as a, x or y, is the symbol used for a variable.
Constant	A number on its own
Coefficient	A number that is multiplied by a variable. Example: $8y$ means 8 times y; 8 is the coefficient, and y is the variable.
Operator	A symbol (+, ×, −, or ÷) representing a mathematical operation
Term	Either a single number, a variable, or numbers and/or variables multiplied together Examples: 4 45 x abc $5w$ $20mn$
Expression	A term or a combination of terms and operators Examples: 2 $2x$ $2x+7$ y $y-3$ $7w+3$ $8ab+9$ $5xyz$
Equation	A mathematical sentence stating that two expressions are equal



Solving Linear Equations

Solve the equation $4y + 5 = -3$.

$4y + 5 = -3$

Subtract 5 from each side:

$4y + 5 - 5 = -3 - 5$

Simplify:

$4y = -8$

Get y by itself by dividing both sides by 4:

$4y \div 4 = -8 \div 4$

$y = -2$

Solve the equation $5(2c - 3) = 19$.

Expand the bracket:

$5 \times 2c - 5 \times 3 = 19$

$10c - 15 = 19$

Isolate $10c$ by adding 15 to each side:

$10c - 15 + 15 = 19 + 15$

$10c = 34$

Isolate c by dividing by 10:

$10c \div 10 = 34 \div 10$

$c = \frac{34}{10} = \frac{17}{5}$ or 3.4

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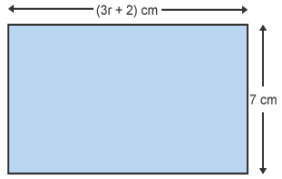
Forming and Solving Equations

The area of this rectangle is 56 cm^2. Find the value of r.



Area of a rectangle = base × height. This means $3r + 2$ will all be multiplied by 7. To show this in algebra, use a bracket for $3r + 2$ to show that both terms are being multiplied by 7.

7 multiplied by $(3r + 2)$ can be written as $7(3r + 2)$ as multiplication signs are not used in algebra.

Area = base × height

Area = $7(3r + 2)$

The area of the rectangle has been given in the question as 56 cm^2:

$56 = 7(3r + 2)$

Expand the bracket:

$56 = 7 \times 3r + 7 \times 2$

$56 = 21r + 14$

Isolate $21r$ by subtracting 14 from both sides:

$56 - 14 = 21r + 14 - 14$

$42 = 21r$

Isolate r by dividing both sides by 21:

$42 \div 21 = 21r \div 21$

$2 = r$

Rearranging Formulae

The **subject** of a formula is the variable that is being worked out. It can be recognised as the letter on its own on one side of the equals sign.

For example, in the formula for the area of a rectangle $A = bh$ (***area = base × height***), the subject of the formula is A.

Rearrange the formula $v = u + at$ to make t the subject of the formula.

$$\begin{array}{rcl} v & = & u + at \\ -u & & -u \\ v - u & = & at \\ \div a & & \div a \end{array}$$

$$\frac{v - u}{a} = t$$

The letter t is now isolated, so t is now the subject of the formula.

Rearrange the formula $T = 2\pi\sqrt{\frac{L}{G}}$ to make L the subject.

Firstly, isolate the root:

$$\begin{array}{rcl} T & = & 2\pi\sqrt{\frac{L}{G}} \\ \div 2\pi & & \div 2\pi \end{array}$$

$$\frac{T}{2\pi} = \sqrt{\frac{L}{G}}$$

Now 'square' both sides:

$$\left(\frac{T}{2\pi}\right)^2 = \left(\sqrt{\frac{L}{G}}\right)^2$$

Lastly, multiply by G:

$$\begin{array}{rcl} \left(\frac{T}{2\pi}\right)^2 & = & \frac{L}{G} \\ \times G & & \times G \end{array}$$

$$G\left(\frac{T}{2\pi}\right)^2 = L$$

Solving Simultaneous Equations

Solve the following simultaneous equations:

$3x + y = 11$

$2x + y = 8$

First, identify which unknown has the same coefficient. In this example this is the letter y, which has a coefficient of 1 in each equation.

Either add or subtract the two equations from each other to eliminate the letter y. In this example the equations will need to be subtracted from each other as $y - y = 0$.

$$\begin{array}{rcl} 3x + y & = & 11 \\ - \quad - & & - \\ 2x + y & = & 8 \\ = \quad = & & = \\ x & = & 3 \end{array}$$

The value of x can now be **substituted** into either equation to find the value of y.

Substitute $x = 3$ into either $3x + y = 11$ or $2x + y = 8$.

$3x + y = 11$ when $x = 3$

Substitute $x = 3$:

$3 \times 3 + y = 11$

$9 + y = 11$

Find the value of y using **inverse operations** to **solve equations**. The inverse of adding 9 is subtracting 9, so subtract 9 from each side:

$9 + y - 9 = 11 - 9$

$y = 2$

Check the answers by substituting both values into the other original equation. If the equation balances, then the answers are correct:

$2x + y = 8$ when $x = 3$ and $y = 2$.

$2x + y = 2 \times 3 + 2 = 6 + 2 = 8$.

In examples like this, one or both equations must be multiplied to create a common coefficient.

$3a + 2b = 17$

$4a - b = 30$

Multiply the bottom equation to create a common coefficient of $2b$.

$3a + 2b = 17$

$8a - 2b = 60$

These equations can now be used to find the values of a and b.

The signs in front of the common coefficients are different, so the equations should be added together:

$$\begin{array}{rcl} 3a + 2b & = & 17 \\ + \quad + & & + \\ 8a - 2b & = & 60 \\ = \quad = & & = \\ 11a & = & 77 \\ \div 11 & & \div 11 \\ a & = & 7 \end{array}$$

Substitute the value of a into one of the original equations to find the value of b.

$3a + 2b = 17$ (when $a = 7$)

Substitute $a = 7$:

$3 \times 7 + 2b = 17$

$21 + 2b = 17$

Solve the equation by using **inverse operations**. The opposite of +21 is -21. Subtract 21 from both sides of the equation:

$2b = -4$

$b = -2$

Check the answers:

$4a - b = 30$ when $a = 7$ and $b = -2$.

$4 \times 7 - -2 = 30$

Hegarty Maths Links

Solving equations 177,178,179,180,181,182,183,184,185,186,187

Forming and solving equations 176,188

Rearranging Formulae 280,281, 282, 283, 284,285,286,287

Simultaneous Equations 190,191,192,193,194,195

Year 11 Foundation Topic 2 – Equations - Student Knowledge Organiser

Solving linear equations

(a) $2x + 3 = 9$ (b) $3w - 1 = 14$

(d) $5x + 20 = 35$ (e) $6c - 12 = 48$

(g) $7w + 13 = 90$ (h) $12p - 18 = 30$

(j) $10a + 40 = 100$ (k) $9x - 24 = 84$

(m) $6x - 19 = 5$ (n) $3w + 4 = 43$

(p) $\frac{c}{2} - 4 = 6$ (q) $\frac{x}{10} + 3 = 9$

(a) $4x + 1 = 2x + 7$ (b) $5x + 4 = 3x + 16$

(d) $7x + 1 = 2x + 46$ (e) $6x - 3 = 2x + 13$

(g) $2x + 21 = 4x + 5$ (h) $x + 2 = 5x - 2$

(j) $5x + 2 = 16 - 2x$ (k) $3x - 1 = 23 - x$

Rearranging formulae

Make x the subject of the following formulae

(a) $4x + c = w$ (b) $dx - t = 8$ (c) $x^2 + 3 = h$

(d) $2x + 2y = P$ (e) $s = x^2 - 3$ (f) $y = xz + s$

(g) $\frac{x}{n} + 2 = w$ (h) $\frac{x}{6} - 5 = w$ (i) $\frac{x + 3}{c} = h$

(j) $3y = 4x + 1$ (k) $x^2 + a = v$ (l) $x^3 - 4 = 5y$

(m) $\frac{x + t}{m} = 2c$ (n) $\frac{w + x}{u} = 3z$ (o) $A = \pi x^2$

(p) $A = \frac{1}{2}bx$ (q) $V = abx$ (r) $v^2 = u^2 + 2ax$

(s) $\frac{a + b}{x} = r$ (t) $\frac{5cx}{b} = a$ (u) $\sqrt[3]{\frac{x}{k}} = w$

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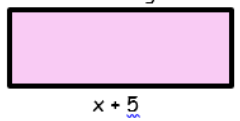
Forming and solving equations

1) Ahmad is twice as old as Bobby. John is 7 years younger than Ahmad. If the sum of their age is 38, how old are the three boys?

2) The perimeter of the rectangle below is 42cm. Calculate the lengths of the sides by forming an equation and solving it.



3) A garden measures p metres by 3p + 2 metres.
   a) Write an expression that describes the perimeter of the garden.
   b) The garden has a perimeter of 76 metres. Write an equation to show this.
   c) Solve your equation to find the value of p.

Simultaneous equations

Solve the following simultaneous equations by using elimination.

(j) $2x - 4y = 10$, $2x + 3y = 24$ (k) $5x - 2y = 120$, $5x + y = 165$ (l) $x - 2y = 8$, $x - 3y = 3$

(m) $3x + 2y = 54$, $2x - 2y = 16$ (n) $7x - 4y = 80$, $3x - 4y = -80$ (o) $5x - 2y = -23$, $5x - 6y = -39$

(a) $3x + 2y = 23$, $2x - y = 6$ (b) $3x - 3y = 9$, $2x + y = 12$ (c) $4x + 2y = 34$, $3x + y = 21$

(d) $9x - 4y = 59$, $2x - y = 12$ (e) $2x + 8y = 43$, $x + 3y = 18$ (f) $6x + 3y = 45$, $2x - 2y = 12$

Applying Knowledge

1. Solve $4(x-3)=7x-10$

Show clear algebraic working.

2.

Here is a rectangle.

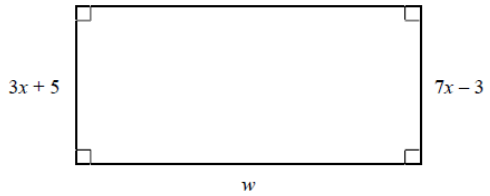


Diagram **NOT** accurately drawn

All measurements are in centimetres.
The area of the rectangle is 242 cm^2.
Find the value of w.

3. HINT… Think simultaneous equations!!

Five adult tickets and three child tickets for a movie cost £58.
Two adult tickets and eight child tickets for a movie cost £47.
Find the cost of each type of ticket.

Year 11 Foundation Topic 3 – Pythagoras and Trigonometry - Student Knowledge Organiser

Key

Formula

$$a^2 + b^2 = c^2$$

a = side of right triangle
b = side of right triangle
c = hypotenuse

The **hypotenuse** (h) is the longest side. It is opposite the right angle.

The **opposite side** (o) is opposite the angle in question (x).

The **adjacent side** (a) is next to the angle in question (x).

Trigonometric Formula

What are the formulas for sin cos and tan?

- $\sin x = \frac{opposite}{hypotenuse}$
- $\cos x = \frac{adjacent}{hypotenuse}$
- $\tan x = \frac{opposite}{adjacent}$

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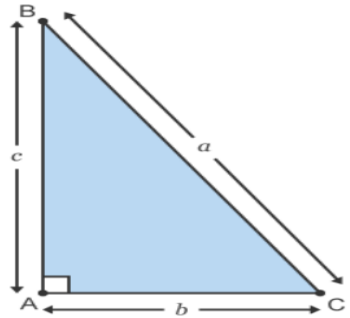
Pythagoras

Right-angled triangles

Pythagoras' theorem states that for all right-angled triangles, **'The square on the hypotenuse is equal to the sum of the squares on the other two sides'**. The hypotenuse is the longest side and it's always opposite the right angle.

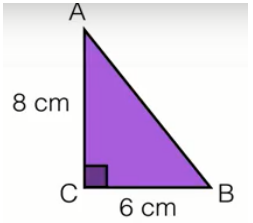


In this triangle $a^2 = b^2 + c^2$ and angle A is a right angle.

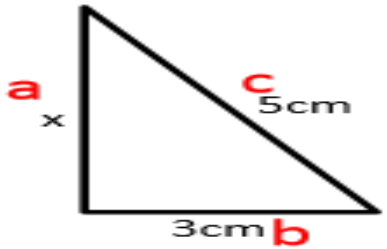
Pythagoras' theorem only works for right-angled triangles, so you can use it to test whether a triangle has a right angle or not.

In the triangle above, if $a^2 < b^2 + c^2$ the angle A is acute.

In the triangle above, if $a^2 > b^2 + c^2$ the angle A is obtuse.

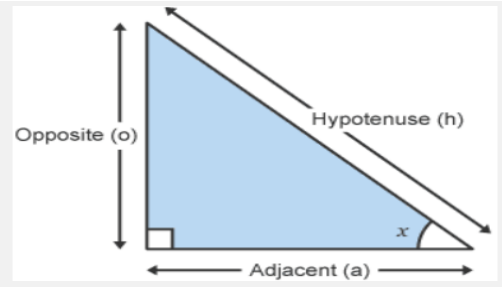


$AB^2 = BC^2 + AC^2$
$AB^2 = 6^2 + 8^2$
$AB^2 = 36 + 64$
$AB^2 = 100$
$AB = \sqrt{100}$
$AB = 10$ cm



$a^2 + b^2 = c^2$
$x^2 + 3^2 = 5^2$
$x^2 + 9 = 25$
$x^2 = 25 - 9$
$x^2 = 16$
$x = \sqrt{16}$
$x = 4$ cm

Trigonometry

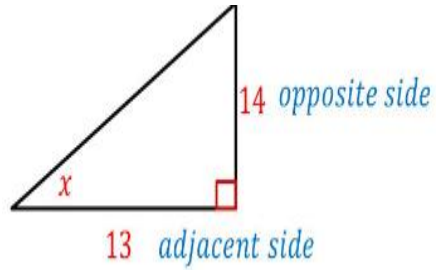


$\sin\theta = \frac{opp}{hyp}$

$\sin(64) = \frac{17.3}{y}$

$y = \frac{17.3}{\sin(64)}$

$y = 19.24801...$



Use tangent ratio $\tan x = \frac{O}{A}$

Use inverse tangent $x = \tan^{-1}\left(\frac{14}{13}\right)$

Solve for x using calculator $x = 47.1°$

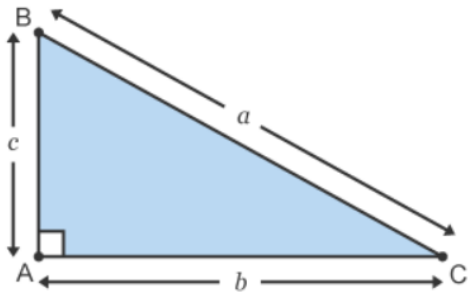
Hegarty Maths Links

Pythagoras: Videos 497-507

Right Angled Trigonometry: Videos 508-515

Year 11 Foundation Topic 3 – Pythagoras and Trigonometry - Student Knowledge Organiser

Pythagoras

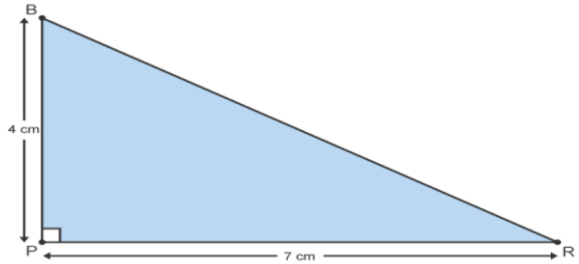


$$a^2 = b^2 + c^2$$

$$b^2 = a^2 - c^2$$

$$c^2 = a^2 - b^2$$

Work out the length of the line BR, correct to 1 decimal place.



A fireman has a ladder that is 13 metres long. If he wants to reach a window that is 12 metres above the ground, how far from the wall should he put the bottom of his ladder?

Peter's house is exactly 481m from school. To get home he walks 480m south and then he walks west. How far west does he have to walk?

A triangle has sides of length 23.8cm, 31.2cm and 39.6cm.

Is this a right-angled triangle?

Show how you decide.

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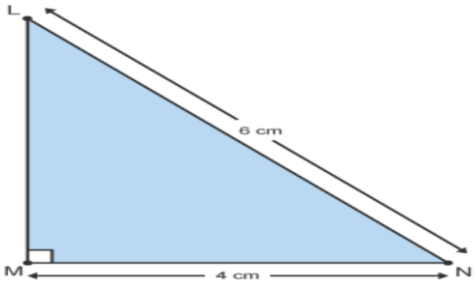
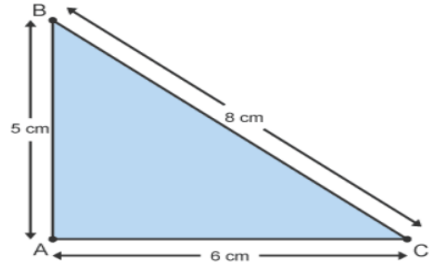
Pythagoras

Work out the length of the line LM, correct to 1 decimal place.



Which of the following triangles is right-angled?

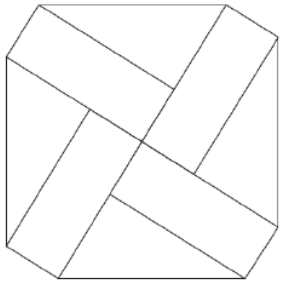
a)



b)

Here is a rectangle.

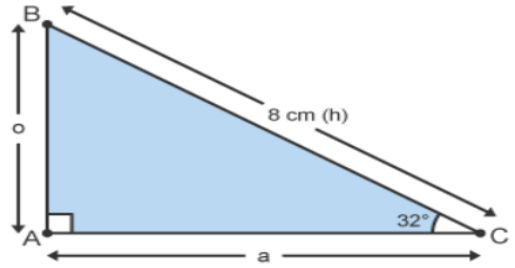
The 8-sided shape below is made from 4 of these rectangles and 4 congruent right-angled triangles.



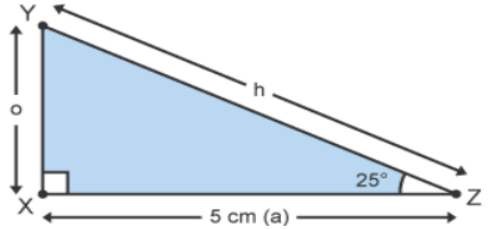
Work out the perimeter of the 8-sided shape.

Trigonometry

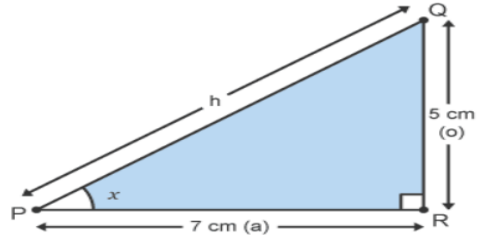
Calculate the length AB. Give the answer to one decimal place.

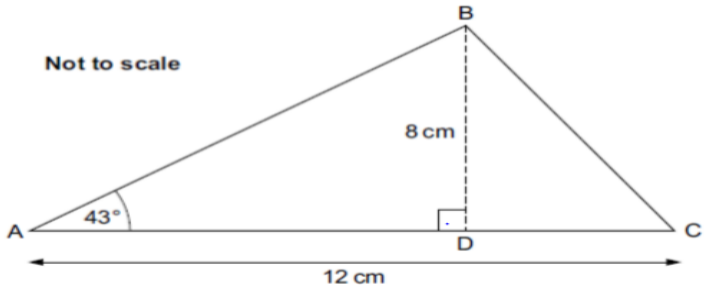


Calculate the length YZ. Give the answer to one decimal place.



Calculate the angle QPR. Give the answer to one decimal place.





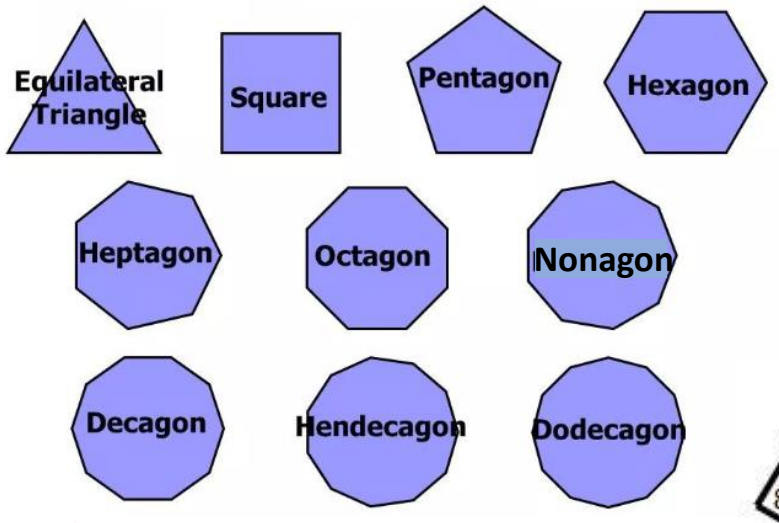
Calculate angle BCA.

Year 11 Foundation Topic 4 – Shapes and Angles- Student Knowledge Organiser

Key words and definitions

Polygon – a plane figure with at least three straight sides and angles, and typically five or more.
Quadrilateral – 4 sided shape.
Pentagon – 5 sided shape.
Hexagon - 6 sided shape.
Heptagon – 7 sided shape.
Octagon – 8 sided shape.
Nonagon – 9 sided shape.
Decagon - 10 sided shape.
Hendecagon – 11 sided shape.
Dodecagon – 12 sided shape.

Polygons



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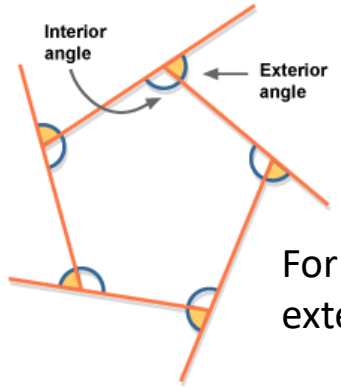
Prior Knowledge

Angles on straight lines/internal angle sums in polygons
Angles in parallel lines

Interior and exterior angles of polygons

***Sum of interior angles* = $180^o \times (n - 2)$**

n = number of sides

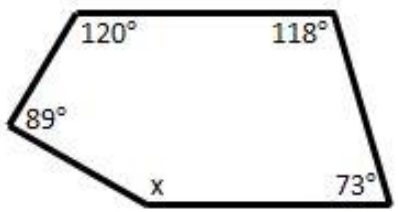


For all polygons the exterior angles total 360°

A regular polygon has an exterior angle of 20°.

How many sides does it have?

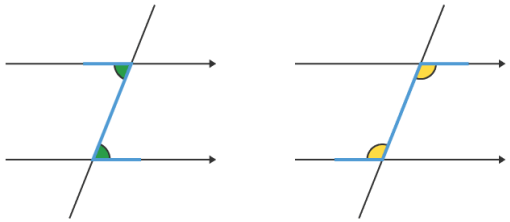
Number of sides
= 360° ÷ 20°
= 18 sides



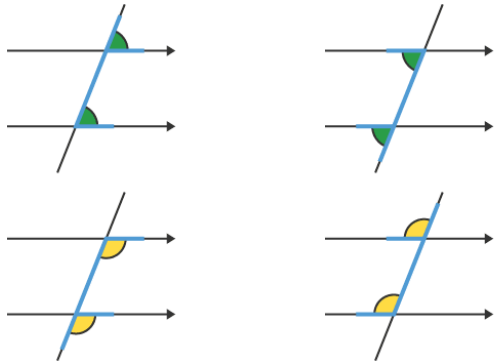
Sum of angles
= 89°+120°+118°+ 73°
= 400°
Sum of interior angles
= 180° x (5-2)
= 540°
x = 540° - 400°
= 140°

Angles in parallel lines

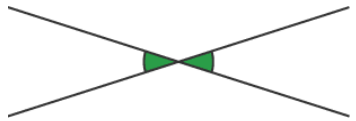
Alternate angles are equal



Corresponding angles are equal



Vertically opposite angles are equal



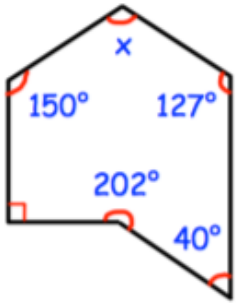
Hegarty Maths Links

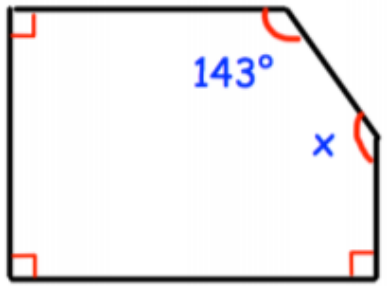
Angles in polygons	561, 562, 563, 564, 565
Vertically opposite angles	480
Alternate angles	481
Corresponding angles	483

Year 11 Foundation Topic 4 – Shapes and Angles- Student Knowledge Organiser

Interior and exterior angles of polygons

Find the missing angle in each irregular polygon

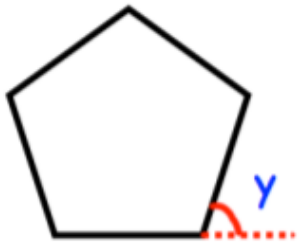




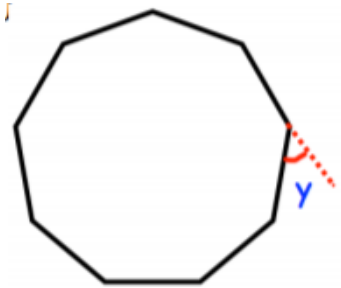
Work out the number of sides of polygons with these sum of interior angles

(a) 1260° (b) 2880° (c) 3960°

Each of the polygons below are regular.
Calculate the size of each exterior angle, y.



regular pentagon



regular nonagon

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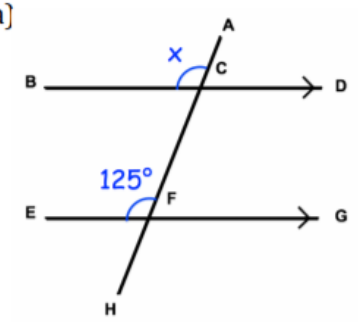
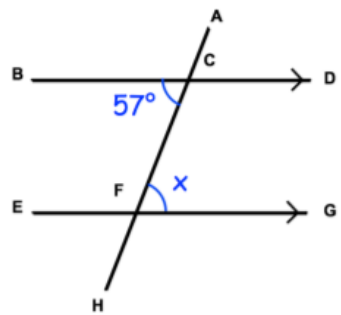
Angles in parallel lines

Find the angle x in each question below.
Give reasons for your answer.

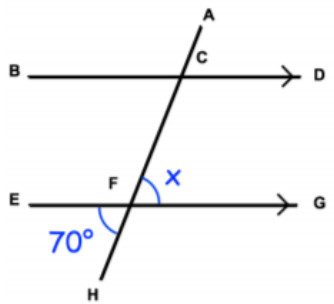
(a)



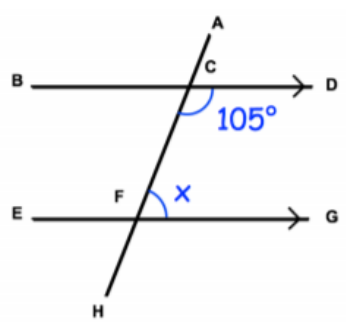
(b)



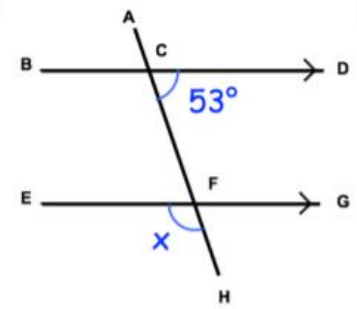
(c)



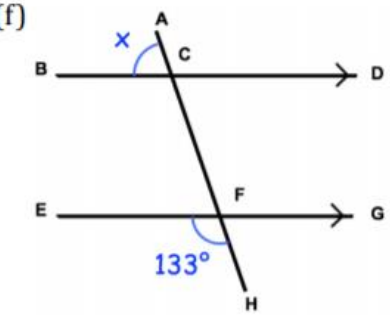
(d)



(e)

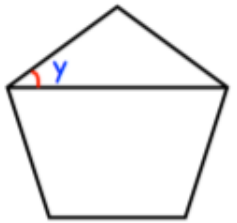


(f)

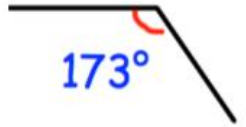


Applying knowledge

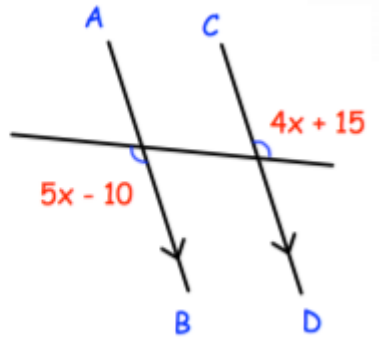
Shown is a regular pentagon.
Find y.



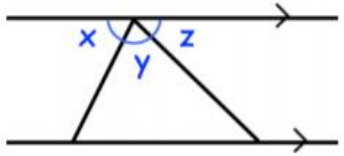
Explain why this cannot be an interior angle from regular polygons.



Find x



Matilda is proving that the angles in a triangle add up to 180°.
She has started with this diagram.
Complete her proof.



Knowledge Organisers and Practice questions

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Year 11 Higher - Topic 1 - Further Trigonometry Student Knowledge Organiser

Key words and definitions

Adjacent – the side next to the given angle in a right angled triangle
Opposite – the side opposite to the given angle in a right angled triangle
Hypotenuse – longest side of a right angled triangle
Tangent (tan) - the trigonometric ratio using Opposite and Adjacent
Cosine (cos) - the trigonometric ratio using Adjacent and Hypotenuse
Sine (sin) – the trigonometric ratio using Opposite and Hypotenuse
Perpendicular – Making a right angle
Inverse function – is a function that "reverses" another function
2D – 2 Dimensional
3D – 3 Dimenesional

Exact Values

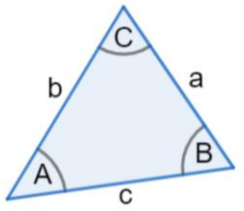
Angle (θ)	$\sin(\theta)$	$\cos(\theta)$	$\tan(\theta)$
0°	0	1	0
30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
45°	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1
60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
90°	1	0	Not Defined

Sine and Cosine Rule

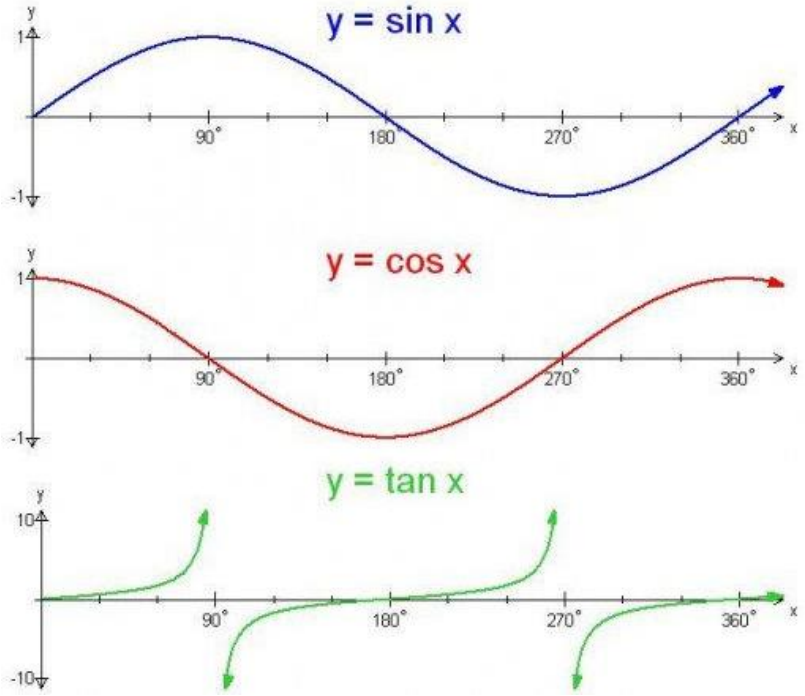
Sine Rule $\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$

Cosine Rule $a^2 = b^2 + c^2 - 2bccosA$

Area of a triangle = $\frac{1}{2}ab\ sinC$



Trigonometric Graphs



Transforming Graphs

Transform graph of y = sin (x) :

$y = -sin(x)$,
$y = sin(-x)$,
$y = sin(x) + a$,
$y = sin(x + a)$

Transform graph of y = cos (x) :

$y = -cos(x)$,
$y = cos(-x)$,
$y = cos(x) + a$,
$y = cos(x + a)$

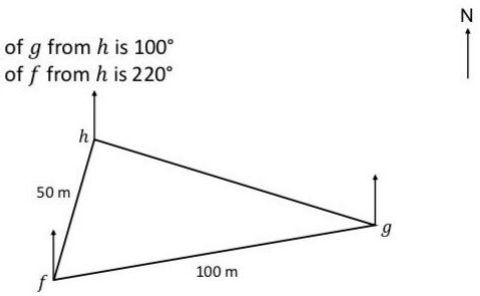
Transform graph of y = tan (x) :

$y = -tan(x)$,
$y = tan(-x)$,
$y = tan(x) + a$,
$y = tan(x + a)$

Bearings

Higher

The bearing of g from h is 100°
The bearing of f from h is 220°



Hegarty Maths Links

Area of a Triangle	516 – 519
Sine Rule	520 – 525
Cosine Rule	526 – 530
Bearings	492 – 496

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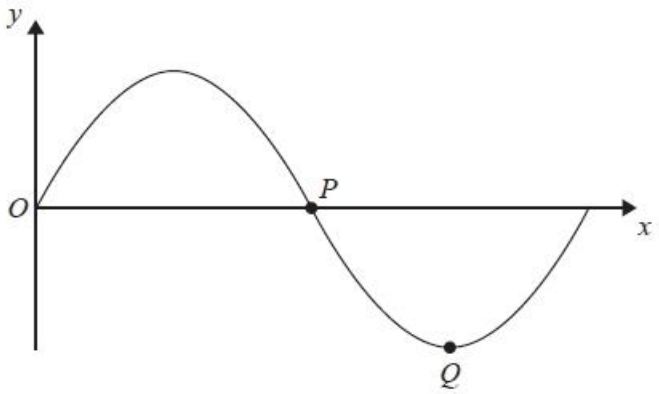
The diagram shows part of a sketch of the curve $y = \sin x°$



(a) Write down the coordinates of the point P.

(..... , ...)

(b) Write down the coordinates of the point Q.

(..... , ...)

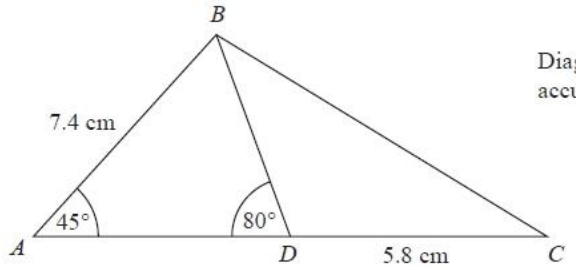
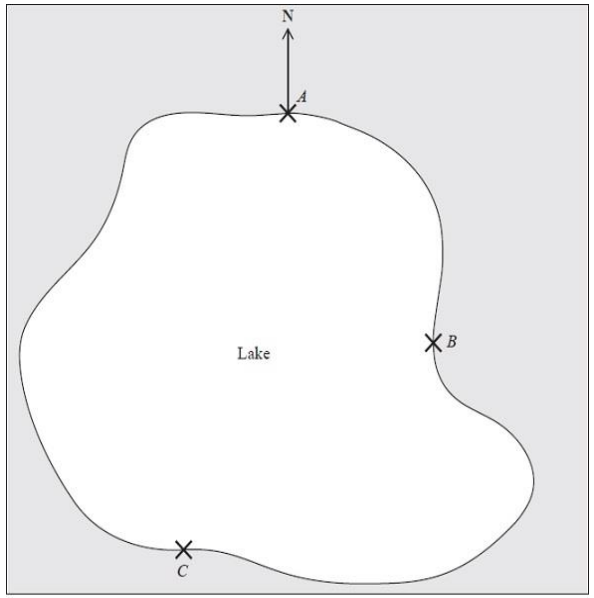


Diagram **NOT** accurately drawn

ABC is a triangle.
D is a point on AC.
Angle $BAD = 45°$
Angle $ADB = 80°$
$AB = 7.4$ cm
$DC = 5.8$ cm

Work out the length of BC.
Give your answer correct to 3 significant figures.

The map shows the positions of three places A, B and C on the edge of a lake.



Scale 1 cm represents 2 km

(a) Find the bearing of B from A.

..... °

(1)

A ferry travels in a straight line from A to B.
It then travels in a straight line from B to C.
A speedboat travels in a straight line from A to C.

(b) How many more kilometres does the ferry travel than the speedboat?
You must show your working.

..... km

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Year 11 Higher - Topic 2 - Functions Student Knowledge Organiser

Key words and definitions

Substitution – putting values into a function to replace the variable x
Function notation – written as F(x) =
Variables – the letters in volved in the expression usually x or y
Domain –the numbers that are substituted into the function (input)
Range – the values that are obtain from substituting (output)
Inverse function – is a function that "reverses" another

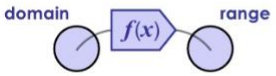
Functions

Evaluate/simplify terms like:
$f(3x)$ $f(2)$ $g(2x-3)$

NOTE
Function Domain and Range

Any function can be thought of as having an input and an output.

The 'input' is sometimes also known as the domain of the function, with the output referred to as the range.



Imporant

Each number in the domain has a unique output number in the range.

Example

The function $f(x) = x^2 + 3x$ has the domain

{ -2, -1, 0, 1, 2, 3 }

Find the range.

$f(-2) = 4 - 6 = -2$
$f(-1) = 1 - 3 = -2$
$f(0) = 0 + 0 = 0$
$f(1) = 1 + 3 = 4$
$f(2) = 4 + 6 = 10$

Range = { -2, 0, 4, 10 }

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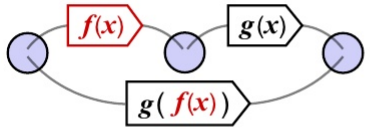
Composite Functions

NOTE
Composite Functions

It is possible to combine functions by substituting one function into another.



$g(f(x))$ is a composite function and is read 'g of f of x'.

Important

In general
$g(f(x)) \neq f(g(x))$

Example

Given the functions

$f(x) = 2x$
and $g(x) = x + 3$

find $f(g(x))$ and $g(f(x))$.

$f(g(x)) = 2(x + 3)$
$= 2x + 6$

$g(f(x)) = (2x) + 3$
$= 2x + 3$

Composite Functions

A composite function is created when one function is substituted into another function.

Example:

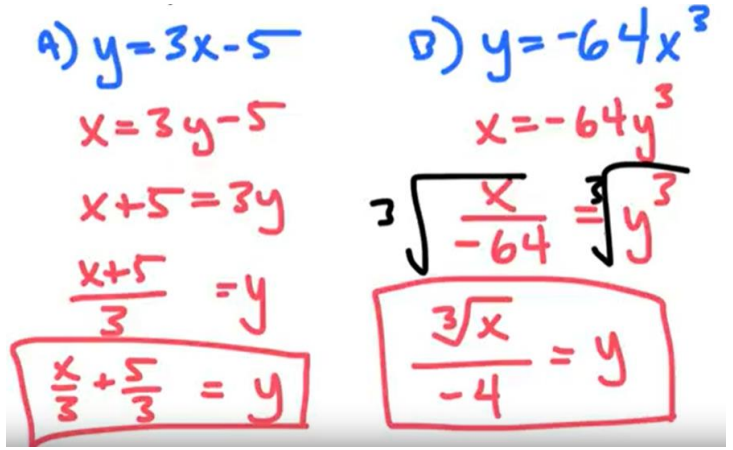
Given f(x) = 3x + 2 and g(x) = x + 5

f(g(x)) = f(x+5)
= 3(x+5) +2
= 3x + 15 + 2
= 3x + 17

g(f(x)) = g(3x+2)
= (3x + 2) + 5
= 3x + 7

Inverse Functions

1. Write as an equation: $y =$
2. Swap x and y
3. Change the subject
4. Write as $f^{-1}(x) =$



Hegarty Maths Links

Function Notation	288, 289
Domain and Range	290, 291
Composite Functions	293, 294
Inverse Functions	295, 296

Given that $f(x)=2x-4$ and $g(x)=3x+5$

a) Find: $gf(3)$

.....

b) Work out an expression for: $f^{-1}(x)$

.....

c) Solve: $f(x)=g(x)$

.....

Given that $f(x)=3x+1$ and $g(x)=x^2$

a) Write down an expression for: $fg(x)$

.....

b) Work out an expression for: $gf(x)$

.....

c) Solve: $fg(x)=gf(x)$

.....

A function f is defined such that

$f(x)=x^2-1$

Find and expression for : $f(x-2)$

.....

) Hence solve: $f(x-2)=0$

.....

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Year 11 Higher - Topic 3 - Proof and fractions Student Knowledge Organiser

Key words and definitions

Rationalise – to change to a rational number
Numerator - the top part of a fraction
Denominator – the bottom part of a fraction
Surd – the root of a prime number or multiple of
Rearrange – to change around using the rule of algebra

Algebraic Fractions

Simplify fractions like:

$$\frac{x^2+3x-4}{2x^2-5x+3}$$

Add, subtract, multiply and divide algebraic fractions like:

$$\frac{4}{x+2}+\frac{3}{x-2}$$

Proof

Expressions and forming expressions including
Integers - n
consecutive numbers - n , n+1 , n+2
Even numbers - 2n
Odd numbers - 2n+1
Consecutive even numbers - 2n , 2n+2 , 2n+4
Consecutive odd numbers - 2n+1 , 2n+3 , 2n+5

Direct Proof

A proof is a logical and structured argument to show that a mathematical statement (or **conjecture**) is always true.
A mathematical proof usually starts with previously established mathematical facts (or **theorems**) and then works through a series of logical steps. The final step in a proof is a **statement** of what has been proven.

Known facts or theorems → Clearly shown logical steps → Statement of proof

- **In a mathematical proof you must**
  - **State any information or assumptions you are using**
  - **Show every step of your proof clearly**
  - **Make sure that every step follows logically from the previous step**
  - **Make sure you have covered all possible cases**
  - **Write a statement of proof at the end of your working**

Change the subject of the formula

Rearranging Formulae

Make c the subject of the formula y = mx + c.

$y = mx + c$
$-mx \quad -mx$
$y - mx = c$

Make m the subject of the formula y = mx + c.

$y = mx + c$
$-c \quad -c$
$y - c = mx$
$\div x \quad \div x$
$\frac{y-c}{x} = m$

Direct Proof

Model expressions that could be a multiple of 7 (7n) or a multiple of 8 (8n) or 2 more than multiple of 3 (3n+2)

Algebraic Proof

Prove the sum of four consecutive numbers is always even.

$x + (x + 1) + (x + 2) + x + 3)$
$4x + 6$
$2(2x + 3)$

Prove $(n + 6)^2 - (n + 2)^2$ is always a multiple of 8

$(n + 6)(n + 6) - [(n + 2)(n + 2)]$
$n^2 + 6n + 6n + 36 - [n^2 + 2n + 2n + 4]$
$n^2 + 12n + 36 - [n^2 + 4n + 4]$
$n^2 + 12n + 36 - n^2 - 4n - 4$
$8n + 32$
$8(n + 4)$

Hegarty Maths Links

Direct Proof	325, 326
Change the subject of a formula	280 – 287
Algebraic Fractions	172, 229, 244

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Year 11 Higher - Topic 3 - Proof and fractions Student Knowledge Organiser

n is an integer greater than 1.
Use algebra to show that $(n^2 - 1) + (n - 1)^2$ is always equal to an even number.

Prove that the difference between the squares of any two consecutive even numbers is always an odd number multiplied by 4.

Here are the first 4 lines of a number pattern.

$1 + 2 + 3 + 4$	=	$(4 \times 3) - (2 \times 1)$
$2 + 3 + 4 + 5$	=	$(5 \times 4) - (3 \times 2)$
$3 + 4 + 5 + 6$	=	$(6 \times 5) - (4 \times 3)$
$4 + 5 + 6 + 7$	=	$(7 \times 6) - (5 \times 4)$

n is the first number in the nth line of the number pattern.
Show that the above number pattern is true for the four consecutive integers n, $(n + 1)$, $(n + 2)$ and $(n + 3)$.

Show that

$$\frac{3x + 6}{x^2 - 3x - 10} \div \frac{x + 5}{x^3 - 25x}$$

simplifies to ax where a is an integer

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Year 11 Higher - Topic 4 - Vectors Student Knowledge Organiser

Key words and definitions

Scalar: a number (measure) with magnitude only

Vector: an illustrative measure which has both magnitude and direction

Magnitude the length of a vector (found using Pythagoras' theorem)

Pythagoras - $a^2 + b^2 = c^2$

Direction: the angle of the vector (often found using trigonometry)

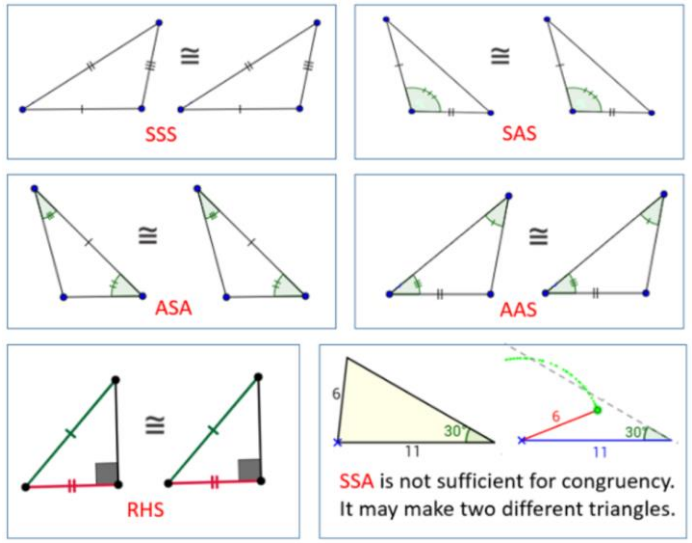
Column: 2 or 3 dimensional matrix isolating dimensional movement

Multiple - many of the same type

Parallel: vectors which are scalar multiples of one another

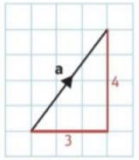
-

Congruent Triangles



Vectors

A vector can be described by its change in position or **displacement** relative to the x- and y-axes.



$\mathbf{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ where 3 is the change in the x-direction and 4 is the change in the y-direction.

This is called **column vector** form.

Notation The top number is the x-component and the bottom number is the y-component.

- **To multiply a column vector by a scalar, multiply each component by the scalar:** $\lambda\begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} \lambda p \\ \lambda q \end{pmatrix}$
- **To add two column vectors, add the x-components and the y-components:** $\begin{pmatrix} p \\ q \end{pmatrix} + \begin{pmatrix} r \\ s \end{pmatrix} = \begin{pmatrix} p+r \\ q+s \end{pmatrix}$

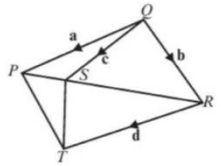
Use of vectors

In the diagram, $\overrightarrow{QP} = \mathbf{a}$, $\overrightarrow{QR} = \mathbf{b}$, $\overrightarrow{QS} = \mathbf{c}$ and $\overrightarrow{RT} = \mathbf{d}$.

Find in terms of **a**, **b**, **c** and **d**:

a $\overrightarrow{PS}$ **b** $\overrightarrow{RP}$

c $\overrightarrow{PT}$ **d** $\overrightarrow{TS}$



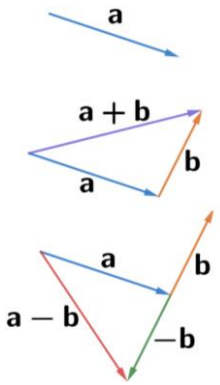
a $\overrightarrow{PS} = \overrightarrow{PQ} + \overrightarrow{QS} = -\mathbf{a} + \mathbf{c}$
$= \mathbf{c} - \mathbf{a}$ — Add vectors using $\triangle PQS$.

b $\overrightarrow{RP} = \overrightarrow{RQ} + \overrightarrow{QP} = -\mathbf{b} + \mathbf{a}$
$= \mathbf{a} - \mathbf{b}$ — Add vectors using $\triangle RQP$.

c $\overrightarrow{PT} = \overrightarrow{PR} + \overrightarrow{RT} = (\mathbf{b} - \mathbf{a}) + \mathbf{d}$
$= \mathbf{b} + \mathbf{d} - \mathbf{a}$ — Add vectors using $\triangle PRT$. Use $\overrightarrow{PR} = -\overrightarrow{RP} = -(\mathbf{a} - \mathbf{b}) = \mathbf{b} - \mathbf{a}$.

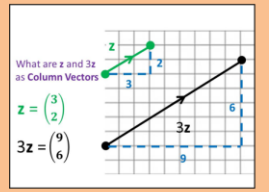
d $\overrightarrow{TS} = \overrightarrow{TR} + \overrightarrow{RS} = -\mathbf{d} + (\overrightarrow{RQ} + \overrightarrow{QS})$
$= -\mathbf{d} + (-\mathbf{b} + \mathbf{c})$
$= \mathbf{c} - \mathbf{b} - \mathbf{d}$ — Add vectors using $\triangle TRS$ and $\triangle RQS$.

Vector addition and multiples of vectors



$\mathbf{z} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

$3\mathbf{z} = \begin{pmatrix} 9 \\ 6 \end{pmatrix}$

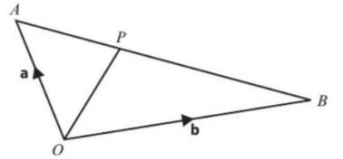


$$3\mathbf{z} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \times 3 = \begin{pmatrix} 9 \\ 6 \end{pmatrix}$$

Geometric Problems - Vectors

In the diagram the points A and B have position vectors **a** and **b** respectively (referred to the origin O). The point P divides AB in the ratio 1 : 2.

Find the position vector of P.



$\overrightarrow{OP} = \overrightarrow{OA} + \frac{1}{3}\overrightarrow{AB}$
$= \overrightarrow{OA} + \frac{1}{3}(\overrightarrow{OB} - \overrightarrow{OA})$
$= \frac{2}{3}\overrightarrow{OA} + \frac{1}{3}\overrightarrow{OB}$
$= \frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$

There are 3 parts in the ratio in total, so P is $\frac{1}{3}$ of the way along the line segment AB.

Rewrite $\overrightarrow{AB}$ in terms of the position vectors for A and B.

Give your final answer in terms of **a** and **b**.

Hegarty Maths Links

Vectors	622 – 636
Congruent Triangles	682 – 690

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Year 11 Higher - Topic 4 - Vectors Student Knowledge Organiser

The diagram shows a regular hexagon *OABCDE*.

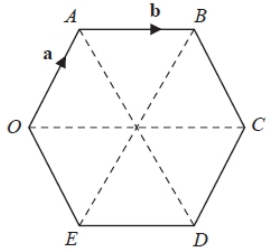


Diagram **NOT** accurately drawn

$\overrightarrow{OA}$ = **a**

$\overrightarrow{AB}$ = **b**

M is the midpoint of *OE*.
N is the midpoint of *AB*.

(a) Find $\overrightarrow{MN}$ in terms of **a** and/or **b**.

$\overrightarrow{MN}$ = ...

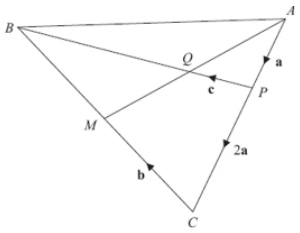


Diagram **NOT** accurately drawn

M is the midpoint of *BC*.
Q is the midpoint of *AM*.

$\overrightarrow{AP}$ = **a** $\overrightarrow{PC}$ = 2**a** $\overrightarrow{CM}$ = **b** $\overrightarrow{PQ}$ = **c**

(a) Find $\overrightarrow{AM}$ in terms of **a** and **b**.

$\overrightarrow{AM}$ = ...

(b) Find $\overrightarrow{QB}$ in terms of **c**.

$\overrightarrow{QB}$ = ...

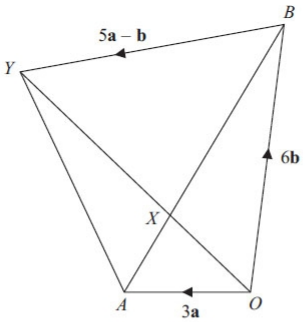


Diagram **NOT** accurately drawn

OAYB is a quadrilateral.

$\overrightarrow{OA}$ = 3**a**

$\overrightarrow{OB}$ = 6**b**

(a) Express $\overrightarrow{AB}$ in terms of **a** and **b**.

.....

X is the point on *AB* such that *AX* : *XB* = 1 : 2

and $\overrightarrow{BY}$ = 5**a** – **b**

*(b) Prove that $\overrightarrow{OX} = \frac{2}{5}\overrightarrow{OY}$

North East Learning Trust

Toto - Africa

Rhythm, (including tempo and metre)

- In **2/2** metre.
- **Tempo: Moderato** (moderately fast)
- **Polyrhythms** in the percussion section

Riff A
- **Syncopated**

Riff B
- **Quaver** pattern

Verse 1
- **Bass** plays **dotted rhythm.**
- **Vocals** are **syncopated**
- **Drum fill** leads into the chorus

Chorus
- **Vocals** are **syncopated**

Verse 2
- Slight rhythmic differences to accommodate different words

Instrumental
- Use of triplets in the flute solo, particularly at the end of phrases

Context

- Recorded in 1981
- Released in 1982 (September 30th)
- Written by David Paich and Jeff Porcaro

Structure

Intro	Bar 1 - 4 (repeated 4 times)
Verse 1	Bar 5 - 39 (35 bars)
Chorus	Bar 40 – 57 (18 bars)
Link 1	Bar 58 – 65 (8 bars)
Verse 2	Bar 14 – 39 (26 bars)
Chorus	Bar 40 – 57 (18 bars)
Link 2	Bar 58 – 65 (8 bars)
Instrumental	Bar 66 – 82 (17 bars)
Chorus	Bar 40 – 92 (22 bars)
Outro	Bar 93 – 96 (18 bars)

Tonality

- Intro, verses, links and the instrumental are all in **B major.**
- Chorus is in **A major.**

Texture

- **Melody and Accompaniment**
- **Homophonic** vocal harmonies
- **Counterpoint** in verse 2
- Texture 'thins' in the outro with instruments dropping out leaving the bass line of Riff A.

Harmony

- **Diatonic** harmony
- **Intro/link/outro:**

A	G#m	C#m	C#m
♭VII	vi	ii	ii

- **Verse:**
  - **Harmonic rhythm** is one chord per bar

B	D#m	G#m	B/F#
I	iii	vi	Ic
A/E	E/F#	G#m	**RIFF A**
♭VIIc	Iv⁹d	vi	

(repeat 3 times)

B	D#m	G#m	G#m
I	iii	vi	vi
RIFF A		C#m	C#m
		ii	ii

- **Chorus/instrumental:**

F#m	D	A	E
vi	IV	I	V

(repeat 3 times)

F#m	D	A	C#m	E	F#m	E/G#
vi	IV	I	iii	V	vi	Vb

Instrumentation

Western Instruments
- Lead vocals
- Backing vocals
- Synthesizer
- Lead guitar
- Bass guitar
- Flute (on a synth)

African inspired instruments:
- Marimba
- Maracas
- Conga drums
- Cowbells
- Flute (on a synth)

Dynamics

- **Verse** is **mezzo forte** (mf) – quite loud
- **Chorus** is **forte** (f) - loud

Melody

Riff A
- **Riff A** is the **hook** of the song, repeated in the verses and after each chorus.

Riff B
- **Anacrusis**
- **Irregular** repeated patterns (**ostinatos**) using the E major **Pentatonic scale**

Verse 1
- 9-bar phrases with different lyrics (repeated 3 times)
  - Each phrase divides into 2 lines: 3 bars, then 5 bars, and a silent bar where riff A enters.
- Fairly low pitched
- **Syllabic**
- **Conjunct**
- Line 4 - the melody moves an octave higher in the 4th bar
- Backing vocals sing a 3rd below in **parallel motion**

Chorus
- 4 phrases
- Phrases 1-3 are:
  - **4 bars** long and only use **2 notes** (**tonic** and **leading note**)
  - **syllabic**
- Phrase 1 is a **solo**
- Phrase 2 is a **duet**
- Phrase 3 and 4 are sung in **3-part harmony**
- Phrase 4 ends with **melisma** ("had")

Verse 2
- 9-bar phrases only repeated twice
- Final line sees **melodic variation** rising on "deep inside"
- **Countermelody** (**descant**) played by the flute
  - **Conjunct**
  - **Descending**
  - One note per bar
- Backing vocals "ooo" added in 5th bar of phrase 1 and 2
- Harmonies on "frightened of this thing that I've become"

Instrumental
- One 9-bar phrase and one 8-bar phrase
- 9-bar phrase:
  - First 4 bars (66-69):
    - **Descending** using the B major **pentatonic scale**
    - Based on Riff B
    - **Harmonised** in 3rds and 4ths
  - Next 5 bars (70-74)
    - **Ascending** and **descending** using the E major scale
    - Harmonised in 3rds
- 8-bar phrase:
  - First 3 bars (75-77):
    - **Ascending** using the **B pentatonic** scale with **acciaccaturas**
    - **Harmonised** mostly with 4ths (some 3rds)
  - Next 5 bars (78-82)
    - Vocal line re-enters

Final Chorus
- Longer – "I bless the rains" sung 5 times
- Vocal **improvisation** added
- Short guitar riff added at the end of each line

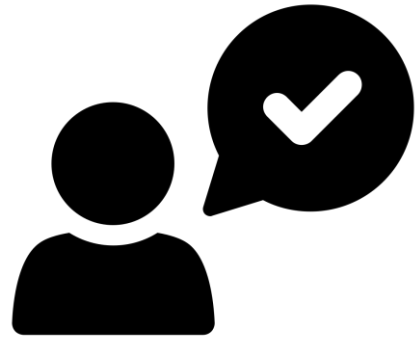
Sport Studies

R187 – Increasing awareness of Outdoor and Adventurous Activities

Outdoor provisions

Outdoor and Adventurous activities are any leisure, recreation or sporting activity undertaken in a **natural, rural or urban space**. These physical challenges can be completed as an **individual** or a **group**.

What activities are examples of outdoor adventurous activities?

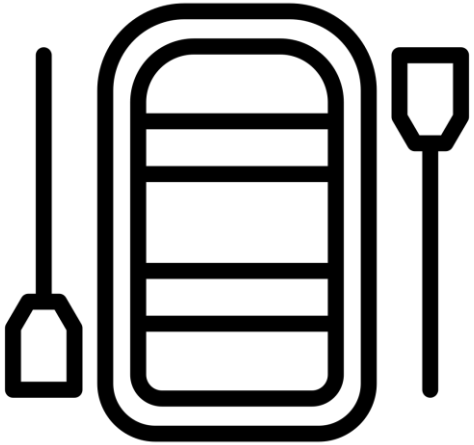


Provision for different outdoor adventurous activities

Water sports
There are many water sports activities that involve single person performance or as part of a team.

Canoeing is with a single-bladed paddle whereas **Kayaking** is with a double-bladed paddle. They can be completed as a pair or individually on lakes, rivers and the sea.

Rafting is a **recreational activity** used to negotiate a body of water. All participants have a single-bladed paddle.



Provision for different types of outdoor adventurous activities

Paddleboarding is completed either **lying down, kneeling or standing up** on a board with a paddle. This is usually on an **open lake.**

Sailing

Windsurfing uses a board and a **single sail** held by an individual standing up. Variations include kiteboarding or wakeboarding.

National Governing body- water sports

The approved **National Governing Bodies** for **water sports** are:

- **British Canoeing**

https://www.britishcanoeing.org.uk/

- **Royal Yachting Association**

https://www.rya.org.uk/

Provision for different outdoor adventurous activities

Trekking/hiking is a long journey on foot in a **rural area**. This is often on **hilly or mountainous terrain**. Walking is one of the most popular outdoor activities in the UK. The word **hiking** is sometimes used.

Mountaineering is climbing and trekking in the mountains. The sub-zero temperatures and altitude add to the element of danger.

Orienteering requires a map and compass to navigate from point to point. Participants move at speed and aim to cross check points as quickly as possible.

Outdoor provisions

The approved **National Governing Bodies** for **Trekking** are:

- **British Orienteering**

https://www.britishorienteering.org.uk/

British Orienteering

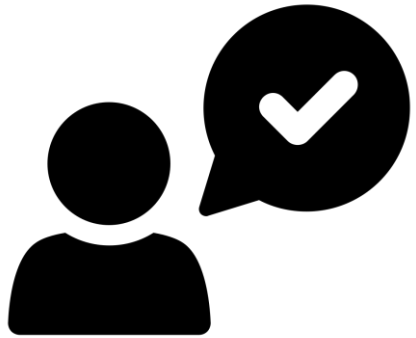
- **Royal Yachting Association**

https://www.rya.org.uk/

Provision for different types of outdoor adventurous activities

Camping involves an **overnight stay** away from home in a shelter, such as a **tent.**
Campers need the following equipment:

- Sleeping bag
- Food
- Water
- Basic cooking equipment



Provision for different types of outdoor adventurous activities

Climbing is the ascent of a steep incline using the hands and feet. It usually done with the aid of specialist equipment such as a rope, harness and belay device.
Specific climbing related activities include:

- **Bouldering**
- **Free climbing**
- **Rock climbing**
- **Indoor climbing**

Abseiling is a controlled descent off a vertical cliff edge or rock face. Techniques involve using friction to control the speed of fall.

- **British Mountaineering Council**

https://www.thebmc.co.uk/

Provision for different types of outdoor adventurous activities

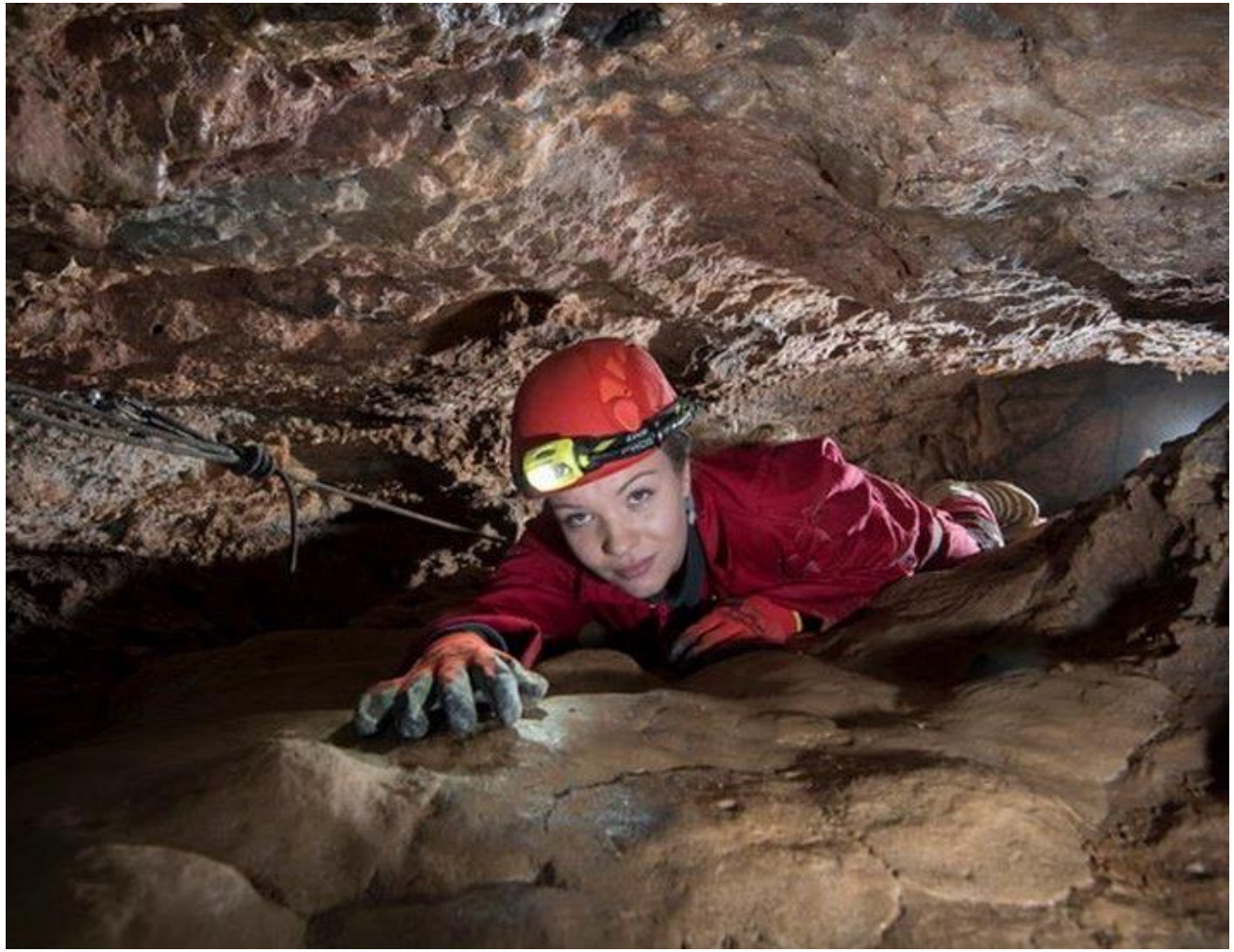
Caving is often called potholing and is the exploration of caves. Caves come in different shapes and sizes and are often extremely dark and cold. Torches and lamps enable participants to navigate through small gaps.

The approved **National Governing Body** for **caving** is:

- **British Caving Association**

https://british-caving.org.uk/

BCA
British Caving Association



Provision for different types of outdoor adventurous activities

Cycling is a recreation activities on bikes. The two main outdoor activities involving bicycles are **mountain biking** and **BMX.**

Mountain Biking is riding off-road over rough terrain using specially design bikes. They have thicker tyres for extra grip and suspension to cater for the uneven surfaces. The activity requires balance, endurance and good bike handling.

BMX is a type of off-road cycling but on purpose built sprint raceways. The race begins with a starting-gate and involves jumps and humps as well as sharp U-turns. The winner is the first to cross the line.

Outdoor provisions

The approved **National Governing Body** for **cycling** is:

- **British Cycling**

https://www.britishcycling.org.uk/

Provision for different types of outdoor adventurous activities

Snow sports are outdoor activities which take place on **snow or ice**. Most involve **skiing, ice skating or sledging**. Traditionally, these would only take place in cold areas of the UK but the development of **artificial** ice and snow allows greater flexibility.

Skiing and snowboarding involve being taken up a mountain and descending on a board or skis.

Variations include:

- **Downhill Skiing – fast downhill racing through gates.**
- **Cross-Country Skiing – usually across flat land**
- **Freestyle – involves tricks and arial skills**

Outdoor provisions

The approved **National Governing Body** for **snow sports** is:

- **Snow Sport England**

https://www.snowsportengland.org.uk/

Provision for different types of outdoor adventurous activities

Gliding is an air-based activity where pilots fly unpowered aircraft using natural air flow. Gliders are launched by aircraft or from winches at an airfield.

Hang gliding uses a lighter aircraft called a hang glider. The pilot is attached underneath in a harness and controls the craft by shifting body weight left and right.

Paragliding involves flying under a canopy adapted from a parachute. Most paragliders use hills and mountains as launch sites.

Outdoor provisions

The approved **National Governing Body** for **gliding** is:

- **British Gliding Association**

BRITISH GLIDING ASSOCIATION

Provision for different types of outdoor adventurous activities

Other **land-based activities** includes:

Canyoning is travelling through canyons or gorges using a variety of activities such as walking, scrambling, abseiling or swimming.

The equipment required is:

- **Wetsuits**
- **Helmets**
- **Specialised shoes**
- **Rucksack**
- **Climbing gear**

Provision for different types of outdoor adventurous activities

High ropes course is a series of challenging poles, net and wires suspended high up in the trees. Participants are attached via a wire and belay cable for safety.

https://www.erca.uk/index.php/en/

This type of activity encourages:

- **Problem solving**
- **Teamwork**
- **Communication**
- **Leadership**

Outdoor organisations

Provision of outdoor activities in the UK can be accessed through **outdoor activity providers.** These outdoor activity centres offer residentials or daily events.

There are several **national sports centres** in the UK that provide the facilities and expertise to complete many of these outdoor activities.

- **Plas-y-Brenin in North Wales**
- **Holme Pierrepont in Nottinghamshire.**
- **Tollymore National Outdoor Centre in Northern Ireland**
- **Glenmore Lodge in Scotland**

Voluntary organisations for outdoor adventurous activities

Voluntary organisations in the UK run and organise trips involving outdoor adventurous activities as part of schemes and awards.

The Scouts are a voluntary organisation that encourage young boys and girls to develop skills such as resilience, leadership and teamwork through activities, some of which are outdoors.

The different age groups within the Scouts are:

- Beavers
- Cub
- Scouts
- Explorers

Voluntary organisations for outdoor adventurous activities

Secondary school aged students can join the **Cadets** and includes:

- **Air Training Corps**
- **Army Cadets**
- **Sea Cadets**

Each of these organisations offer student an opportunity to become involved in activities such as **rifle shooting, climbing, fieldcraft, parade drills** and others events linked to the **armed services**.

More information:

https://www.army.mod.uk/who-we-are/the-armys-cadets/

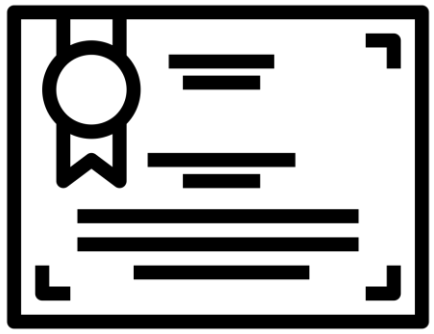
Voluntary organisations for outdoor adventurous activities

The Duke of Edinburgh Award (DofE) is a youth award programme with a series of levels to achieve. These take one to four years to complete and have a number of objectives:

- Volunteering
- Physical
- Skill development
- Expedition
- Additional 5th residential (Gold award)

The levels are:

- **Bronze**
- **Sliver**
- **Gold**



DofE | THE DUKE OF EDINBURGH'S AWARD

Provision for different types of outdoor adventurous activities

Local providers offer several activities around the country to school groups, families and organisations.

These include organisations like:

- **Go Ape**
- **National Climbing Centre**

Task 1 – The provision for different types of Outdoor and Adventurous Activities 6MARKS

Write about the provision for **3 outdoor and adventurous activities.**

You must write about:

1.High Ropes Courses
2.Mountain Cycling
3.Hill Walking

You must:

• Research which of the 3 approved activity areas you could do within your **region(local area)** AND where you could go to do these

• Research where you could go **nationally(within UK)** to take part in the three approved activity areas

• Research the provision available from outdoor activity organisations for the three approved activity areas both regionally AND nationally.

Provision for different types of outdoor adventurous activities

Task 1:
Your teacher wants you to write a proposal about the provision for outdoor and adventurous activities within **three** different approved activity areas. You must include those that are available both regionally to you as well as nationally.

For the above activities, **you must**:

- Research which of the above activities you could do within your region and where you could go
- Research where you could go nationally to take part in activities within your three areas
- Research the provision available from outdoor activity organisations both regionally and nationally for activities within your **three** areas.

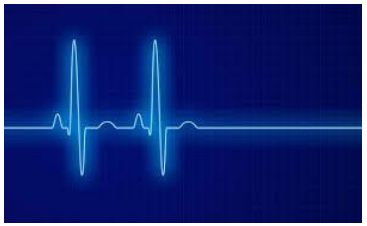
The evidence for this task **must be** in the form of a written report.

Religion and Life: Knowledge Organiser

Important Key words to remember	
Fundamental Christians	Christians who believe that all the statements in the Bible are literally true.
Liberal Christians	Christians who believe that the Bible's authors were guided by God, but that not everything they wrote is a literal account of what happened.
Stewardship	The idea that believers have a duty to look after the environment on behalf of God
Dominion	Dominance over something; humans having power or charge of the earth
Evolution	The process by which living organisms are thought to have developed and diversified from earlier forms of life during the history of the earth
Adaptation	A process of change where an organism or species becomes better suited to its environment
Sanctity of life	The belief that all life is holy and loved by God; Christians believe human life should not be misused or abused
Quality of life	The general well-being of a person, in relation to their health and happiness; also the theory that the value of life depends upon how good or satisfying it is
Euthanasia	Assisted suicide

Key beliefs: Christianity

1. God created the world (**fundamentalists** believe this was in 6 days as it says this in the Bible, and liberals believe it was created in 6 stages – the bible is just a guide)
2. God wanted humans to be good **stewards** and care for the earth. He gave them **dominion** to rule over the earth.
3. Christians believe humans have been created in the **"image of God"** so their lives are therefore more valuable than animals.
4. Christians believe God created humans. In the Bible it says that Adam and Eve were the first humans. Fundamental Christians believe this is true, whereas liberal Christians might believe humans have **evolved**.
5. Christians believe in the **sanctity of life**, and therefore Catholics believe abortion should not be permitted. However, other Christians believe it may be permitted in certain circumstances, for example if the mother's life is at risk, or if she was raped.
6. Because of Christian beliefs in the **sanctity of life**, many Christians will be against euthanasia because it interferes with God's plan. They would prefer a patient to have their pain lessened in a hospice.
7. Some Christians believe that the quality of life is more important than the sanctity of life, and would therefore permit euthanasia and abortion.
8. Christians believe that the most important goal for all Christians is to reach heaven in the afterlife. To do this they must avoid sin, which hurts their relationship with God.
9. Christians believe that Jesus' death healed the relationship between man and God, and that by following Jesus' example by living a life of doing good and avoiding sin will allow them to enter heaven.
10. Catholics believe in **purgatory** which is where souls undergo purification in order to achieve the holiness necessary to approach God and enter heaven.

Key teachings to remember:

"In the beginning God created the heavens and the earth"

"The earth is the Lord's and everything in it."

"Everything that lives and moves about will be food for you."
" Rule over the birds of the air and the fish of the sea"

"So God created mankind in his own image."

"Before I formed you in the womb I knew you, before you were born I set you apart."

"You shall not murder"

"Blessed are the merciful."

"For God so loved the world that he gave his one and only Son, that whoever believes in him shall not perish but have eternal life."

"I am the resurrection"

"Treat others how you want to be treated"

"Your body is a temple of the Holy Spirit"

"In my Fathers house are many rooms"
"Eternal damnation"
"God breathed life into Adam"

"God is love"

"God is the only judge"

Annotation guide

What next?

Why was this research useful to your developing project?

What ideas will you take into your next photoshoot?

- What visual elements will you take inspiration from?
- Are there conceptual ideas that have inspired you?

Which elements of the artists' work will you choose to explore? Why?

How does this artists work link to your theme/developing idea?

How could this be inspirational to your developing ideas?

How does this link to the work of other artists and ideas you have explored?

If you were to create work in a similar way, it would include:

(e.g.)

- A black background
- Natural lighting
- Subject centralised within the frame

Camera settings:

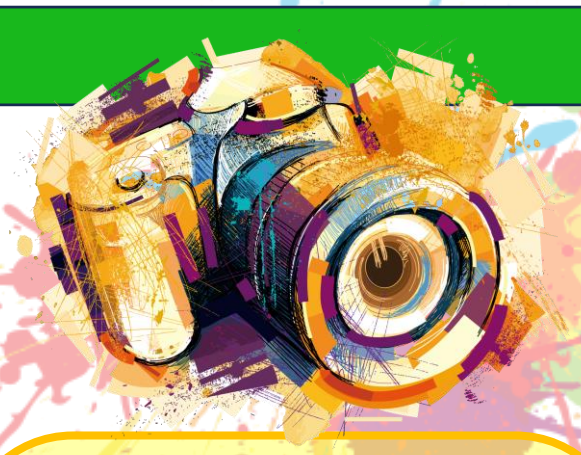
- What aperture?
- Fast/slow shutter speed…
- What ISO?

Message?

Is there a message the artist is conveying through their work?

How has this been achieved?

Do you have a message to convey? If so, how will you ensure the viewer understands?



What set up would be required to create visually similar work? What camera settings do you think they need to achieve these results? What lighting? Any other equipment?

Why did the artist choose to capture the subject/s in this way?

What have you observed/learnt by analysing this artists' work?

What do you like about these images? What makes them successful?

What Formal Elements?

Carefully consider…

Composition

How has the subject been positioned within the frame? What effect does this have?
How has the artist used the space?

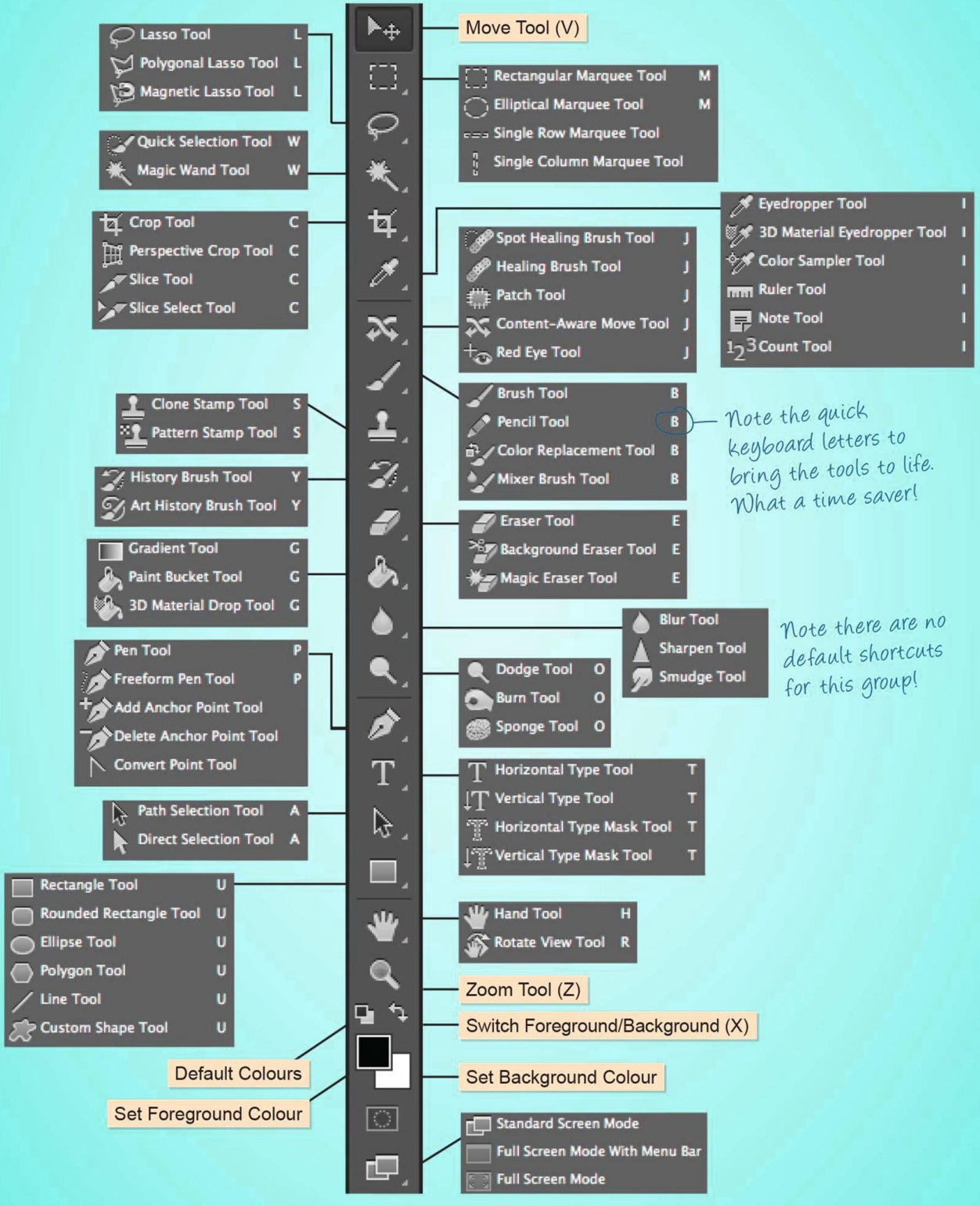
Colour, Tone, Texture, pattern, line, shape, form…?

1. Include <u>relevant</u> facts about the artist.
2. Include **5** words to describe the style.
3. Your initial opinion about their work.
4. What formal elements are important within this work?
5. Present 3 to 5 images.

AO1 AO3

PHOTOSHOP

CS6 AND CC SHORTCUTS



ART VOCAB

You may find the following words useful when writing about your own artwork or that of others. If there are words you do not know then use a dictionary to look them up or ask a friend.

ELEMENTS OF DESIGN

Colour:
Blend
Bright
Clash
Cold
Deep
Dull
Glowing
Harmonious
Intense
Luminous
Mixed
Opaque
Pale
Pastel
Primary
Pure
Saturated
Secondary
Soft
Tint
Translucent
Transparent
Vibrant
Warm

Line:
Angular
Broken
Confident
Faint
Flowing
Fluent
Free
Hesitant
Scribble
Sweeping
Tight
Woolly

Shape:
Angular
Body
Conical
Figure
Form
Frame
Harmonious
Image
Precise
Sharp
Uniform
Vague

Texture:
Coarse
Cross-hatching
Fine
Flat
Glaze
Hatching
Impasto
Jagged
Matt
Rough
Shiny
Smooth
Soft
Splatter
Thick
Thin
Wash

Tone:
Bleach
Bright
Contrast
Crisp
Dark
Fade
Fair
Gradation
Harsh
Intense
Smooth
Sombre

Pattern:
Embellish
Flowing
Fluid
Geometric
Irregular
Natural
Negative
Order
Ornamental
Overlap
Plain
Positive
Repeat
Simple
Spiral
Stamp
Stencil
Structure
Symmetric
Uniform

Composition:
Background
Blurred
Complex
Confused
Design
Distant
Eye-line
Focus
Foreground
Form
Middle-ground
Near
Perspective
Plane
Proportion
Scale
Shape
Sharp
Space
Symmetry

Light:
Artificial
Dapple
Dark
Ethereal
Evening
Fall of light
Fierce
Gentle
Harsh
Haze
Highlight
Intense
Light
Midday
Natural
Night
Shading
Shadow
Soft
Source
Tone

Feeling:

Alive	Atmospheric	Delicate
Depressing	Dignified	Disturbing
Exciting	Expressive	Fresh
Happy	Humorous	Imposing
Moving	Nostalgic	Sad

Sentence Starters: Artist Work

- In this piece I can see...
- The materials the artist have used are....
- The technique the artist has used is....
- I think this piece is about.....
- I think that because....
- The artist created this work because....
- The focal point for me is.....
- The artist links to my topic because.....
- I like/dislike this work because.....

Sentence Starters: Own Work

- In this piece I have...
- My work links to my artist because....
- My focus artist influenced me.....
- I am proud of.....
- An area I need to improve is....
- To develop this piece further I could...
- I made this piece personal to me by....
- Through working in this way I have learnt....
- The materials I have used are....
- The technique I used is....

Chemistry

- Paper 1

Atomic Structure 01

Knowledge Organiser - Science – year 11

North East Learning Trust

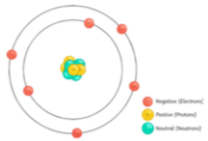
Atoms

All substances are made of atoms. An atom is the smallest part of an element that can exist.

Atoms are very small, having a radius of about 1 x 10^{-10}m. The radius of the nucleus us less than 1/10000 of that of the atom.

In an atom, the number of electrons is equal to the number of protons in the nucleus, Atoms have no overall electric charge.

Particle	Relative Mass	Relative Charge
Proton	1	+1
Neutron	1	0
Electron	Very small	-1



Atomic Number and Mass Number

The number of protons in an atom of an element is its **atomic number**. All atoms of a particular element have the same number of protons. The sum of the protons and neutrons in an atom is its **mass number**.

Electronic structure

The electrons in an atom occupy the lowest available energy level. The electronic structure can be represented by numbers or by a diagram. For example, the electronic structure of carbon (above) is 2,4.

Elements, compounds and mixtures

Elements are substances that only contain one type of atom. These are represented by chemical symbols, e.g. O represents oxygen. There are about 100 different elements on the periodic table.

Compounds are formed when two of more different elements chemically bond together, in fixed proportions. Compounds can only be separated by **chemical reactions**.

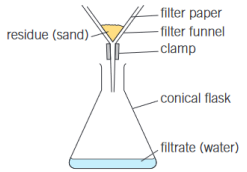
Mixtures consist of two or more elements or compounds **not** chemically combined together. **Mixtures** can be separated by **physical processes**.

Key terms

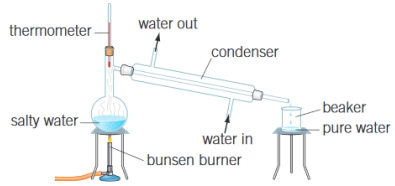
atom **atomic number** **compound** **electron** **mass number** **neutron** **nucleus** **proton**

Separating techniques

Filtration



Distillation



Evaporation

Development of the atomic model

Scientist	Period	Discovery	Model
John Dalton	1808	Atoms described as solid spheres	
JJ Thomson	1897	Plum Pudding model – the atom is a ball of positive charge with scattered electrons	
Ernest Rutherford	1911	Alpha Scattering – concentrated positive mass in the centre. Atoms are mostly empty space.	
Niels Bohr	1913	Electrons are in shells orbiting the nucleus	
James Chadwick	1932	Neutrons in the nucleus	

Structure and Bonding 03

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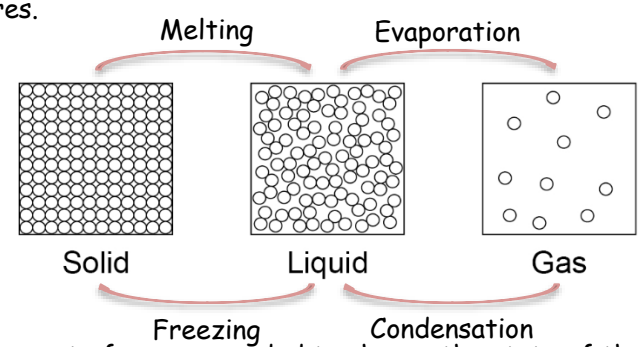
States of matter

The three states of matter are solid, liquid and gas. They can be represented using the particle model, by small solid spheres.



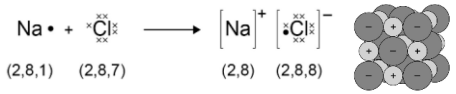
The amount of energy needed to change the state of the substance depends on the strength of the forces between the particles. The stronger the forces between the particles, the higher the melting and boiling point of the substance.
There are limitations to this model, due to the following assumptions:

- No forces between the particles
- Particles are all solid spheres

In chemical equations, the three states of matter are shown as (s), (l) and (g), with (aq) for aqueous solutions.

Ionic bonds

When a **metal** atom reacts with a **non-metal** atom, outer-shell electrons are transferred. Metal atoms **lose** electrons to become positively charged ions, whilst non-metal atoms **gain** electrons to become negatively charged ions.



Ionic compounds are giant structure of ions, held together by strong electrostatic forces of attraction between oppositely charged ions. These forces act in all directions in the **lattice**. These compounds have **high** melting and boiling points, as large amounts of energy is needed to break the strong bonds. When in liquid or aqueous form, they can conduct electricity as the ions are free to move.

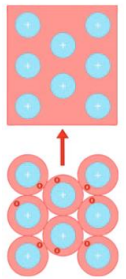
Covalent bonds

A covalent bond forms when electrons are **shared** between **non-metal** atoms. The number of electrons shared depends on how many extra electrons are needed to fill the outer shell. Covalent bonds can be represented in a number of ways.

Atoms forming **covalent bonds** form different types of structures.
Giant structures consist of billions of atoms covalently bonded together. An example is diamond.
Small molecules contain only a few atoms. Different molecules are held together by weak **intermolecular forces**. An example is water.
Large molecules contain many repeat units joined covalently in a chain. Polymers are examples.

Metallic bonding

Metallic bonding occurs only in metals. Tightly packed rows of **positive ions** are surrounded by a **sea of delocalised electrons** which are free to move throCE6MT9 ugh the whole structure. There are strong **electrostatic** forces of attraction between the **positive** metal ions and **negative** electrons. They have **high** melting and boiling points. **Pure metals** are **malleable (soft)**, as the layers can slide over each other, so are mixed with other metals to make **alloys**.



Carbon allotropes

There are numerous carbon structures. **Diamond** and **graphite** are **giant covalent structures** with **very high** melting and boiling points. **Graphite** contains layers of covalently bonded carbon atoms. Between the layers, there are no covalent bonds. This means the layers can **slide**, making graphite soft. Graphite can conduct electricity due to delocalised electrons. For **diamond**, the carbon atoms have a **rigid** structure, making it very hard. **Graphene** consists of a single layer of graphite. **Fullerenes** exist as **cage-like** structures and **tubes**, where molecules are held together by **weak** intermolecular forces. They typically **can** conduct electricity.

Key terms

Boiling point **Covalent bond** **delocalised electrons** **fullerene** **giant covalent** **graphene** **diamond** **small molecules** **boiling point** **conductor** **electrostatic** **ionic bond** **ion** **lattice**

Periodic Table 02

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Periodic table

In the early 1800s, elements were arranged by **atomic weights**. The periodic table was not complete because some of the elements had not been found and some elements were put in the wrong group.

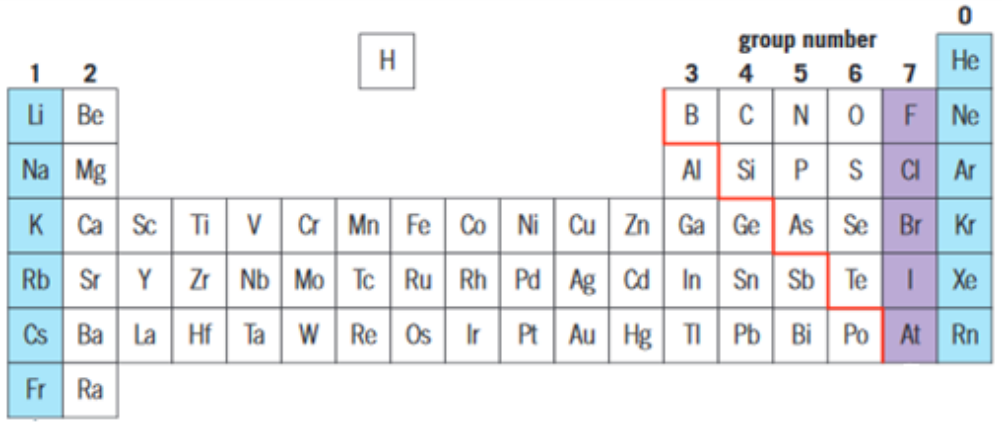
Dimitri Mendeleev (1869) left gaps in the periodic table to account for elements he thought had not yet been discovered. He put them in order of **atomic number**. Elements with properties predicted were discovered and filled the gaps. The existence of isotopes supported ordering by atomic number.

Modern Periodic table

The red step shows the divide between metals and non-metals. **Metals** are on the **left** and **non-metals** on the right.

Groups are the columns in the periodic table – they go downwards. The group number shows the number of **electrons** in the **outer shell**. Elements in the same group normally follow the same trends in properties.

Periods are the rows in the periodic table – they go sideways. Each **period** shows another full shell of electrons.

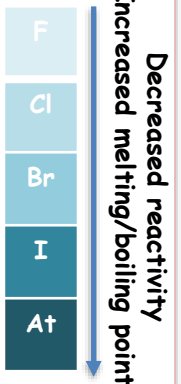


Group 0 – Noble gases

Noble gases include: **helium, neon** and **argon**. They are all **non-metals** with **low** melting and boiling points. The boiling points all increase as they go down the group due to greater intermolecular forces.
They are colourless gases at room temperature.
Group 0 elements are typically unreactive.

Group 7 - Halogens

Halogens include: fluorine, chlorine, bromine and iodine. They are all **non-metals**. The reactivity **decreases** as they go down the group due to an increase in difficulty gaining an extra electron. The melting and boiling points become **higher** down the group.



Group 1 – Alkali metals

Alkali metals include: lithium, sodium, potassium and rubidium. They are all soft reactive **metals**. The reactivity **increases** as they go down the group. They get bigger and it is easier for them to lose and electron if it is further from the nucleus. The melting and boiling points become **lower** down the group.

Key terms

alkali metals | group 1 | group 7 | group 0 | halogen | noble gas | Period | Trend

Quantitative Chemistry 01

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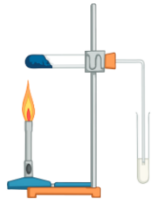
Conservation of mass

The conservation of mass states that atoms cannot be created or destroyed during a chemical reaction., so the mass of the reactants will equal the mass of the product. In other words, all the atoms you had in the reactants must be present in the products.. For some reactions, the mass appears to **decrease**. This typically occurs when a gas is produced and lost to the surroundings. For other reactions, the mass appears to **increase**. This typically occurs when a gas is a reactant.

Decrease in mass

Sodium carbonate (s) → sodium oxide (s) +carbon dioxide (g)

When sodium carbonate is thermally decomposed, carbon dioxide gas is produced and released into the surroundings.



Increase in mass

Magnesium (s) + Oxygen (g) → Magnesium oxide (s)

Oxygen from the air is added to the magnesium which will be heavier in mass.

Relative mass

The masses of atoms are compared by measuring them relative to atoms of carbon-12. You can work out the relative formula mass (M_r) of a compound by adding up the relative atomic masses (A_r) of the elements in it, in the ratio shown by its formula

Concentration

Concentration is the amount of solute in a volume of solvent. The more substance that is dissolved, then the more concentrated the solution is.
It is possible to calculate concentration using:

$$Concentration = \frac{Mass}{Volume}$$

With concentration measured in g/dm^3, mass in g and volume in dm^3.
Remember:

$$Volume(dm^3) = \frac{Volume(cm^3)}{1000}$$

Moles (HT)

The **Avogadro constant**, 6.02×10^{23}, is the number of molecules of a substance that make up one mole of that substance.
One mole of a substance has the same mass as the M_r of the substance. E.g. Oxygen (O_2) has an M_r of 32, so 1 mole of oxygen has a mass of 32g.

The number of moles can be determined using:

$$Moles = \frac{Mass\ (g)}{M_r}$$

Balanced equations (HT)

When writing symbol equations you need to ensure that the number of each atom on each side is equal.

$$2H_2 + O_2 \rightarrow 2H_2O$$

There are 4 hydrogen and 2 oxygen atoms on each side.
You can deduce the balanced symbol equations from the masses (and hence the ration of the numbers of moles) of substances involved in a chemical reaction. On the other hand, balanced symbol equations tell you the number of moles of substances, and thus the masses of reactants and products.

Excess and limiting reactants (HT)

In a chemical reaction between two or more reactants, often one reactant will run out before the others.
The reactant that is left over is in **excess**.
The reactant that runs out is the **limiting reactant**.

Key terms

Avogadro constant **balanced** **concentration** **conservation** **equation** **formula mass** **excess** **limiting reactant** **mass** **mole** **ratio** **state**

Chemical Reactions 2

Knowledge Organiser Science – year 11

Reactivity series

Reaction with water	Reaction with acid	Reactivity series: Metal	Reactivity series: Reactivity	Extraction method
Fizzes, gives off hydrogen gas	Explodes	Potassium	High reactivity	Electrolysis
		Sodium		
		Lithium		
	Fizzes, gives off hydrogen gas	Calcium		
Reacts very slowly		Magnesium		
		Aluminium (carbon)		
		Zinc		Reduction with carbon
		Iron		
No reaction	Reacts slowly with warm acid	Tin		
		Lead (hydrogen)		
	No reaction	Copper		
		Silver		Mined from Earth's crust
		Gold	Low reactivity	

Displacement reactions

In a **displacement reaction**, the **more** reactive element takes the place of the **less reactive** element.

For example, **Potassium is more reactive than calcium**, so potassium displaces the calcium in calcium chloride

Calcium chloride + Potassium → Potassium chloride + Calcium

$$CaCl_2 + 2K \rightarrow 2KCl + Ca$$

Acids and alkalis

Acids are compounds that release H^+ ions when in an aqueous form. The three acids are sulfuric acid, nitric acid and hydrochloric acid. They have a pH below 7.

Alkalis are compounds that release OH^- when in aqueous form. They have a pH above 7.

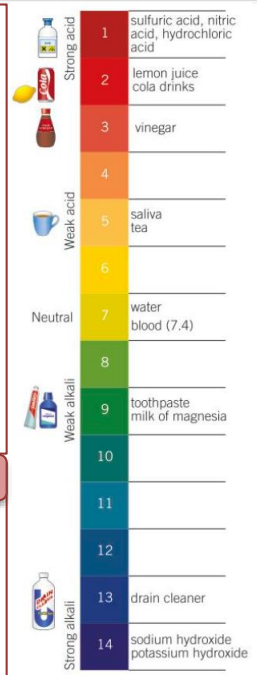
Neutral solutions have a pH of 7.

The pH scale is a measure of how acidic or alkaline a substance is. It is a scale from 1 to 14.

Indicators, such as **universal indicator or a pH probe** can be used to determine the pH of a solution.

When an acid and alkali react, **neutralisation can occur.**

Acid + alkali → metal salt + water



Reactions of acids

Reactions of acids with metals

Acids react with **metals** to form metal salts and **hydrogen gas**

Reaction of acids with metal oxides and hydroxides

Acids react with **metal hydroxides/oxides** to form metal salts and **water**

Reaction of acids with metal carbonates

Acids react with **metal carbonates** to form metal salts, **water** and **carbon dioxide**

Metal extraction

Metals that are **more reactive** than carbon are extracted using a process called **electrolysis.**

Metals that are **less reactive** than carbon are extracted by reduction with carbon

Metals that are **unreactive** are found as pure metals and are mined from the Earth's crust.

Salts

Hydrochloric acid forms a **chloride salt** e.g. Sodium chloride (NaCl)

Sulfuric acid forms a **sulfate salt** e.g. Sodium sulfate (Na_2SO_4)

Nitric acid forms a **nitrate salt** e.g sodium nitrate ($NaNO_3$)

Key terms

Acid alkali base crystallisation displacement metal neutralisation ore oxidation pH reactivity

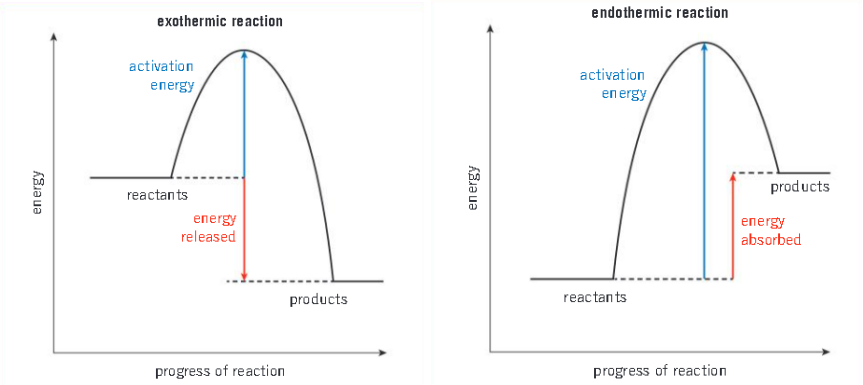
Chemical Changes

Knowledge Organiser - Science – year 11

Energy changes

During a chemical reaction, **energy** is transferred either:

- to the surroundings – **exothermic** – temperature of the surroundings **increases**
- from the surroundings – **endothermic-** temperature of the surroundings **decreases**



Bond energies

Chemical bonds occur between atoms. In order for a chemical reaction to occur, bonds are broken before new ones are made between different atoms.

- Breaking bonds- **endothermic- energy is taken in**
- Making bonds – **exothermic – energy is released**

Bond energy example calculation

Bond energy values can be used to predict whether a chemical reaction will be exothermic or endothermic.

Taking the following reaction as an example:

$H_2 + Cl_2 \rightarrow 2HCl$

Bond type	Bond energy (kJ/mol)
H-H	436
Cl-Cl	243
H-Cl	432

Overall energy transferred = energy required to break bonds - energy released when making bonds

The energy required to break bonds in H2 and Cl2 is 436 + 243 = 679 kJ/mol

The energy released on making bonds in HCl is (2x432) = 864 kJ/mol

Overall energy transferred = 679-864 = -185 kJ/mol → exothermic

Summary

Reaction	Energy transfer	Temperature changes	Examples	Everyday uses	Bonds
Exothermic	To the surroundings	Increase of surroundings temperature	Combustion Neutralisation	Hand warmers	More energy released, than needed for bonds to break
Endothermic	From the surroundings	Decrease of surroundings temperature	Thermal decomposition Melting and boiling	Sports injury packs Freezing and condensing	**Less** energy released, than needed for bonds to break

Key terms

activation energy **bond energy** **endothermic** **exothermic** **reaction profile** **bond making** **bond breaking**

Chemistry

- Paper 2

Rates and equilibrium
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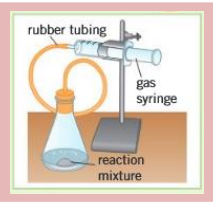
Rates of reaction

The rate of reaction is how quickly the reactants become the products, The rate of reaction can be determined by:

$$Mean\ rate\ of\ reaction = \frac{quantity\ of\ reactant\ ised}{time\ taken} \text{ OR } \frac{quantity\ of\ product\ formed}{time\ taken}$$

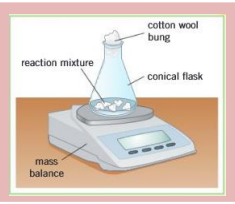
Practically this can be determined from measuring how the mass of the reaction changes, the volume of gas given off from the reaction or the changes in the colour or turbidity of a solution when a solid precipitate is produced

Change in mass



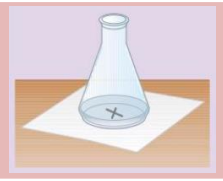
The reactants are placed in a conical flask, which is connected to a gas syringe of upside down measuring cylinder. As the reaction proceeds, the gas is collected.

Volume of gas produced



The reactants are placed in a conical flask on a balance. As the reaction proceeds the gaseous product is given off and the mass of the flask decreases.

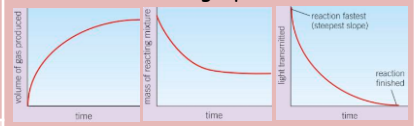
Change in colour or turbidity



The reactants are placed in a conical flask, which is placed on top of a cross. As the reaction proceeds the solid precipitate is produced eliminating view of the cross.

Calculating rate from a graph

The results from each can be plotted on a graph.



A steep gradient indicates a fast rate of reaction, whereas a shallow gradient indicates a slow rate of reaction. A plateau indicates the reaction has reached completion.

Collision theory

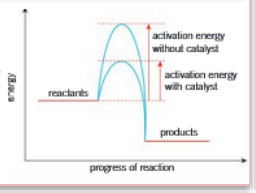
For a reaction to occur, the reactant particles need to collide with sufficient energy to react. This amount of energy is called the **activation energy**. The rate of a reaction can be increased by: increasing the **frequency of collisions** and increasing the **energy of particles** when they collide.

Factors affecting the rate of reaction

Factor	Impact on rate of reaction
Increasing the temperature …	Particles gain more kinetic energy, move faster and therefore collide more frequently, with more energy so more collisions result in a reaction.
Increasing the concentration of solution reactants …	There are more reactant particles therefore more frequent collisions occur.
Increasing the pressure of gaseous reactants …	There is less space between the particles, so more frequent collisions occur.
Increasing the surface area of solid reactants …	Only reactant particles at the surface of a solid are able to interact and collide with another reactant, so a larger surface area leads to more frequent collisions occurring.

Catalysts

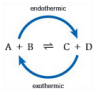
Catalysts speed up the reaction without being used up in the reaction. They provide an alternative pathway that has a lower activation energy.



Reversible reactions

For some reactions, he products can react to produce the original reactants. This is a reversible reaction. We use this symbol: ⇌

If carried out in a closed system, equilibrium can be reached where the forward and reverse reactions occur at the same rate.



Le Chatelier's principle (HT only)

To move from equilibrium, and to change the amount of reactant and product, the conditions of the reaction must be changed. Le Chatelier's principle states, that within a closed system, the system will work to oppose or counteract the change by favouring either the forward or the reverse reaction. Conditions that can be changed are: concentration of the reactants or products, temperature of the system or the pressure of the system.

Concentration – When the concentration of a substrate is altered, the system will oppose the change. For example, if the reactant concentration is increased, the forward reaction is favoured, less reactant is available and more product is made.

Temperature – When the temperature of the system is altered, the system will oppose the change. For example, if the temperature of the system is increased, the endothermic reaction is favoured, resulting in the surrounding temperature to decrease.

Pressure – When the pressure of the system is altered, the system will oppose the change. For example, if the pressure of the system is increased, the reaction will favour the direction with fewer molecules, resulting in a decrease in pressure.

Key terms

Activation energy, catalyst, collision theory, frequency, rate of reaction, temperature, equilibrium, concentration, pressure, surface area, closed system, energy, reversible

Organic Chemistry 01 Knowledge Organiser

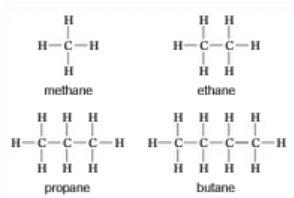
Crude oil

Crude oil formed from the remains of plants and animals millions of years ago. Crude oil is a mixture of **hydrocarbons** (molecules made of only carbon and hydrogen) of different sizes. As a raw product, crude oil is not particularly useful.
The properties of **hydrocarbons** depend heavily on the length of the molecule.

Chain length	Flammability	Boiling point	Viscosity
Long chains	Low	High	High
Short chains	High	Low	low

Alkanes

Alkanes are a family of hydrocarbons that have only single bonds. They are described as saturated. The general formula is C_nH_{2n+2}. The first four alkanes are:



Alkenes

Alkenes are also a family of hydrocarbons that have a double bond functional group between 2 carbon atoms. The general formula is C_nH_{2n}. Alkenes are used as fuels and to produce polymers.
Alkenes are more reactive than alkanes. They react with hydrogen, with the use of a nickel catalyst to form alkanes, with water(steam) under high temperatures and pressures to form alcohols and with halogens at room temperature to form halo-alkanes.

Combustion

Hydrocarbons are used as fuels. When they react with oxygen, during the process of **combustion** they release a lot of energy.
Complete: Hydrocarbon + oxygen → carbon dioxide + water
Incomplete: Hydrocarbon + oxygen → carbon + carbon monoxide + water

Cracking

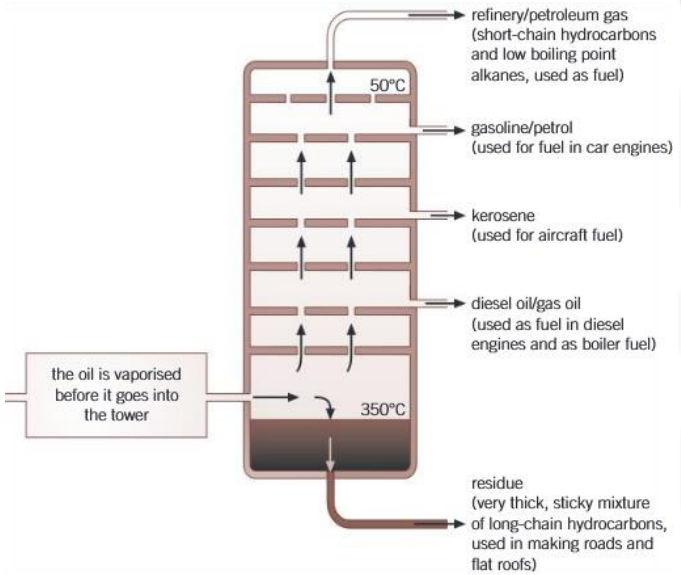
Not all h**ydrocarbons** are useful. Longer chain hydrocarbons tend to be less useful than those shorter chains. A process called cracking is used to break up the longer hydrocarbons, to produce shorter **alkanes** and **alkenes.**
The two cracking techniques are:

- **Catalytic cracking -** hydrocarbons are heated to become a gas before being passed over a hot ceramic catalyst
- **Steam cracking –** hydrocarbons are mixed with steam at very high temperatures to break the longer chains.

Fractional distillation

Crude oil can be separated into **fractions** based on the different boiling points of different length hydrocarbons through a process called **fractional distillation.**
Each f**raction** contains molecules of a similar number of carbon atoms.

To carry this process out a **fractionating column** is used, with a increasing temperature gradient moving up the column.



1. The crude oil is heated beyond 300°C and is vapourised.
2. The vapourised hydrocarbons enter the fractionating column, which is hot at he bottom and gets cooler towards the top
3. The hydrocarbon vapours rise through the column.
4. When the different hydrocarbons reach their boiling point in the column they condense
5. The hydrocarbon fraction is collected.

Products of fractional distillation

There are many useful products resulting from the separation of crude oil during fractional distillation

Fuels	Raw materials	Other useful products
Petrol, diesel, kerosene, heavy fuel oil and petroleum gases	Fractions can be used as the raw materials for other processes	Solvents, lubricants, polymers and surfactants (detergents)

Key terms

Alkanes alkenes boiling point combustion cracking crude oil raw products flammability fractional distillation fuel hydrocarbon viscosity volatility

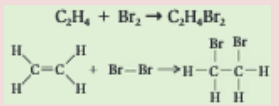
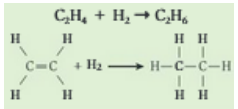
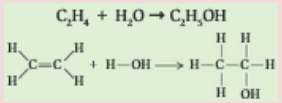
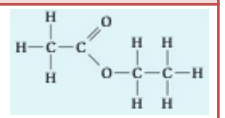
Organic reactions and Polymers 02 (SEPARATES ONLY)

Knowledge Organiser

Organic Reactions

There are numerous families of carbon based compounds. Each family is a homologous series, which has similar properties and reactions. Each homologous series is defined by the functional groups present.

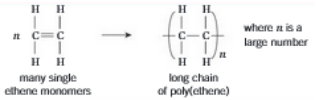
Alkenes, alcohols, carboxylic acids and esters

Homo-logous series	Function-al group	Formation	Uses	Combustion	Reactions
Alkenes	C=C	Catalytic cracking or steam cracking	Formation of polymers Raw materials	Complete → carbon dioxide and water. Incomplete → carbon, carbon monoxide and water	Halogens: At room temperature, two halogen atoms are added across the double bond to form a haloalkane. 
					Hydrogen: With a nickel catalyst, two hydrogen atoms are added across the double bond to form an alkane. 
					Water: Under high temperature and pressure, steam is added across the double bond to form an alcohol. 
Alcohols	-OH	Reaction of alkene and steam. Ethanol can be formed by fermentation	Ethanol - alcoholic drinks, biofuels Others - raw products and solvents	Complete → carbon dioxide and water	Sodium: Alcohols react with sodium to release hydrogen, similar to when alkali metals are added to water. The product is an alkoxide, which if added to water forms a strongly alkaline solution.
					Oxidation: Primary alcohols react with oxidising agents such as potassium dichromate (IV) to form carboxylic acids.
Carboxylic acids	-COOH	Oxidation of alcohols with potassium dichromate (IV) in the presence of dilute H_2SO_4	Food additives - vinegar, citric acid and malic acid	Not typically used as a fuel.	Bases/alkalis: Carboxylic acids react similarly to other acids
					Sodium carbonate: Formation of salts. For example carboxylic acids + metal carbonate → salt +carbon dioxide + water
					Alcohols: Carboxylic acids react with alcohols to make water and **esters**. For example, ethanol + ethanoic acid → ethyl ethanoate + water 

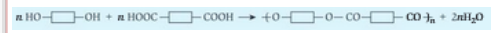
Polymers

Polymers are long molecules made up of small repeating **monomers**. They are formed during **polymerisation**.

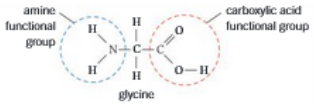
Addition polymerisation reacts small alkene monomers together to form large molecules.



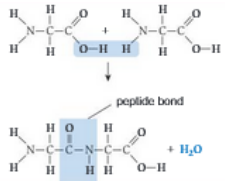
Condensation polymerisation involves monomers with **two** functional groups, such as diols or dicarboxylic acids. When these react they lose a small molecules such as water, and as such are called condensation reactions



Amino acids have **two** different functional groups – **amine** and **carboxylic acid** groups.



They react by condensation reactions to produce polypeptides. When lots of polypeptides come together they form proteins.



DNA (Deoxyribonucleic acid) is a large molecule which encodes genetic instructions for the development of living organisms. DNA is made of two long polymers that wind around each other in a double helix. The polymers are made of four different monomers called **nucleotides**. Other naturally occurring polymers important for life include **starch** and **cellulose**, which are made from **glucose** molecules joined together.

Key terms

Addition alcohol alkene alkoxide amine amino acid carboxylic acid DNA ester fermentation functional group homologous series monomer oxidation oxidising agent polymer polymerisation

Chemical analysis
Knowledge Organiser

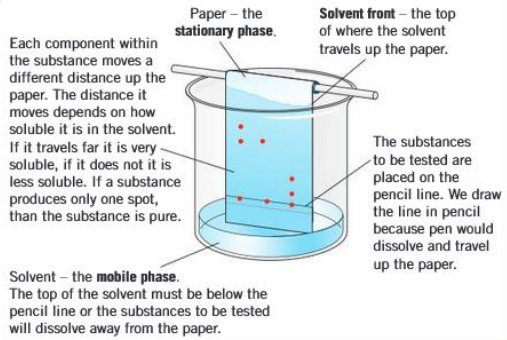
Pure and impure

Pure substances contain a single element, or compound that is not mixed with another substance. They have specific melting and boiling temperatures.
Impure substances contain more than one type of element or compound in a **mixture**. These have a range of melting and boiling temperatures.
Formulations are mixtures that have been designed as a useful product. They are made by mixing components in specific proportions. They include fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods.

Chromatography

Chromatography can be used to separate different components in a mixture. Chromatography involves a stationary and a mobile phase. Separation depends on the distribution of substances between the phases.
The **R_f value** is a ratio of the distance moved by a compound to the distance moved by the solvent.

$$R_f = \frac{distance\ moved\ by\ substance}{distance\ moved\ by\ solvent}$$



Different compounds have different R_f values in different solvents and at different temperatures. R_f values for particular substances can be used to identify a substance. R_f values are always between 0 and 1.

Testing gases

Common gases can be identified using the following tests:

Gas	Test	Observations
Hydrogen	Hold a lit splint near gas	Squeaky pop sound
Oxygen	Hold a glowing splint near gas	Splint re-lights
Carbon dioxide	Bubble gas through limewater	Limewater turns milky
Chlorine	Hold piece of damp litmus near gas	Bleaches litmus white

Testing for ions (Separates only)

Metal ions always have a positive charge. Sodium hydroxide solution can be used to identify some metal ions.

Cation	What you do
Aluminium Al^{3+}	On slow addition of NaOH solution, **white precipitate** forms, that dissolves in excess NaOH
Calcium Ca^{2+}	On addition of excess NaOH solution, **white precipitate** forms that does not dissolve
Magnesium Mg^{2+}	On addition of excess NaOH solution, **white precipitate** forms that does not dissolve
Copper(II) Cu^{2+}	Formation of a blue precipitate
Iron(II) Fe^{2+}	Formation of a green precipitate
Iron(II) Fe^{3+}	Formation of a brown precipitate

Anion	Test	Positive result
Carbonate CO_3^{2-}	Add dilute acid	CO_2 formed – milky limewater
Chloride Cl^-	Add silver nitrate solution in presence of nitric acid	White precipitate formed
Bromide Br^-	Add silver nitrate solution in presence of nitric acid	Cream precipitate formed
Iodide I^-	Add silver nitrate solution in presence of nitric acid	Yellow precipitate formed
Sulfate SO_4^{2-}	Add barium chloride solution in presence of hydrochloric acid	White precipitate formed

Flame tests

Flame tests can be used to identify some metal ions as they produce distinctive colours.

Metal	Flame colour
Lithium	Crimson
Sodium	Yellow
Potassium	Lilac
Calcium	Orange-red
Copper	Green

Instrumental methods

Elements and compounds can be detected and identified using instrumental methods. These are rapid, accurate and sensitive,

Flame emission spec

Flame emission spectroscopy is a instrumental method used to analyse metal ions in solutions. The sample is put into the flame, light is given out and passed through a spectroscope. The line spectrum produced can be analysed to identify metal ions and measure their concentrations.

Key terms

Chromatography flame emission spectroscopy flame test formulation impure instrumental analysis mobile phase precipitate pure Rf value solvent solvent front stationary phase

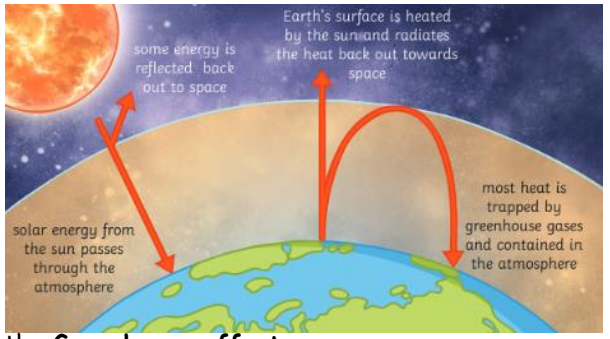
The Earth's Atmosphere
Knowledge Organiser

The Earth's changing atmosphere

Period	Proportions of gases	Evidence
~ 4.6 billion years to 2.7 billion years ago	CO_2 – Released by volcanoes. Biggest component of the atmosphere. O_2 – Very little oxygen present N_2 – Released by volcanoes H_2O – Released by volcanoes. Existed as vapour -Earth too hot. Ammonia and methane may also have been present.	Very limited evidence. Comparisons made to other planets with an atmosphere rich in CO_2
~ 2.7 billion years to 200 million years ago	CO_2 – Begins to reduce. • Water condenses to form oceans, which CO_2 dissolves in. • Algae start to photosynthesise using CO_2. • CO_2 precipitates in the oceans as carbonates to form rocks • CO_2 taken in by plants and animals. Trapped as fossil fuels for millions of years O_2 – Increases due to evolving plants releasing during photosynthesis N_2 – Continues to increase through volcanic release H_2O – Decreases as the Earth cools, condensing to form seas and oceans	Still limited. Look at processes such as photo-synthesis to make theories.
~ 200 million years ago until the present day	CO_2 – about 0.04%. O_2 – about 21% N_2 – about 78% H_2O – Very little overall. Collects in clouds. A small proportion of other gases	Ice core evidence. Global measure-ments.

Greenhouse effect

Greenhouse gases such as **carbon dioxide, methane** and **water vapour** absorb radiation from the sun and maintain the temperature on Earth. During the day, the Sun warms the earth's surface, whilst at night the earth cools and releases the heat back into the atmosphere. Some of the heat becomes trapped – this is the **Greenhouse effect**.



In the last 200 years, human activities have led to an increase in the release of greenhouse gases through burning of fossil duels, deforestation and cattle farming.

Global warming

A vast amount of peer-reviewed evidence demonstrates that an increase in the release of greenhouse gases causes an increase in the average global temperature.

Global climate change

Global warming leads to changes in the weather patterns across the globe. This is known as global climate change. Climate change has numerous effects on the planet: Rising sea levels, changes in the amount of rainfall, polar ice caps melting and extreme weather events.

Pollutants

Pollutant	Origin	Effect
CO	Incomplete combustion	Colour/odourless toxic gas
Particulates	Incomplete combustion	**Global dimming**
SO_2	Sulfur impurities	**Acid rain**/respiratory issues
Nitrogen oxides	Heating of nitrogen in air	**Acid rain**/respiratory issues

Key terms

Acid rain **atmosphere** **carbon footprint** **global climate change** **global dimming** **global warming** **particulate** **greenhouse gas** **pollutant**

Using Resources 01
Knowledge Organiser

Earth's Resources

We use Earth's resources to provide us with warmth, fuel, shelter, food, and transport. These can be **natural** (timber, fuel) or **synthetic** resources made by scientists. When choosing resources, it is important to consider **sustainable development**.
Resources can also be categorised as **finite** or **renewable**. Finite resources such as fossil fuels will run out. Wood is a renewable resource, as trees can be grown to replace any that are cut down.

Water

Type	What is in it? How is potable water made?
Pure	Just water molecules.
Potable	Water molecules, low level of salts, safe levels of harmful microbes
Salty	Water molecules, high levels of salts, high levels of harmful microbes. **Desalination** is the process to turn salt water into potable water, either through **distillation** or **reverse osmosis**.
Fresh	Water molecules, low level of salts, often high levels of harmful microbes. To produce potable water, fresh water is passed through filters to remove larger objects before being **sterilised** to kill microbes with ozone, chlorine or UV light.

Metal extraction (HT)

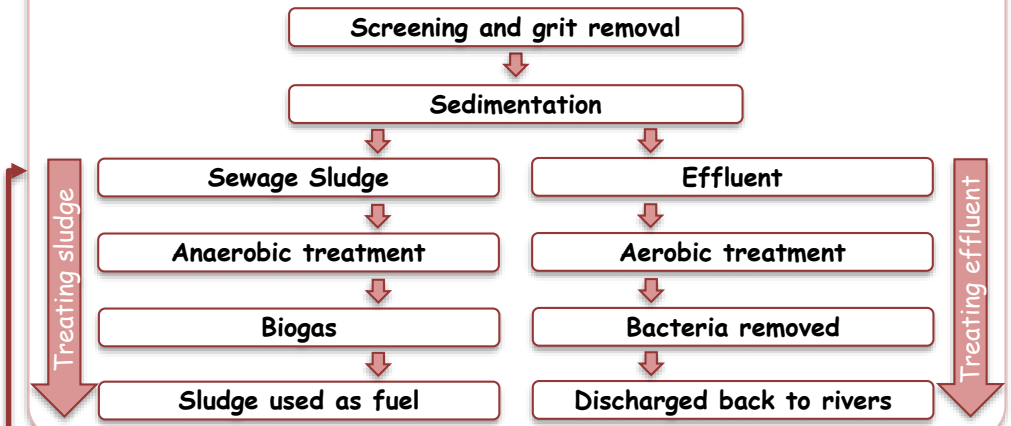
Metals can be extracted from their ores by reduction or electrolysis. **Phytomining** and **bioleaching** are two alternative methods to extract from low grade ores.

Phytomining: Grow plants near ore → burn plants → collect ash containing metal compound → process ash by electrolysis or displacement

Bioleaching: Grow plants near ore → bacteria produce leachate containing metal compound → process leachate by electrolysis or displacement

Waste water treatment

Human activities produce lots of waste water as **sewage,** agricultural and industrial waste

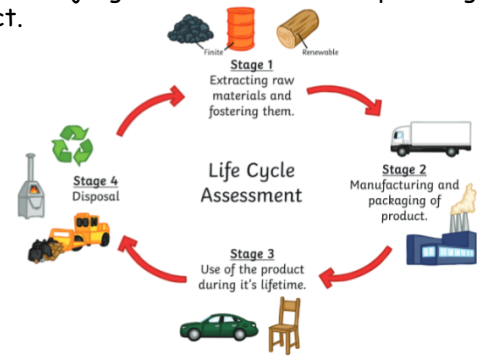


Recycling

Many materials are made from **natural resources** that have **limited supplies**. When finished with a product, it can be: added to landfill, incinerated, reused or recycled. Items can be **reused** (used again for a similar purpose) or **recycled** (conserves resources and requires less energy than creating new materials.

LCAs

A **Life cycle assessment (LCA)** is a way of looking at the whole life of a product and assessing its impact on the environment. It is broken down into four categories. Some parts are objective – the amount of water used or waste produced, whilst others are judgements – such as the polluting effect.



Key terms

Aerobic, Anaerobic, Distillation, Finite, Potable, Renewable, Reverse osmosis, Effluent, Screening, Sedimentation, Sewage, Sustainable development, LCA, Phytomining, Bioleaching

Using Resources 02 – Separates only
Knowledge Organiser

Corrosion

Corrosion occurs when materials react with other substances within the environment and wear away. **Rusting** is an example of corrosion, caused when iron reacts with oxygen and water. **Corrosion** can be **prevented** using either **physical barriers** such as paint or grease, or through electroplating. **Sacrificial protection** is where a more reactive substance is introduced. This will react with the environment rather than the main material.

Alloys

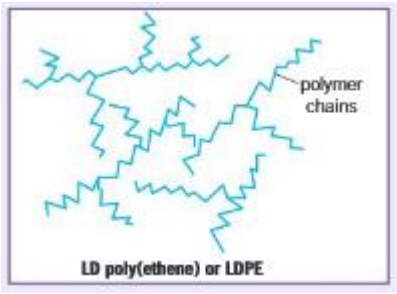
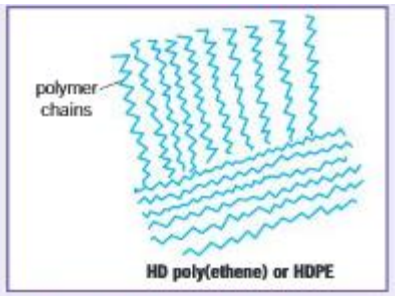
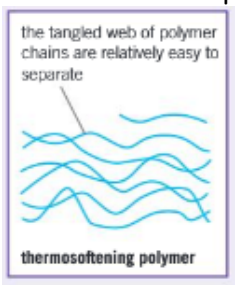
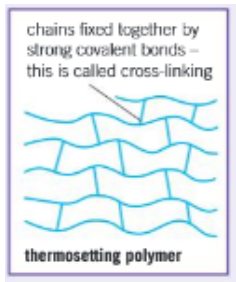
Alloy	Properties	Uses
Bronze – Cu/Sn	Resistant to corrosion	Statues, decorative items
Brass – Cu/Zn	Hard	Musical instruments, ornaments, home fittings
Stainless steel – Fe/Cr/Ni	Both resistant to corrosion and hard	Cutlery, pipes

Ceramics

Ceramic	Properties	Uses
Clay	Hard, brittle, resistant to corrosion, easy to shape	Pots, plumbing, crockery
Borosilicate glass	High melting point	Oven and lab glassware
Soda-lime glass	Transparent	Glass objects used everyday

Polymers

There are many types of polymers. The properties depend on their monomer composition and the processing conditions.

Low density poly(ethene)	High density poly(ethene)
These are formed from the addition polymerisation of ethene under high pressure. The polymer chains have many branches and prevent the polymers from packing, causing the low density.  LD poly(ethene) or LDPE	These are formed from the addition polymerisation of ethene utilising a catalsyt at 50°C. The straight polymer chains pack together, causing the high density.  HD poly(ethene) or HDPE
Thermosoftening polymers	**Thermosetting polymers**
The chains are not linked together, and soften when heat is applied.  thermosoftening polymer	The chains have strong links and do not soften/melt when heated.  thermosetting polymer

Key terms

Alloy ceramic composite corrosion galvanise matrix reinforce rusting thermosetting thermosoftening polymer

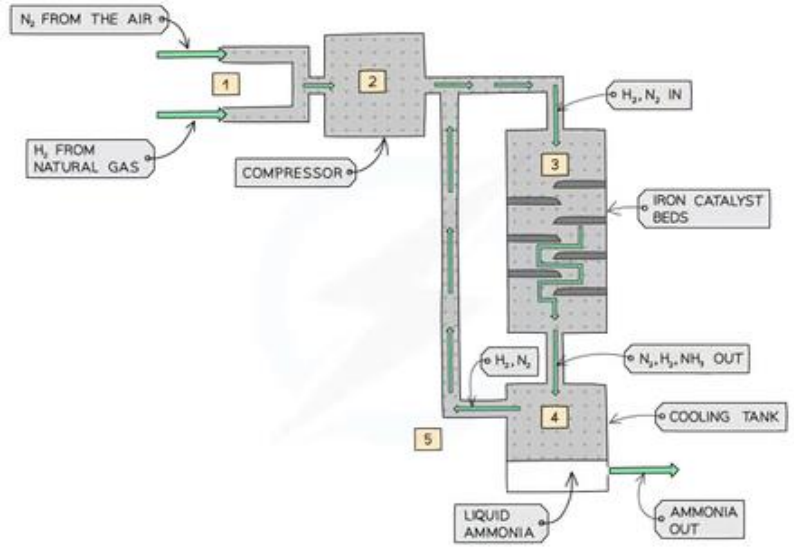
Using Resources 03 – Separates only
Knowledge Organiser

Haber process

The **Haber Process** is used to produce ammonia which is a key component form the production of fertilisers.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The reaction is reversible
Stage 1: H2 and N2 gases are pumped into the compressor through pipes.
Stage 2: The gases are compressed to ~ atm.
Stage 3: The gases are pumped into a tank containing catalytic iron beads at 450 ° C. Some of the hydrogen and nitrogen react to form ammonia in the reversible reaction stated above.
Stage 4: Any unreacted hydrogen and nitrogen, alongside any ammonia pass into a cooling tank. The ammonia is liquified and extracted.
Stage 5: The unreacted hydrogen and nitrogen are recycled and pumped back into the system.



Conditions

The conditions used for the Haber process are deemed a compromise, balancing cost, yield and rate of reaction.

Temperature	Pressure	Catalyst
Temperature of ~450°C The forward reaction is exothermic, hence a lower temperature would be favoured to increase the yield of ammonia, howeber the rate of reaction would be very slow.	Pressure of ~200 atm There are less product gas molecules than reactants, hence a higher pressure would be favoured to increase the yield and the rate of reaction, however it is expensive to stabilise high pressures.	An iron catalyst Catalysts have no impact on the yield of ammonia, however they will incrase the rate of the forward reaction. Iron is a n effective catalyst for the Haber process.

Fertilisers

Fertilisers are produced to increase the amount of food obtained from crop. NPK fertilisers are formulations consisting of nitrogen, phosphorus and potassium.

	Laboratory	Industrial
Equipment	Simple glassware needed	Large expensive and complex
Reactant concentration	Low concentration – less heat given off	High concentration – lots of heat given off. Highly exothermic.
Separation of product	Crystallisation – very slow process	Heat given off is used to evaporate water from the reactant mixture to produce concentrated ammonia nitrate.

Key terms

Haber process

NPK fertiliser

Physics

- Paper 1

Knowledge Organiser Energy – Science – Year 11

SCIENCE

Key vocabulary:

Kinetic energy- Energy of a moving object due to its motion. Joules, J

Mass- The quantity of matter in an object. Kilograms, kg

Elastic potential energy- Energy stored in an elastic object when work is done to change its shape. Joules, J

Spring constant- The stiffer the spring the greater the spring constant. Newton per metre N/m

Extension- The increase in length from the original length. Metres, m

Gravitational potential energy- The energy of an object due to it's position in a gravitational field. Joules, J

Gravitational field strength - The force of gravity on an object-given in your question. Newton per kilogram N/kg

Power- Energy transferred every second. Watts, W

Work done- Energy transferred by a force. Joules, J

Specific heat capacity- Energy needed to increase the temperature of a material by 1°C when the mass is 1kg. J/kg°C

Efficiency- Useful energy transferred by a device/ total energy. There is no unit- answer should be a number less than 1. If you have multiplied your answer by 100 you have changed it into a percentage.

System- an object or group of objects.

An open system- energy is transferred between stores or to the surroundings.

A closed system - no energy can escape to or enter from the surroundings. The total energy in a closed system never changes.

Energy stores

Kinetic	Energy an object has because it is moving
Gravitational potential	Energy an object has because of its height above the ground
Elastic potential	Energy an object has when it is stretched of compressed
Thermal (or internal)	Energy an object has because of its temperature (the total kinetic and potential energy of the particles in the object)
Chemical	Energy that can be transferred by chemical reactions involving foods, fuels and the chemicals in batteries
Nuclear	Energy stored in the nucleus of an atom
Magnetic	Energy a magnetic object has when it is near a magnet or in a magnetic field
Electrostatic	Energy a charged object has when it is near another charge object

Energy transfers

Energy can be transferred to and from different stores by:

Heating
Energy is transferred from one object to another object with a lower temperature.

Waves
Waves (e.g. light and sound waves) can transfer energy by radiation.

Electricity
When an electric current flows it can transfer energy.

Forces
Energy is transferred when a force moves or changes the shape of an object.

Kinetic energy:

The kinetic energy of a moving object can be calculated using the equation:

- kinetic energy = 0.5 × mass × speed ^{2}
- $E_k = 1/2\ m\ V^2$

kinetic energy, Ek , in joules, J
mass, m, in kilograms, kg
speed, v, in metres per second, m/s

Gravitational potential energy:

The amount of gravitational potential energy gained by an object raised above ground level can be calculated using the equation:

- g . p . e . = mass × gravitational field strength × height
- Ep = m g h

gravitational potential energy, Ep, in joules, J
mass, m, in kilograms, kg
gravitational field strength, g, in newtons per kilogram, N/kg
(In any calculation the value of the gravitational field strength (g) will be given.) height, h, in metres, m

Knowledge Organiser Energy – Science – Year 11

SCIENCE

Power:

Power is defined as the rate at which energy is transferred or the rate at which work is done.

- power = energy transferred /time
- P = E /t
- power = work done /time
- P = W /t

power, P, in watts, W
energy transferred, E, in joules, J
time, t, in seconds, s
work done, W, in joules, J
An energy transfer of 1 joule per second is equal to a power of 1 watt.

Specific heat capacity:

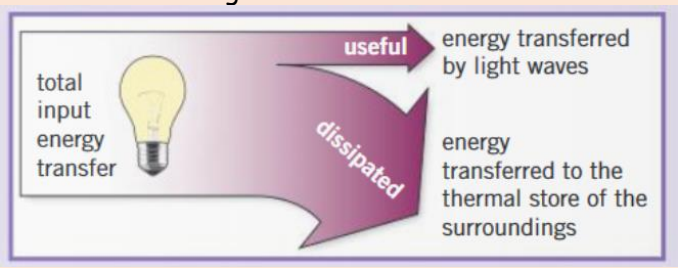
The amount of energy stored in or released from a system as its temperature changes can be calculated using the equation:

- change in thermal energy = mass × specific heat capacity × temperature change
- $\Delta E = m \times c \times \Delta\theta$

change in thermal energy, ΔE, in joules, J
mass, m, in kilograms, kg
specific heat capacity, c, in joules per kilogram per degree Celsius, J/kg °C
temperature change, $\Delta\theta$, in degrees Celsius, °C
The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius.

Useful and dissipated energy:

Energy cannot be created, or destroyed-it can only be transferred usefully, stored or dissipated.
Dissipated energy means it transfers to the surroundings; this is often described as being wasted.



All energy eventually ends up transferred to the thermal stores of the surroundings.
Lubrication is a way of reducing unwanted energy transfer due to friction.
Streamlining is a way of reducing energy wasted due to air resistance or drag.
Insulation is a way of reducing thermal energy to surroundings.

Elastic energy:

The amount of elastic potential energy stored in a stretched spring can be calculated using the equation:

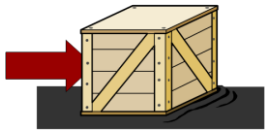
- elastic potential energy = 0.5 × spring constant × extension ^{2}
- $E_e = 1/2\ k\ e^2$

(assuming the limit of proportionality has not been exceeded)
elastic potential energy, Ee, in joules, J
spring constant, k, in newtons per metre, N/m
extension, e, in metres, m

Work done:

Work done= energy transferred

work done = force × distance moved in the direction of the force



Efficiency:

Efficiency is a measure of how much energy is transferred usefully. You must know the equation to calculate efficiency as a decimal:

$$\text{efficiency} = \frac{\text{useful output energy transfer (J)}}{\text{total input energy transfer (J)}}$$

or

$$\text{efficiency} = \frac{\text{useful power output (W)}}{\text{total power input (W)}}$$

To give efficiency as a percentage you multiply your decimal by 100 and add the % sign.
NEVER add the % or J to your decimal!

Knowledge Organiser Energy transfer – Science – Year 11

SCIENCE

Key vocabulary:

Conduction- The transmission of heat through a solid substance from a region of high temperature to lower temperature.

Infrared radiation- Electromagnetic waves in between visible light and microwaves in the electromagnetic spectrum.

Insulator- A substance that is a poor conductor of heat and electricity. This is due to a lack of mobile electrons.

Insulation- materials that are good insulators and are used to keep you warm (clothes) or thermal energy in your house.

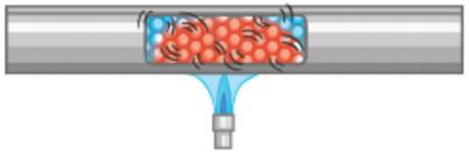
Specific heat capacity- the amount of energy required to increase the temperature of 1kg of a substance by 1°C.

Loft insulation- fibreglass in the loft to reduce energy transfer

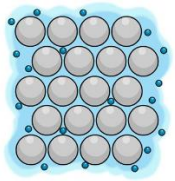
Black body- is a theoretical object that absorbs 100% of the radiation that falls on it.

Energy transfers:

1. Conduction- when a solid is heated, the particles vibrate and collide more. Energy is transferred.



Conduction
Good conductors are metals



Metals

- Free / delocalised electrons
- Increase kinetic energy
- Collisions
- Heat/ thermal energy transferred

2. Convection- in a fluid (liquid or gas) You do not need to know about this in detail!

3. Radiation- Infrared radiation is part of the electromagnetic spectrum. You will learn about this in year 10.

Infrared radiation:

Infrared radiation (IR) is a part of the electromagnetic spectrum (EM).

All objects emit (give out) and absorb (take in) IR.

The higher the temperature of the object the more IR it emits.

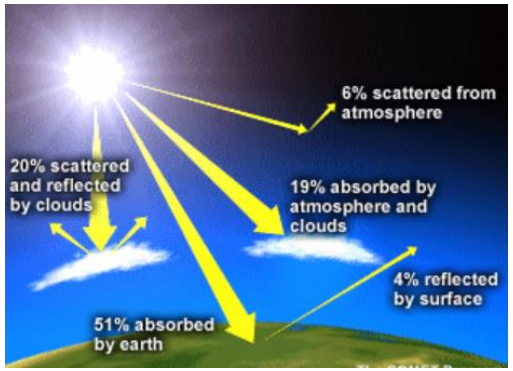
A good absorber of IR is also a good emitter.

For an object at a constant temperature:

- IR emitted = IR absorbed
- IR radiation s emitted across a continuous range of wavelengths

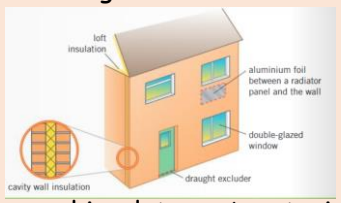
A perfect black body would not reflect or transmit any radiation and would also be a perfect emitter of radiation.

Radiation and the Earth's temperature:
The temperature of the surface of the Earth depends on a lot of factors, including the rate at which visible light and IR are reflected, absorbed and emitted by the Earth's atmosphere and surface.



Insulating buildings:

Heating bills are expensive and so it is important to reduce heat loss from buildings.



Some factors that affect the rate of heat loss from a building are:

1. Th thickness of its walls and roof
2. The thermal conductivity of its walls and roof
3. Lower thermal conductivity = lower rate of heat loss

The thermal conductivity of the walls and roof can be reduced by using thermal insulators. A material with a low thermal conductivity. The rate of energy transfer through an insulator is low. The energy transfer per second through a material depends on:

1. The materials thermal conductivity
2. The temperature difference between the two sides of the material
3. The thickness of the material

Knowledge Organiser Electricity – Science – Year 11

SCIENCE

Key vocabulary:

Potential difference – the work done in moving one coulomb of charge from one point in the circuit to another.

Current – a flow of electrons.

Charge – the rate of flow of electrons.

Resistance – the opposing of a current.

Power – how much energy is transferred (work done) in a certain amount of time.

Series – all components in a circuit follow on directly from each other.

Parallel – the current has alternate pathways to possibly take in a circuit.

Free (or delocalised) electrons – electrons that are free to move through the conductor (eg metal).

Key equations:
Q = It (charge = current x time)

V=IR (potential difference= current x resistance)

Total resistance = R1 + R2

P = VI (power=potential difference x current)

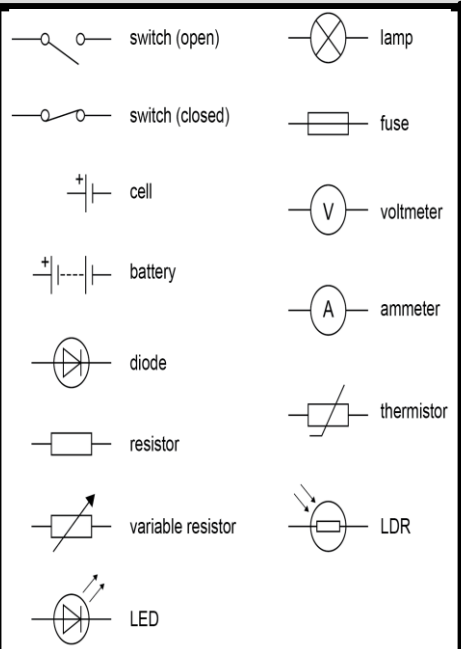
P= I x I x R (power=current squared x resistance)

E=Pt (energy transferred=power x time)

E=QV (energy transferred=charge flow x potential difference)

Key Units:
Current–Amps **(A)**
Potential difference–volts **(V)**
Charge-coulombs **(C)**
Resistance-ohms **(Ω)**
Power-watts **(W)**
Energy transferred-joules **(J)**

Energy transferred is the same as work done.



Series circuits – all components follow on directly from each other. The current only has one pathway to follow.
The current is the same all the way around a series circuit. The potential difference is shared between the components in the circuit.
Parallel circuit – the electricity has more than one pathway to take. The current will take the path of least resistance.
The current will be shared between the branches in the circuit. The potential difference will be the same across each component in the circuit.
Resistance – caused by the collision between free electrons and metal ions. The more collisions the greater the resistance.
Factors that can affect resistance are:

- Length – double length, double resistance: directly proportional
- Temperature – increase temperature, increase resistance
- Diameter – bigger diameter, less resistance
- Material – number of free electrons

Fixed resistor at constant temperature – Ohm's Law. R=V/I. Directly proportional.

Diode – no current until certain potential difference. Current rapidly increases. Very high resistance in negative bias. Only allows current in one direction.

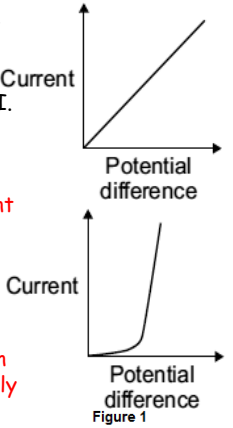
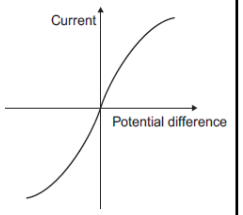


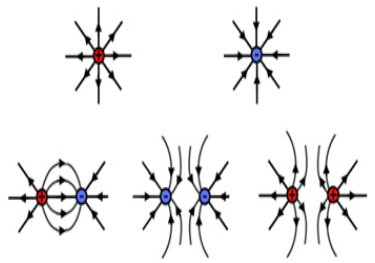
Figure 1

Filament bulb – bulb gets hotter, so line curves as resistance increases.



Electric fields

Electric fields will always run from positive to negative – shown by arrows. The greater the number of arrows, the stronger the electric field.
Like charges – the field lines show a gap in the electric field.
Unlike charges – filed lines move from + to -.



Static

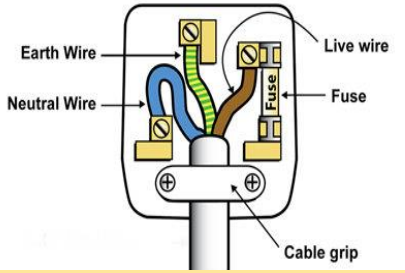
Static is caused because of friction between two insulators resulting in the transfer of electrons.

Object gains electrons – object is negatively charged.
Object loses electrons – object is positively charged.

If there is a build-up of charge and the potential difference between two objects is great enough, a spark will 'jump' – this is a discharge of electricity.

The objects do not have to be touching – no contact needed for attraction / repulsion.

The National Grid: a system of transformers (step up and step down) and cables.
Cables can be overhead or underground.
Electricity transmitted at high voltage, low current in order to reduce heat loss from the cables. Less energy is wasted therefore it makes the National Grid more efficient.



Plug case – plastic / rubber electrical insulators
Pins – brass hard wearing conductor of electricity
Wires – copper flexible conductor of electricity. Coated in coloured plastic(insulator of electricity) and identification.
Earth wire (green Yellow) – safety (pd=0v)
Live (brown) - carries current (pd=230V)
Neutral (blue) – completes circuit (p.d. = 0V)

Paper 1 Knowledge Organiser energy resources – Science – Year 11

SCIENCE

Key vocabulary:

Renewable energy- energy from natural sources that is always being replenished so it never runs out.

Nuclear fuel- substance used in nuclear reactors that releases energy due to nuclear fission.

Solar heating panel designed to use sunlight to heat water running through it.

Biofuel- is any fuel taken from a living or recently living organism. Animal waste is an example.

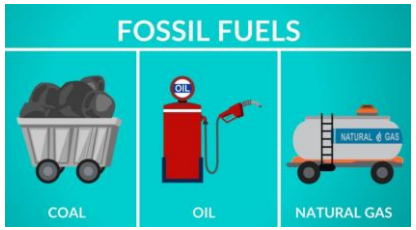
Carbon neutral- A biofuel from a living organism that takes in as much carbon dioxide from the atmosphere as it released when the fuel is burnt.

Energy resources:

The main ways we use the Earth's energy resources are:

- Generating electricity
- Heating
- Transport

Most of our energy comes from fossil fuels- coal, oil and natural gas.



Some energy resources are more reliable than others. Reliable energy resources are ones that are available all the time (or they are predictable).

Both renewable and non- renewable energy resources have some kind of environmental impact when we use them.

Non- renewable	Renewable
Are not replaced as quickly as they are used	Can be replaced at the same rate as they are used
Will eventually run out	Will not run out
Examples are fossil fuels and nuclear fission	Examples are solar, wave, wind, geothermal, biofuel and hydroelectric.

Non-renewable energy resources

Resource	Main uses	Source	Advantages	Disadvantages
coal	generating electricity	extracted from underground	enough available to meet current energy demands reliable – supply can be controlled to meet demand relatively cheap to extract and use	will eventually run out release carbon dioxide when burned – one of the main causes of climate change release other polluting gases, such as sulfur dioxide (from coal and oil) which causes acid rain oil spills in the oceans kill marine life
oil	generating electricity transport heating			
natural gas	generating electricity heating			
nuclear fission	generating electricity	mining naturally occurring elements, such as uranium and plutonium	no polluting gases or greenhouse gases produced enough available to meet current energy demands large amount of energy transferred from a very small mass of fuel reliable – supply can be controlled to meet demand	produces nuclear waste, which is: • dangerous • difficult and expensive to dispose of • stored for centuries before it is safe to dispose of nuclear power plants are expensive to: • build and run • decommission (shut down)

Knowledge Organiser energy resources – Science – Year 11

SCIENCE

Renewable energy resources

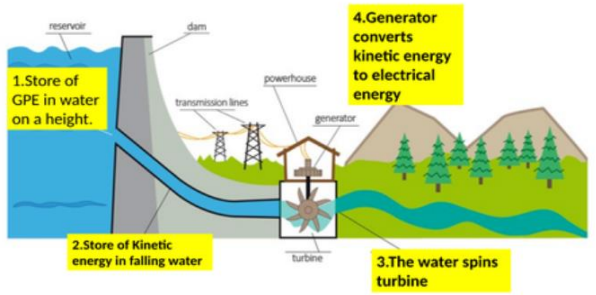
Resource	Main uses	Source	Advantages	Disadvantages
solar energy	generating electricity	sunlight transfers energy to solar cells	can be used in remote places very cheap to run once installed no pollution/greenhouse gases produced	supply depends on weather expensive to buy and install cannot supply large scale demand
	heating	sunlight transfers energy to solar heating panels		
hydroelectric energy	generating electricity	water flowing downhill turns generators	low running cost no fuel costs reliable and supply can be controlled to meet demand	expensive to build hydroelectric dams need to flood a large area behind the dam, destroying habitats and resulting in greenhouse gas production from rotting vegetation
tidal energy	generating electricity	turbines on tidal barrages turned by water as the tide comes in and out	predictable supply as there are always tides can produce large amounts of electricity no fuel costs no pollution/greenhouse gases produced	tidal barrages: • change aquatic habitats and can harm animals • restrict access and can be dangerous for boats • are expensive to build and maintain cannot control supply supply varies depending on time of month
wave energy	generating electricity	floating generators powered by waves moving up and down	low running cost no fuel costs no pollution/greenhouse gases produced	floating generators: • change aquatic habitats and can harm animals • restrict access and can be dangerous for boats • are expensive to build, install, and maintain dependent on weather cannot supply large scale demand
wind energy	generating electricity	turbines turned by the wind	low running cost no fuel costs no pollution/greenhouse gases produced	supply depends on weather large amounts of land needed to generate enough electricity for large scale demand can produce noise pollution for nearby residents
geothermal energy	generating electricity heating	radioactive substances deep within the Earth transfer heat energy to the surface	low running cost no fuel costs no pollution/greenhouse gases produced	expensive to set up only possible in a few suitable locations around the world
biofuels	generating electricity transport	fuel produced from living or recently living organisms, for example, plants and animal waste	can be **carbon neutral** – the amount of carbon dioxide released when the fuel is burnt is equal to the amount of carbon dioxide absorbed when the fuel is grown reliable and supply can be controlled to meet demand	expensive to produce biofuels growing biofuels requires a lot of land and water that could be used for food production can lead to deforestation – forests are cleared for growing biofuel crops

<u>Hydroelectric power station:</u>

Water is stored high off the surface of the earth. This has a large amount of gravitational potential energy.

The water falls which turns turbine. The turbine is attached to a generator which generates electricity. The water is then pumped back up.

Gravitational potential energy →kinetic energy→ electrical energy



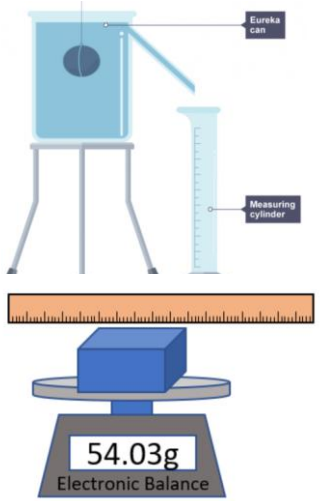
Knowledge Organiser Particle Model of Matter – Science – Year 11

SCIENCE

	Solid	Liquid	Gas
Arrangement of particles	Close together Regular pattern	Close together Random arrangement	Far apart Random arrangement
Movement of particles	Vibrate on the spot	Move around each other	Move quickly in all directions
Diagram			

States of matter – what form a substance can exist as.
Solid – regular arrangement of **vibrating** particles with strong forces of attraction. Fixed shape and volume.
Liquid – random arrangement of slowly moving particles which have weak forces of attraction. Takes the shape of the container. Fixed volume.
Gas – random arrangement of quickly moving particles which have negligible (no) forces of attraction. Volume can be changed (gases can be compressed). No fixed shape – fills container.
Melting – changing state from solid to liquid.
Evaporating / boiling / vaporisation – liquid to gas.
Condensation – gas to liquid.
Freezing / solidifying – liquid to solid.
Sublimation – solid to gas.
Meting point – the **temperature** at which a solid becomes a liquid.
Boiling point – the **temperature** at which a liquid becomes a gas.
Freezing point – the **temperature** at which a liquid becomes a solid.
Density – the amount of mass in a given volume. Density = mass ÷ volume.
Latent heat – the energy transferred to or from a substance when it changes state.
Specific latent heat – the energy required to change the state of 1kg of a substance without an increase in temperature.
Specific Heat Capacity – the energy required to change the temperature of 1kg of a substance by 1°C.

Density required practical
Density is the mass per unit volume of any object. It is calculated by dividing the mass of an object by its volume.

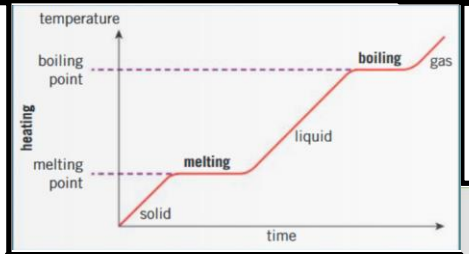


Density = mass / volume
(kg/m³) (kg) (m³)

Regular object (e.g. cube) – use a ruler to measure length, width, height. Multiply these 3 values together for volume. Use electronic scales to find mass. Use equation to calculate density.

Irregular object. – use electronic scales to find mass. Submerge object under water in a displacement can. The volume of the water displaced is the volume of the object (EUREKA!). Use equation to calculate density.

Liquid – Measure the volume of the liquid in a measuring cylinder. Use electronic scales to find the mass of the empty cylinder and then the cylinder and the liquid. Subtract to find the mass of the liquid. Use the density equation to calculate the density.



Changing state:
In the graph showing the change in temperature of a substance being heated or cooled, the flat horizontal section shows when the substance is changing state.
The energy transfers taking place during a change in state do not cause a change in temperature but do change the internal energy of the substance.

Specific Heat Capacity– the energy required to change the temperature of 1kg of a substance by 1°C.

Energy = mass X SHC X temperature change

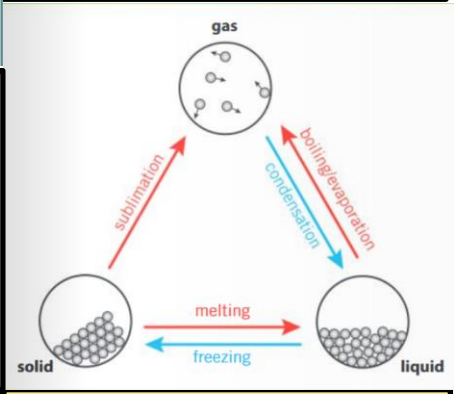
Energy	(J)
Mass	(kg)
SHC	(J/kg°C)
Temperature	(°C)

Specific latent heat – the energy required to change the state of 1kg of a substance without an increase in temperature.
Specific latent heat of fusion – solid to liquid
Specific latent heat of vaporisation – liquid to gas

Energy for change of state = mass x SLH

Energy	(J)
Mass	(kg)
SLH	(J/kg)

Changing state:
Red arrows – more energy (hotter).
Forces of attraction getting weaker.
Blue arrows – less energy (colder).
Forces of attraction getting stronger.



Gas Pressure – produces a force at right angles to the wall of the container.
For a fixed mass of gas at a constant temperature:

pressure X volume = constant

Pressure (Pa; pascals)
Volume (m^3)

Work is the transfer of energy by a force.
Internal energy is the total kinetic and potential energy of all the particles in a system.

Doing work on a gas increases the internal energy of a gas, so temperature increases.

Particle motion in a gas is random (i.e. particles move in different directions at a range of speeds)

The temperature of a gas is related to the average kinetic energy of the molecules.

Knowledge Organiser
Radioactivity – Science Y11

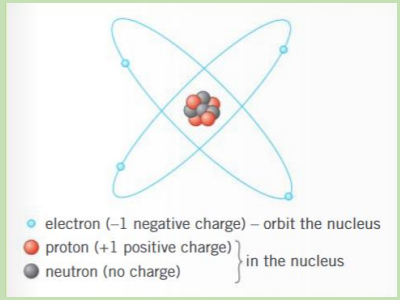
SCIENCE

Keywords

Alpha particle– composed of two protons and two neutrons.
Atomic number- the number of protons (which equals the number of electrons) in an atom. It is sometimes called the proton number.
Electron- tiny negative charged particles that move around the nucleus of an atom.
Energy level- specific energy values of electrons in an atom.
Ionisation- a process in which atoms become charged.
Irradiated- an object that has been exposed to ionising radiation.
Isotope- atoms with the same number of protons and different numbers of neutrons.
Mass number- the number of proton and neutrons in a nucleus.
Neutron- uncharged particles of the same mass as protons. The nucleus of an atom consists of protons and neutrons.
Nuclear model- Rutherford's model of the atom where the mass is in the centrally located positively charged nucleus.
Orbit- moving around in a circular path.
Plum pudding model- J. J. Thomson's model of the atom that had a positively charged cloud with negatively charged electrons spread throughout. The model was called the plum pudding model because the positive medium was like a pudding and the electrons were like the plums or fruit.
Proton- positively charged particles with an equal and opposite charge to that of an electron.

Modern model of an atom

The model of the atom we have today was developed over time with the help of evidence from experiments.



Future experiments may change our understanding and lead us to change this model.

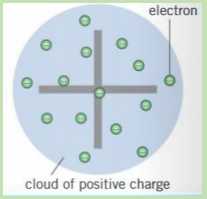
Dalton's model

John Dalton thought the atom as a solid sphere that could not be divided into smaller parts. His model did not include protons, neutrons and electrons.

Plum pudding model

Scientists' experiments resulted in the discovery of charged sub-atomic particle. The first to be discovered were electrons.

The discovery of electrons led to the plum pudding model. A cloud of positive charge with negative electrons embedded in it.

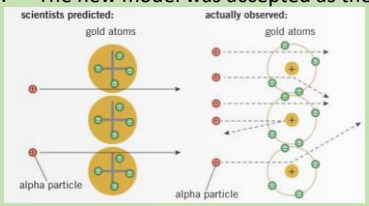


In the plum pudding model the electrons are the plums, and the positive charge is the rest of the cake.

The scattering experiment

Ernest Rutherford designed an experiment to test the plum pudding model.

1. Scientists fired small positively charged particles (alpha particles) at a piece of gold foil only a few atoms thick.
2. They expected the alpha particles to pass straight through the foil.
3. Instead a small number of alpha particles bounced ack and some were deflected.
4. This was evidence suggested that the positive charge and the mass of the atom must be concentrated in a very small space at the centre called the nucleus.
5. The new model was accepted as the old model was not supported by the evidence.

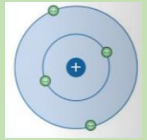


Nuclear model

Scientists replaced the plum pudding model with the nuclear model. They suggested that electrons orbit the nucleus, but not at set distances, and that the mass of the atom was concentrated in the charged nucleus.

Bohr's model

Niels Bohr improved the nuclear model and calculated that electrons must orbit the nucleus at fixed distances. The orbits are called shells o energy levels. These calculations agreed with experimental results.



Protons

Later experiments provided evidence that the positive charge of a nucleus could be split into smaller particles with the opposite charge to electrons. The positive charged particles are called **protons**.

Neutrons

James Chadwick carried out experiments that provided evidence for particles without a charge. This is the neutron and found in the nucleus.

Nucleus

- Has a radius about 10,000 times smaller that the radius of the atom.
- Contains protons and neutrons.
- Is where most of the mass of an atom is concentrated.

Electrons

- Orbit the nucleus at different fixed distances called energy levels.
- Can gain energy by absorbing electromagnetic radiation. This causes them to move into a higher energy level.
- Can lose energy by emitting electromagnetic radiation. This causes them to move to a lower energy level.

Element symbols

Mass number- number of protons and neutrons added together.
Atomic umber – number of protons.

Knowledge Organiser Radioactivity – Science – Year 11

SCIENCE

Ionisation

Atoms can become charged when they lose or gain electrons. This process is called ionisation.

- A positive ion is formed if an uncharged atom loses one or more electrons.
- A negative ion is formed if an atom gains one or more electrons.

Radioactive decay

Atoms with an unstable nucleus emit radiation. When nuclear radiation is given out the atomic nuclei become more stable. It is a random process. The radiation can knock electrons out of atoms in a process called ionisation.

Activity and count rate

The activity of a radioactive source is the rate of decay of an unstable nucleus, measured in becquerel (Bq).

1Bq= 1 decay per second

Detectors, e.g a Geiger- Muller tube, record a count rate (number of decays detected per second).

Half-life

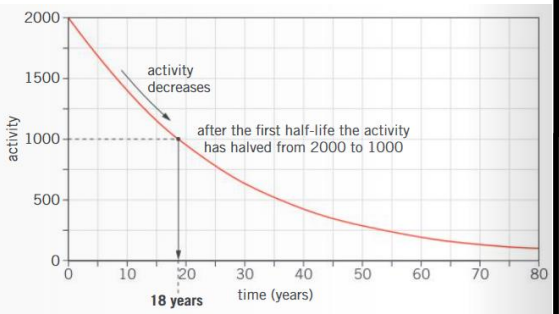
The half-life of a radioactive source is the time

- For half the number of unstable nuclei in a sample to decay

OR

- For the count rate or activity of a source to halve.

The half- life of a source can be found from a graph of its count rate or activity against time.



The time taken for the activity to halve is 18 years. This is the half-life of this substance.

Type of radiation	Change in the nucleus	Ionising power	Range in air	Stopped by
α **alpha** particle (two protons and two neutrons)	nucleus loses two protons and two neutrons	highest ionising power	travels a few centimetres in air	stopped by a sheet of paper
β **beta** particle (fast-moving electron)	a neutron changes into a proton and an electron	high ionising power	travels ≈ 1 m in air	stopped by a few millimetres of aluminium
γ **gamma** radiation (short-wavelength, high-frequency electromagnetic radiation)	some energy is transferred away from the nucleus	low ionising power	virtually unlimited range in air	stopped by several centimetres of thick lead or metres of concrete

Half-life

To find the reduction in activity after a given number of half –lives:

1. Calculate the activity after each half life.
2. Subtract the final activity from the original activity.

Net decline as a ratio = reduction in activity/ original activity

Ionising radiation

Living cells can be damaged or killed by ionising radiation.

The risk depends on the half life of the source.

Inside the body alpha radiation is very dangerous, it is the most ionising. Outside the body it affects only the skin and eyes as it is the least penetrating.

Background radiation- natural examples are rocks and cosmic rays. Man made examples are nuclear weapons and accidents.

Irradiation versus contamination

Irradiation- when an object is exposed to ionising radiation. Protect by shielding or moving away from the source.

Contamination- When atoms of a radioactive material are on an object. Object remains exposed to radiation as long as it is contaminated.

Nuclear equations

Alpha emission. An alpha particle is made of two protons and two neutrons. So when an unstable atom emits an alpha particle the atomic number decreases by 2 and the mass number goes down by 4. $^{228}_{90}Th \longrightarrow {}^{224}_{88}Ra + {}^{4}_{2}\alpha$

Beta emission. A beta particle is a high energy electron from the nucleus. A neutron changes into a proton and electron, which is instantly emitted, this is the beta particle. The atomic number goes up by 1 and the mass number is unchanged. The charge of the nucleus is increased, and the mass of the nucleus is unchanged. $^{40}_{19}K \longrightarrow {}^{40}_{20}Ca + {}^{0}_{-1}\beta$

PHYSICS SEPARATES ONLY

Nuclear radiation in medicine

Gamma emitting tracers are injected or swallowed by a patient. Gamma cameras can then create an image showing where the tracer has gone. The tracer must have a short half- life for safety, to limit the patients' dose.

Control or destruction of unwanted tissue. Narrow beams of gamma radiation can be focused on tumours. Gamma is used as it can penetrate the body.

PHYSICS SEPARATES ONLY

Nuclear fission- when a large unstable nucleus absorbs an extra neutron and splits into smaller nuclei of roughly equal size.

During fission gamma radiation and energy is released.

Two or three fission neutrons are released and go on to cause a chain reaction.

The reaction is controlled by control rods which can absorb neutrons.

Spontaneous fission is rare and occurs when the nucleus splits without absorbing a neutron.

Two fissionable isotopes Uranium 235 (most common fuel in nuclear reactors) and plutonium 239.

Nuclear Fusion- when two light nuclei join together and make a heavier one. Energy is released. This takes place in stars/ the sun.

Physics

- Paper 2

Year 11 Knowledge Organiser - Forces in balance

SCIENCE

North East Learning Trust

Key vocabulary:

- Vector
- Scalar
- Magnitude
- Displacement
- Newton
- Driving force
- Braking force
- Friction
- Resultant force
- Balanced forces
- Unbalanced forces
- Weight
- Air resistance
- Stretching force (tension)
- Contact forces
- Non- contact forces
- Magnetic force
- Electrostatic force
- Gravity
- Free body force diagram
- Centre of mass
- Suspended equilibrium
- Symmetrical objects
- Parallelogram of forces

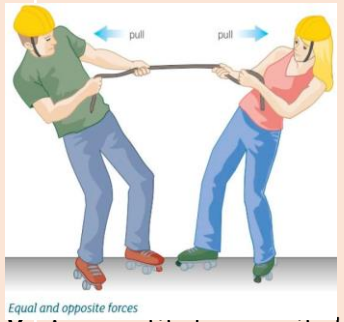
Physics only

- Moments
- Load
- Effort
- Force multiplier
- Pivot

Forces between objects

Newton's third law of motion:

When two objects interact with each other, they exert equal and opposite forces on each other.



Equal and opposite forces

Vector quantity has magnitude (size) and direction

Scalar quantity has magnitude only

Resultant forces

Resultant force is a single force that has the same effect as all the forces acting on the object.

Balanced forces, resultant force is zero:

- objects at rest remains stationary
- object moving keeps moving at a constant speed

Unbalanced forces

- Depends on the size and direction of the resultant force

Centre of mass

The centre of mass or the centre of gravity is if you think of the weight of an object as if it acts at a single point.

The centre of mass of an object is the point at which its mass can be thought of as being concentrated.

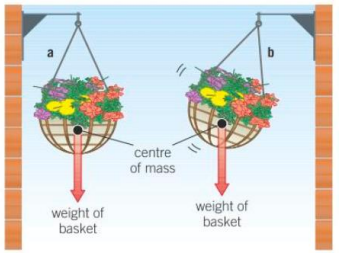


Figure 2 *Suspension* **a** *In equilibrium* **b** *Non-equilibrium*

Centre of mass

The centre of mass of a uniform ruler is at its midpoint.

When an object is freely suspended, it comes to rest with its centre of mass directly underneath the point of suspension.

For a flat object that is symmetrical, its centre of mass is along the axis of symmetry. If the objects has more than one axis of symmetry , its centre of mass is where the axes of symmetry meet.

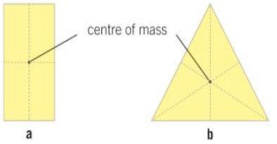


Figure 3 *Symmetrical objects*

Balanced forces

Same size and opposite direction

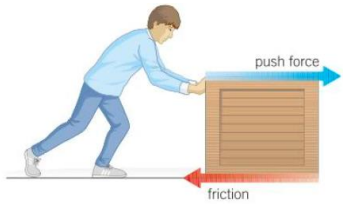


Figure 2 *Overcoming friction*

When the crate is pushed across the floor at a constant speed without changing direction, the push force on it is equal in size and opposite direction to the friction of the floor on the crate.

Unbalanced forces

The movement depends on the size and direction of the resultant force.

When a jet plane takes off the thrust from the engine is greater than the air resistance or drag on it. The plane is **accelerating**.

Figure 3 *A passenger jet on take-off*

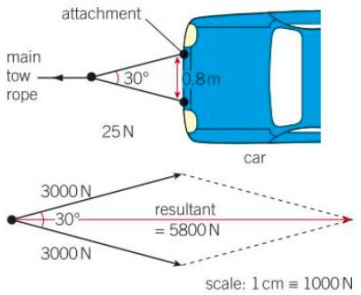
A free body diagram show the forces acting on it.

Parallelogram of forces

The parallelogram of forces is a scale diagram of two force vectors.

The parallelogram of forces is used to find the resultant of two forces that do not act along the same line.

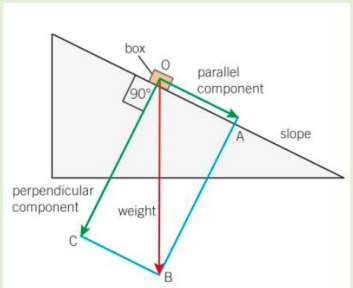
The resultant is the diagonal of the parallelogram that starts at the origin of the two forces.



Resolution of forces (HT)

Resolving forces means finding perpendicular components that have a resultant force that is equal to the force.

To resolve a force in two perpendicular directions, draw a rectangle with adjacent sides along the two directions so that the diagonal represents the force vector.



Year 10 Knowledge Organiser - Mot

SCIENCE

North East Learning Trust

Key vocabulary:

- Vector-a quantity with direction and magnitude
- Scalar- a quantity with magnitude only
- Magnitude- size or amount of a physical quantity
- Displacement- distance in a given direction
- Velocity- speed in a given direction
- Speed- how fast something is moving
- Acceleration- change of velocity per second
- Deceleration- negative acceleration, used for any situation where an object slows down
- Gradient- (of a straight live graph) Change of the quantity plotted on the y-axis divide by the change of the quantity plotted on the x axis
- Tangent- a straight line drawn to touch a point on a curve, so it has the same gradient as the curve at that point
- Independent variable- the one you chose to vary in an investigation
- Dependent variable- used to judge the effect of varying the independent variable
- Continuous data- any numerical value
- Categoric data- one that is best described by a word or a label

Equations to remember:

$$v = \frac{s}{t}$$

$$a = \frac{v - u}{t}$$

Equation you will be given and expected to use:

$$v^2 - u^2 = 2as$$

Speed, distance and time:

You can calculate the speed of an object by using the equation speed= distance/ time. If you have a distance time graph you can get the distance and the time for each section and therefore calculate the speed.

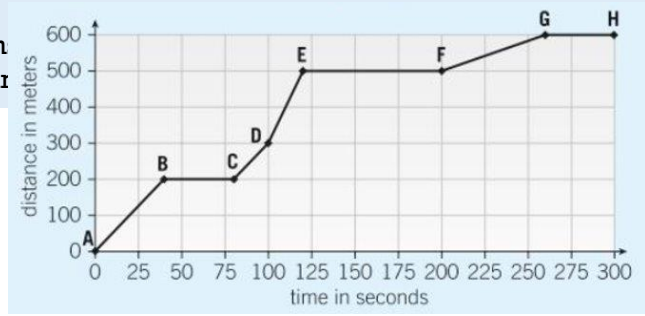
The gradient on a distance time graph represents the speed.

A-B shows constant speed as it is a straight line

B-C shows the object is stationary as the distance is not changing

C-D is also con

greater constar



Acceleration, change in velocity and time:

You can calculate the acceleration of an object if you know the change in velocity and the time it takes for the change in velocity. These can be taken from a velocity- time graph.

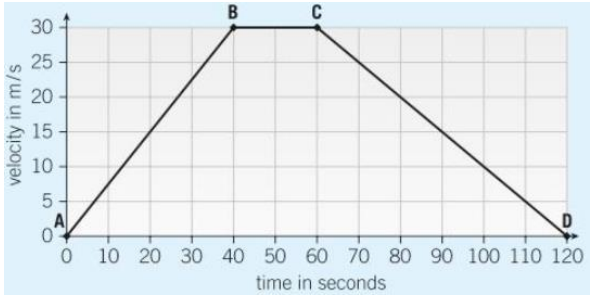
The gradient of the line on a velocity- time graph represents the acceleration.

A-B shows constant acceleration

B-C shows constant speed

C-D shows deceleration

A steeper gradient shows a greater constant acceleration



Higher tier

The area under the velocity-time graph represents the distance travelled in a direction (displacement). Work out the area of regular shaped

Key Information to remember:

Typical speeds of people:

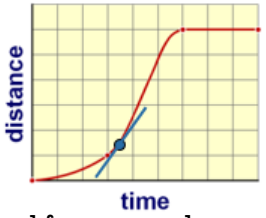
- **walking ~ 1.5 m/s**
- **running ~ 3 m/s**
- **cycling ~ 6 m/s**

Near the Earth's surface any object falling freely under gravity has an acceleration of about 9.8 m/s^2.

HT *An object moving in a circle has a direction of motion that changes continuously as it goes round. So its velocity is not constant even if its speed is constant, this is because the direction is continuously changing direction.*

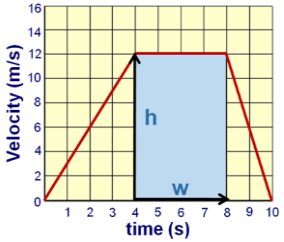
HT only

If the graph has curved sections, the motion is not uniform.



To find the speed for a curved part of the graph you need to draw a tangent. The would out the speed by doing ΔY/ΔX

Work out the distance travelled, the area under the V-T graph. Calculate the area of the rectangles and the right-angled triangles.



Knowledge Organiser Forces and motion

Keywords

Braking distance– the distance a car travels while under the braking force or while the brakes have been applied
Inertia- an objects tendency to reman in a steady state
Momentum- mass x velocity
Reaction time- the time for you to react to a stimuli. It varies from person to person but ranges from 0.2-0.9s
Stopping distance- braking distance + thinking distance
Thinking distance- the distance the car travels while the driver reacts
Inertia- the tendency for an object to continue in its state of motion
Inertial mass-Is a measure of the difficulty of changing the object's velocity
Recoil- rebound or movement backwards
Directly proportional (∝)- There is a direct proportion between two values

Remember from previous topics:

Velocity is *speed* in a given *direction.* It is a vector quantity.
A change in velocity means an object:

- *Starts to move*
- *Stopes moving*
- *Speed up*
- *Slows down*
- *Changes direction*

Balanced forces are the same size and opposite directions.

When the forces are balanced the resultant force is zero Newtons and an object at rest will remain at rest and if the object is moving it will continue to move at the same speed in the same direction.

Newton's Second law

Newton's Second Law states that:

- the acceleration of an object is proportional to the force on the object.

$$a \propto F$$

- Is inversely proportional to the mass of the object

$$a \propto \frac{1}{m}$$

- They are then linked in the equation:

F= m x a

Where
F= force in N
m= mass in kg
a= acceleration in m/s^2

Stopping distance

The distance it takes for a car to stop is the stopping distance.

Stopping distance = thinking distance + braking distance

Thinking distance-the *distance* the car travels while the driver reacts.

Braking distance-the *distance* the car travels while the driver brakes.

Factors that affect:

Braking distance	Thinking distance
Speed	Tiredness
Road conditions (ice, snow rain- must state this!)	Drugs and alcohol
Condition of brakes or tyres.	Distractions such as phones

Factors that reduce friction increase the braking distance. Less friction can increase skidding.
Drugs and alcohol slow the drivers reactions and so the car travels further while the driver reacts.

Newton's Second law Required practical

Force and acceleration experiment

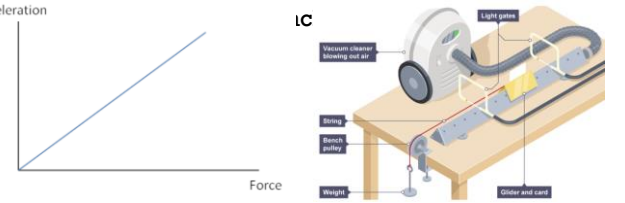
Investigate the effect of varying the force on the acceleration of an object of constant mass

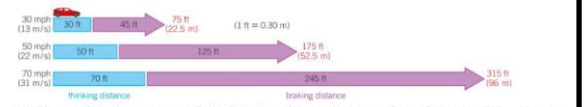
There are different ways to investigate the effect of varying the force on an object. In this required practical activity, it is important to:
•make and record measurements of length, mass and time accurately
•measure and observe the effect of force
•use appropriate apparatus and methods to measure motion
The diagram shows apparatus that can be used in this investigation. A constant stream of air reduces the friction between the glider and the air track.

Investigate the effect of varying the force on the acceleration of an object.

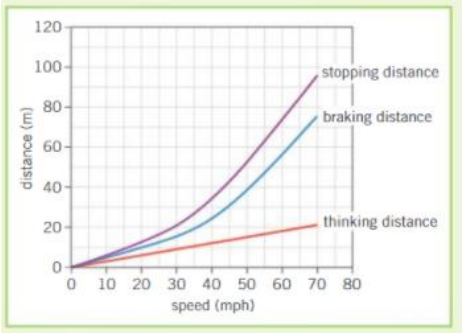
Method

Position an air track on a bench with a bench pulley at one end and two light gates above the track. Cut an interrupt card to a known length (such as 10 cm) and attach it to an air track glider.
Connect the glider to a hanging mass by a string the length of the air track passing over the bench pulley. Make sure the air track is level and that the card will pass through both gates before the mass strikes the floor.
Set the data logging software to calculate acceleration.
Add 5 × 20 g slotted masses (0.98 N of force) to the end of the string.
Release the glider, then record the weight and acceleration.
Repeat steps 4 and 5 two more times, and calculate a mean value for the acceleration.
Repeat steps 4 to 6, removir
0.78 N, 0.59 N, 0.39 N and 0.





stopping distance = thinking distance + braking distance

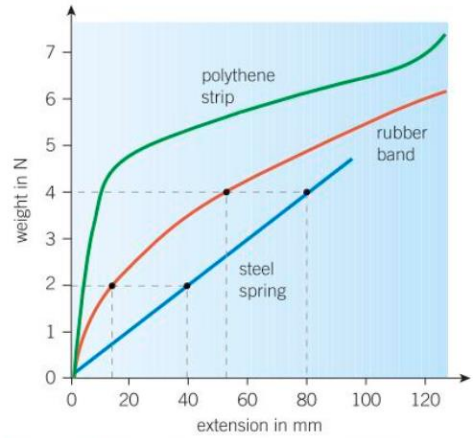


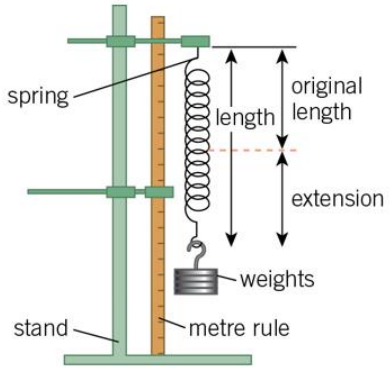
Knowledge Organiser Forces and motion

Forces and elasticity Required practical

Equipment	Safety glasses Spring Slotted masses 1m ruler Clamp stand
Method	1. Attach the spring to the clamp stand by hanging it off a clamp and let the spring hang freely over the side of the bench. 2. Use the two clamps to hold the ruler vertically, near but not touching the spring. You will use this to measure the length of the spring. 3. Measure the length of the spring with no force acting on it. 4. Hang the slotted masses from the spring and measure the new length of the spring. Record the length of the spring and the mass suspended from it. Work out the **extension** of the spring. 5. Continue adding slotted masses and record the new mass each time and work out the extension. 6. Plot the results on a graph. Extension v weight.
Safety	Safety glasses must be worn throughout Carefully place the slotted masses on the spring

Accurate means close to the true value. To increase accuracy you use a wooden split as a pointer to the ruler. The ruler is clamped in position so it is vertical.





F=k x e

Where:
F= force in N
k= spring constant in N/m
e=extension in m

HT Momentum

Momentum is the property of all moving objects. It is a vector quantity
Momentum depends on the mass and velocity of the object.

p = m x v

Where:
p= momentum in kg m/s
m= mass in kg
v= velocity on m/s

The law of conservation of momentum says that:
In a closed system, the total momentum before an event (e.g. a collision or an explosion) is equal to the total momentum after the event.

If two objects collide the law of conservation can be written as:

$$M1u1 + m2u2 = m1v1 + m2v2$$

m1= mass of object 1
u1= initial velocity of object 1

HT Inertia

The tendency for an object to remain at rest or to continue in uniform motion is called inertia.
The inertial mass of an object is the measure of the difficulty of changing the object's velocity.
Inertial mass= force/ acceleration

HT SUVAT

The deceleration of a vehicle can be calculated using the following e

$$v^2 = u^2 + 2as$$

You do not need to remember this equation it will be given to you.
You will need to be able to re-arrange it, know units and know that the acceleration close to the surface of the Earth is 9.8ms^2

PHYSICS SEPARATES ONLY

Momentum

If an object is moving an unbalanced force acting on it will change its momentum.
Since F= ma and a= ΔV/t so we can write F= mΔv/t where mΔvis the change in momentum

The greater the time for the change in the momentum:
- The smaller the rate of change of momentum
- The smaller the force experienced

Vehicle safety features increase the time take for the change in momentum:
Aire bags, seat belts, crumple zones, cycle helmets and crash mats

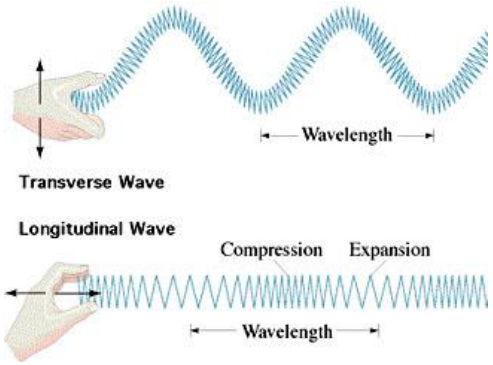
P12: Waves
Knowledge Organiser

The properties of waves

All waves, no matter what kind, transfer energy without the movement of matter. Waves can be mechanical, such as sound, waves on water, spring oscillations an earthquakes. These all require a medium to travel through, solid liquid or gas. Electromagnetic waves such as light, radio and microwaves can all travel through a vacuum.

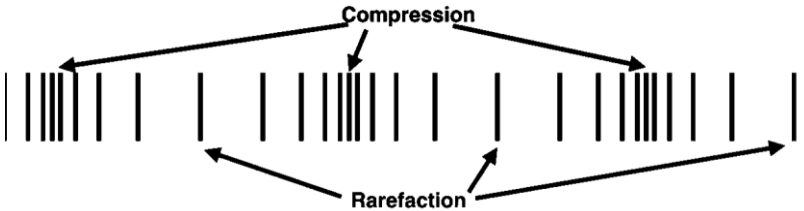
There are 2 types of wave; transvers waves and longitudinal waves. We can show these on a stretched slinky spring:

If the spring is shaken side to side or up and down, this produces a perpendicular oscillation. The movement is at right angles to the direction the waves travel. We call this kind of wave a transverse wave.



Examples of transverse waves are waves on water and electromagnetic waves.

Move your hand in and out and you produce an oscillation that is parallel to the movement of the wave. We call this a longitudinal wave, examples of which are sound and certain types of seismic (earthquake) waves.

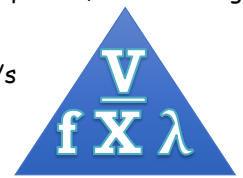


Longitudinal waves travel as a series of squashes called compressions and stretches called rarefactions.

The wave equation

You must be able to use the wave equation, and rearrange if necessary.

- **V** => **Velocity** of the wave in m/s
- **f** => **Frequency** in Hertz (Hz)
- **λ** => **Wavelength** in metres (m)



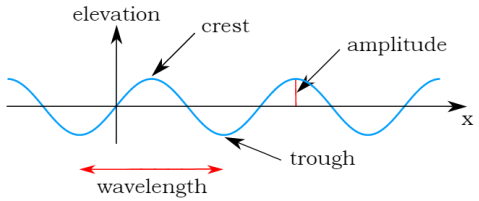
From the triangle:

$V = f \times \lambda$,

$f = V \div \lambda$

$\lambda = V \div f$

Measuring a wave

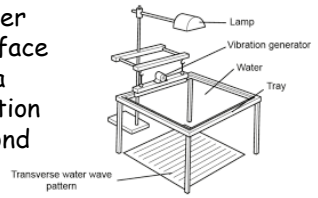


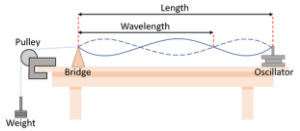
The wavelength of a wave is the distance between two like points on that wave, such as crest to crest, a trough to a trough or, in the case of longitudinal waves, compression to compression.

The amplitude of a wave is the distance between the rest point and the point of maximum displacement. Frequency is the number of waves that pass per second

Required practicals

A ripple tank can be used to project an image of water waves. A paddle vibrates to make ripples on the surface of the water. A photograph showing the waves and a ruler allows you measure the wavelength. A slow motion video clip will allow for waves to be counted per second and the speed calculated using the wave equation.





If a vibration generator is linked to a weighted string, the wavelength of the waves produced can be measured:

λ = length of sting x2 / number of half waves.

As the frequency is the independent variable, the speed can again be calculated.

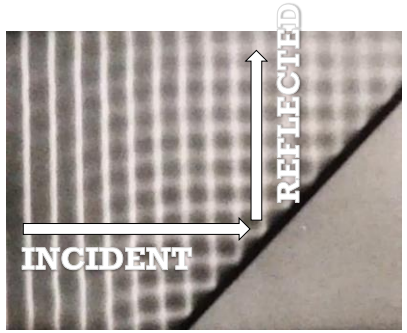
Key terms

Transverse **Longitudinal** **Wavelength** **Frequency** **Amplitude** **Compression** **Rarefaction** **Crest** **Trough** **Perpendicular** **Parallel**

P12: Waves 2
Knowledge Organiser

HIGHER Reflection of waves

We can investigate the wave property of reflection using a ripple tank. Waves on water will reflect off a barrier.



You can see from this photograph that the wavelength of the incident waves is the same as that of the reflected waves. This is because during reflection, neither the speed of the waves, nor their frequency changes

The waves reflect off the barrier at the same angle to the normal as they approach

LAW OF REFELCTION: angle of incidence = angle of reflection

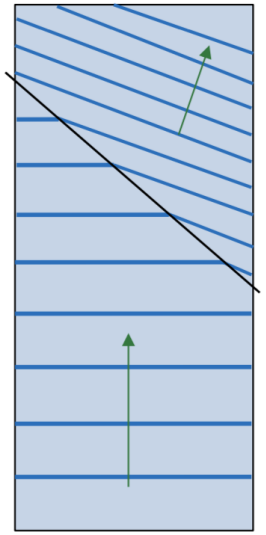
HIGHER Refraction of waves

We can also investigate the wave property of **refraction** using a ripple tank. Waves on water refract when they move into **shallower water**.

As the waves enter the shallower water they are slowed down in the same way as light waves are slowed down when they enter glass. If they approach along the **normal line** (perpendicular to the boundary) the waves reduce in speed and wavelength.

As we can consider each wave to be made up of **wavelets**, crossing a boundary at an angle will change the direction of the wave as wavelets which hit the boundary first will slow down first. So the waves direction is altered – refraction.

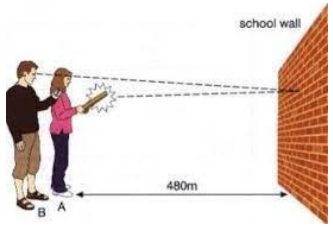
At a boundary, waves may be **transmitted**, **reflected refracted** or **absorbed**.



Sound Waves

Sound is caused by **vibration**. If you look as a working loudspeaker you can see it moving. Sound can travel in solids liquids and gases but **cannot travel through a vacuum** – no one in space can hear you scream!

We can measure the speed of sound by timing how long it takes for a sound to be made and then **echo back** to the observer.



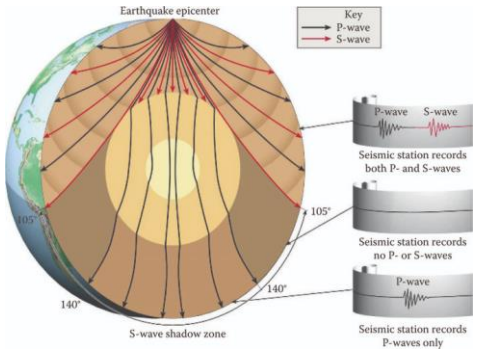
TRIPLE Ultrasound

Ultrasound is frequencies in **excess of 20,000Hz** – too high for human hearing to detect. It can be used to **detect the boundaries** deep within a material such as flaws in materials or the bones of an unborn child.

The distance to the boundary can be calculated by:

Distance to boundary$_{(m)}$ = ½ x speed of sound through medium$_{(m/s)}$ x time taken$_{(s)}$

TRIPLE Seismic waves



Seismic waves travel out from the epicentre of an earthquake:
Primary waves - the initial tremors which are **longitudinal**.
Secondary waves – slower moving **transverse** waves.
Long waves – last to arrive and **only travel through the crust**.

As transverse S-waves cannot pass through a liquid a **shadow zone** tells us the outer core is liquid.

By monitoring the passage of the P-waves through the Earth we have mapped the structure of the Earth as it **refracts the longitudinal waves** at medium boundaries.

Key terms

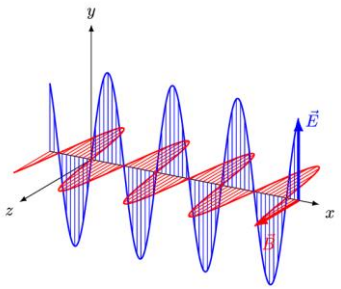
Reflection Refraction Normal Wavelet Incidence
Transmitted Absorbed Vacuum Crust Mantle Core

P13: Electromagnetic waves

Knowledge Organiser

A Family of waves

Radio waves, **microwaves**, **infra red**, **visible light**, **ultraviolet**, **x-rays** and **gamma waves** are all part of the **electromagnetic spectrum**. These are electric and magnetic disturbances that can transmit energy from a source to an absorber



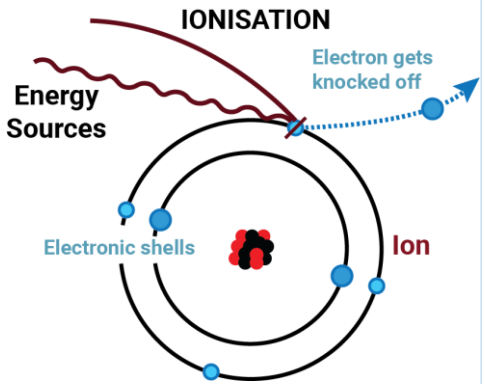
All EM-Waves exhibit the same properties:

- **Transverse** waves (electric and magnetic components at right angles to each other
- Travel through a **vacuum**
- **Speed of 3 x 10^8m/s** in a vacuum
- May **reflect** off smooth surfaces
- May **refract** when slowed down by a medium other than free space

Waves from different parts of the spectrum have **different wavelengths**. Radio waves may have a wavelength of over 100,000m. Whereas gamma rays may be as short as 10^{-12}m.

The shorter the wavelength (the higher the frequency) the greater their energy and penetration capacity the waves have.

Shorter wavelengths like gamma, x-ray and ultraviolet are also more likely to cause **ionisation**.



Some EM-waves are emitted by electrons when they move down energy level.

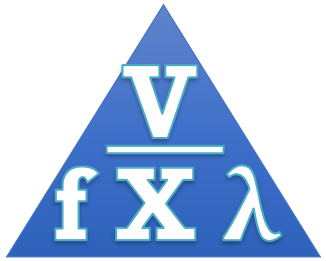
Gamma rays are emitted by emitted due to **changes in the nucleus** of an unstable atom.

Speed of EM-waves

As all EM-wave travel at the **same speed** (the speed of light!!) we can link this to the wave speed equation

- **V** => **Velocity** of the wave in m/s
- **f** => **Frequency** in Hertz (Hz)
- **λ** => **Wavelength** in metres (m)

- V = 300,000,000 m/s

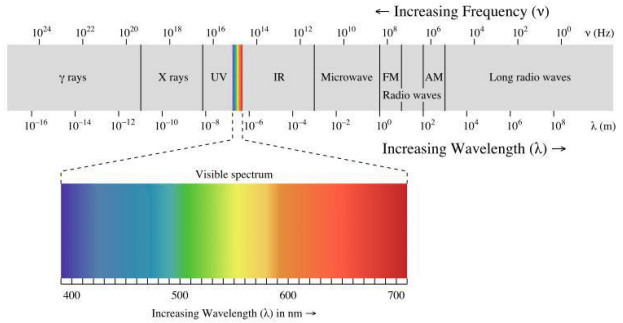


For example, a microwave with a wave length of 8cm:

- V = 3 x 10^8 m/s
- λ = 0.08m

$f = \frac{300{,}000{,}000}{0.08}$ = **3.75 x 10^9Hz** or **3750MHz**

Visible light



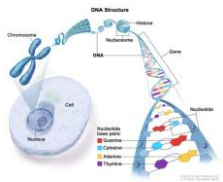
The visible spectrum is only a very narrow band of the wider EM-spectrum. Wavelengths of **400nm** for **violet**, to **700nm** for **red** light

Remember **ROYGBIV** **R**ichard **o**f **Y**ork **g**ave **b**attle **i**n **v**ain

Dangers of Ionising EM waves

So gamma, x-ray and ultraviolet can cause problems if their energy is deposited inside a living cell. Gamma rays can kill cells. As with all ionising radiation, damage to the DNA could cause the cell to divide out of control – cancer

The level of danger is dependant on the radiation dose.



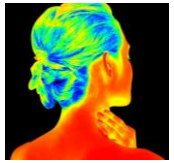
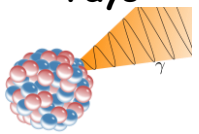
Key terms

Alternating, Reflection, Refraction, Wavelength, Frequency, Transverse, Spectrum, Radiation dose, Wavelength, Amplitude

P13: Electromagnetic waves 2

Knowledge Organiser

Looking at the entire spectrum

Type of wave	Radio waves	Microwaves	Infrared	Visible light	Ultraviolet	X-rays	Gamma rays
							
Average wavelength	10^{3}m	10^{-2}m	10^{-5}m	5^{-7}m	10^{-8}m	10^{-10}m	10^{-12}m
Uses	Used for radio and television signals as they can travel long distance in the air. Also used for Wi-Fi and Bluetooth as they will bend round objects so a line of sight is not needed. **HT:** Radio waves produced by oscillations in an electric circuit linked to a transmitter may create an alternating current in a receiver aerial of the same frequency.	Used in radar, satellite and mobile communications as they can pass easily through the Earth's atmosphere but tend not to spread out as much as radio (though their range is not as long.) Used in cooking food as they can penetrate the food and vibrate water and fat molecules within causing a heating effect in the food only, not the oven.	Used for heating and cooking as can transfer energy quickly to food etc. The Sun heats the planet through the transmission of infra red radiation. As all hot objects emit infrared, sensors to detect them can be used in alarm systems and thermal imaging cameras. Dull black surfaces are the best emitters and absorbers of infra red.	Visible light as its name suggests is used for our vision, the narrow band of EM frequencies that the human eye can detect. Are increasingly used in communication as the shorter wavelengths allow for the carriage of more information. Visible light is used in optic fibre communications. A light beam reflects off the inside of transparent / thin fibre of glass	Has an effect on the pigmentation in human skin so used in sun beds, but is also responsible for the synthesis of vitamin D in our bodies. Fluorescent lights use a coating that absorbs UV and emits visible light. UV is also used to detect forged notes, and fluorescent dyes and inks (which also absorb the UV and emit light.) Popular in night clubs	Use primarily for diagnostic imaging , mainly of the body as the rays pass easily through soft tissue but are absorbed by denser material such as bone. For this reason airport security screening also uses x-rays to see inside luggage. X-rays have become invaluable to the art world by detecting forged painting detection	As it passes easily through skin, gamma rays are used in radiation therapy to kill cancer cells. Several beams are focussed on the tumour to kill the cancer but not the surrounding tissue. Gamma rays are also used in the sterilisation of equipment and food as the rays will kill bacteria. Irradiated food also has a longer shelf life.
Hazards	Can penetrate the body and cause a heating effect.	Like radio, can have a heating effect on the body.	Can cause damage to skin – burns.	Excessive amounts can cause damage to the retina.	Can damage skin cells causing aging and risk of cancer	Ionising radiation. Can kill cells, cause mutation - cancer	Ionising radiation. Can kill cells, cause mutation - cancer

INCREASING FREQUENCY

INCREASING WAVELENGTH

Key terms

Absorption Emission Penetration Ionising Irradiation Mutation Sensors Fluorescent Atmosphere

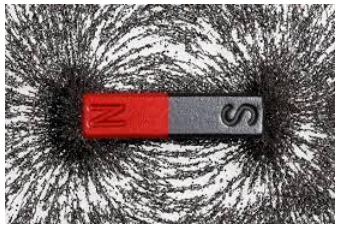
P15: Electromagnetism
Knowledge Organiser

Magnets and magnetic materials

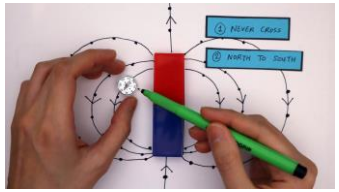
A magnet is a an object that produces a **magnetic field**, an area where other magnetic materials experience a non contact force as a result. There are 3 main magnetic materials – **Iron**, **Nickel** and **Cobalt** as well as alloys containing them. We call such materials, **ferromagnetic**, as in the presence of a magnetic field the material becomes magnetised . We say the magnetism is **induced**.

There are two easy ways of determining the shape of a magnetic field.

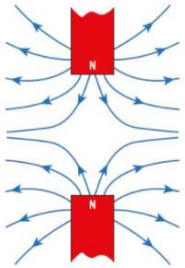
One is to use **iron filings**. As they are made of iron,. Magnetism is induced in the pieces of iron which then line up along the magnetic lines of flux.



The second method is to use a **plotting compass**. The needle is magnetised so also lines up on the **lines of flux** and pints in the direction of the magnetism

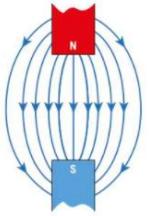


Magnets always have a **north seeking** and a **south seeking** pole. The magnetic lines of flux always **point from north to south**. The closer the lines of flux are the stronger the magnetic field. Magnets are strongest at the two poles.



Like poles repel whereas **unlike poles attract**. We can see what effect this has on the lines of flux here.

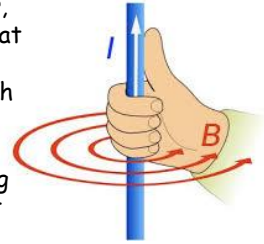
The 2 like poles on the left show the lines of seem to avoid contact with the other magnet. Whereas with the unlike poles, lines of flux point from north to south



Magnetic field lines **never cross**.

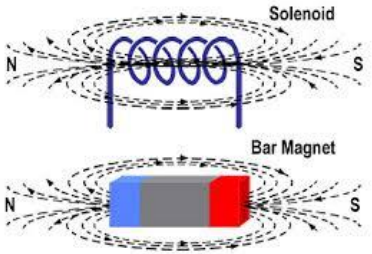
Electromagnetism

When an electric current flows through a conductor it generates a magnetic field around the conductor. However, there are no poles in this field, the shape of the field is that of **concentric circles**. The magnetic field is **stronger** the **closer** you get to the wire, and we can increase the strength still further by **increasing the current** in the conductor.



The direction of the magnetic field can be worked out using the **right hand grip rule**: If you grip the wire in your right hand and point your **thumb** in the direction of the **current**, (+ to -), you **fingers** curl round in the direction of the **field**.

Solenoids

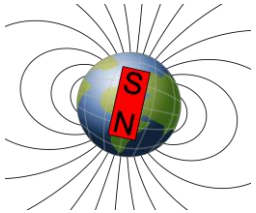


A **solenoid** is a **coil of wire** carrying an electric current. This creates multiple fields which interact to produce a field similar to a **bar magnet**. As before we can increase the field using a greater current, but increasing the turns of the coil will also effect a greater field. Placing a magnetic material within the coil induces a field in the material, adding to the magnetism – **an electromagnet**.

Unlike permanent magnets, electromagnets **can be turned on and off** and their strength adjusted by changing the current.

The Earth's magnetic field

As a **compass**, when not near a magnet or current carrying wire, **will point North**, we have evidence for the **magnetic core of the Earth** – Iron and Nickel.



But as the north pole of a magnet points north when suspended, the **magnetic poles** of the Earth **must be reversed** compared to the geographic names.

Key terms

Attraction **Repulsion** **Induced magnetism** **Permanent magnetism**
Magnetic field **Solenoid** **Current** **Field strength**

P15: Electromagnetism 2

Knowledge Organiser

HIGHER The motor effect

When a current carrying conductor is placed in a magnetic field it may experience a force due to the interaction between the field produced by the current in the wire and the magnetic field it is placed in.

The size of the **force** will depend upon the **current** in the wire, the **length** of the wire in the field, and the **magnetic flux density** - a measure of the strength of the magnetic field:

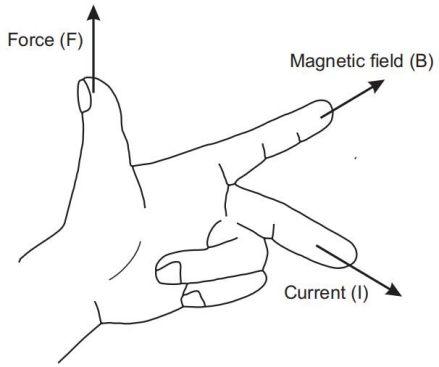
$$F_{(N)} = B_{(T)} \times I_{(A)} \times L_{(m)}$$

T -> Tesla

Flemings left hand rule can be used to determine the direction of the force produced.

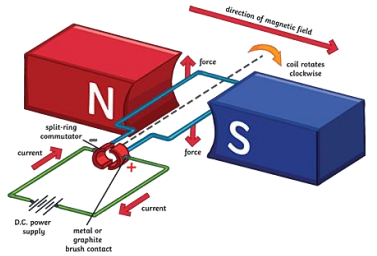
The direction of the motion is at **right angles to both the field** (first finger) **and the current** (second finger.)

Just remember - ***F.B.I.*** for your thumb first finger and second fingers.



HIGHER Electric motors

If the current carrying conductor is wound into a **coil** and allowed to **pivot** the motor effect will produce a **rotary motion** thanks to opposing **moments** on the coil - one pushing the coil up, one down. This happens because the current is flowing in **opposite directions** on either ide of the coil. s

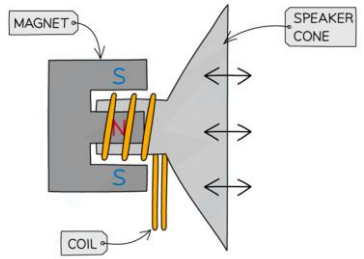


A **commutator** keeps the coil spinning by reversing the current and therefore the forces **every half a turn**. You can make a motor move faster by increasing the current, the turns on the coil or the strength of the magnetic field

HIGHER Loudspeakers

A loudspeaker makes use of the motor effect too. A coil of wire in the field of a permanent magnet is fixed to a **lightweight cone**.

Current in the coil makes the cone move **forwards** for one current direction **and back** for current in the opposite direction. This causes the cone to create **pressure variations in the air** with a frequency the same as the **frequency** of the **alternation of current** in the coil.



TRIPLE Uses - Scrap crane

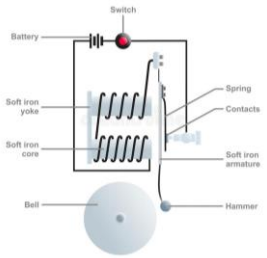
Being able to **switch on and off**, a scrap yard crane can quickly be attached to a vehicle by the **touch of a button**.

Such cranes have large **powerful electromagnets** so their lifting capability is high.

TRIPLE Uses - Doorbell

When the switch is pressed, current flows in the coil causing an electromagnet to generate a **magnetic field** which pulls the **hammer** to strike.

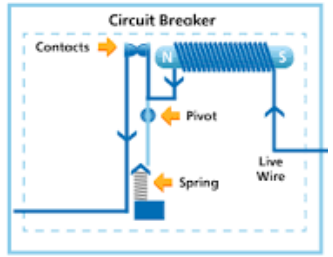
But the hammer is part of the circuit so as it moves it **breaks** the circuit again.



TRIPLE Uses - Circuit breaker

An switch in series with an electromagnet. A **spring** keeps the switch closed until the current is so **high** that the **contacts are parted** by the electro magnet.

Used in place of traditional **fuses**.



Key terms

Flux density, Tesla, Commutator, Circuit breaker, Moments, Field strength, Pressure, Alternating, Frequency

Separate Biology Science Resources Pack

Biology

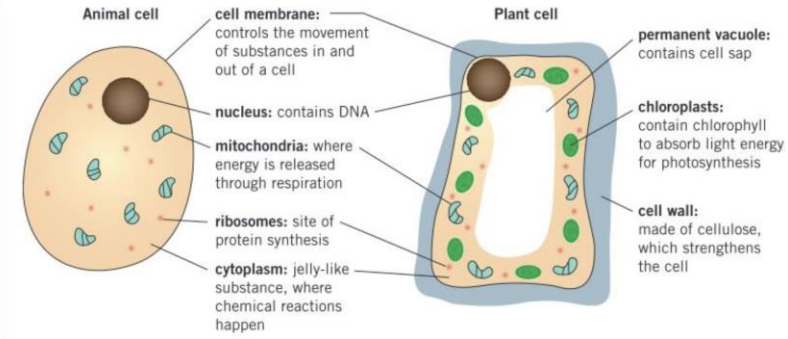
- Paper 1

Cell Structure – Science – Year 11

Knowledge Organiser

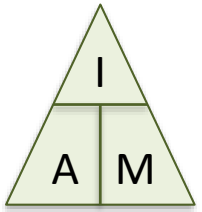
Animal and Plant Cells

Animal and plant cells are eukaryotic cells. They have genetic material (DNA) that forms chromosomes and is contained within a nucleus.

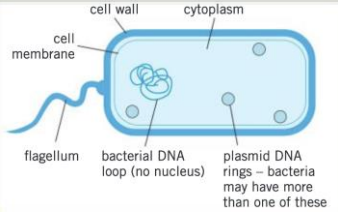


Microscopes

Light microscope	Electron microscope
Uses light to form images	Uses a beam of electrons to form images
Living samples can be views	Samples cannot be living
Relatively cheap	expensive
Low magnification	High magnification
Low resolution	High resolution



Bacterial cells



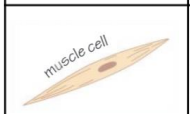
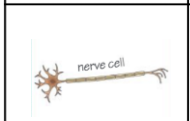
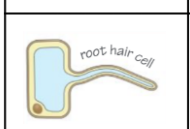
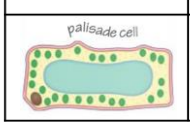
Bacteria have the following characteristics:

- Single-celled
- No nucleus – have a single loop of DNA
- Have small rings of DNA called plasmids
- Smaller that eukaryotic cells

Comparing sub-cellular structures

Structure	Animal	Plant	Bacteria
cell membrane	/	/	/
cytoplasm	/	/	/
nucleus	/	/	-
cell wall	-	/	/
chloroplasts	-	/	-
permanent vacuole	-	/	-
DNA free in cytoplasm	-	-	/
plasmids	-	-	/

Specialised cells

Specialised cell	Function	Adaptations
	Fertlise an ovum (egg)	- Tail to swim to the ovum and fertilse it - Lots of mitochondria to release energy from respiration, enabling the sperm to swim to the ovum
	Transport oxygen around the body	- No nucleus so more room to carry oxygen - Contain a red pigment called hemoglobin that binds to oxygen molecules - Flat bi-concaved disc shape to increase surface area-to-volume ratio
	Contract and relax to allow movement	- Contains protein fibres, which can contract to make the cells shorter - Contains lots of mitochondria to release energy from respiration, allowing the muscles to contract
	Carry electrical impulses around the body	- Branched endings, called dendrites, to make connections with other neurones or effectors - Myelin sheath insulates the axon to increase the transmission speed of the electrical impulses.
	Absorb mineral ions and water from the soil	- Long projection speeds up the absorption of water and mineral ions by increasing the surface area of the cell - Lots of mitochondria to release energy for the active transport of mineral ions from the soil
	Enable photosynthesis in the leaf	- Lots of chloroplasts containing chlorophyll to absorb light energy - Located at the top surface of the leaf where it can absorb the most light energy

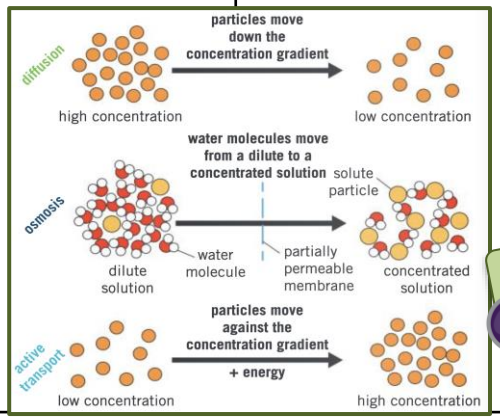
Key terms

chloroplast chromosome cytoplasm eukaryotic prokaryotic resolution ribosome

Cell Structure – Science – Year 11

Knowledge Organiser

	Diffusion	Osmosis	Active Transport
Definition	The spreading out of particles, resulting in a net movement from an area of higher **concentration** to an area of lower concentration.	The diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.	The movement of particles from a more dilute solution to a more concentrated solution using energy from respiration.
Movement of particles	Particles move down the concentration gradient – from an area of high concentration to an area of low concentration.	Water moves from an area of lower solute concentration to an area of higher solute concentration.	Particles move against the concentration gradient – from an area of low concentration to and area of high concentration.
Energy required?	No – passive process	No – passive process	Yes – using energy released during respiration
Examples	Humans: • Nutrients in the small intestine diffuse into the blood in the capillaries through the villi. • Oxygen diffuses from the air in alveoli into the blood in the capillaries. Carbon dioxide diffuses from the blood in the capillaries into the air in the alveoli. • Urea diffuses from cells into the blood for excretion by the kidney. Fish: • Oxygen from water passing over the gills diffuses into the blood in the gill filaments. • Carbon dioxide diffuses from the blood in the gill filaments into the water. Plants: • Carbon dioxide used for photosynthesis diffuses into leaves through the stomata. • Oxygen produced during photosynthesis diffuses out of the leaves through the stomata	Plants: Water moves osmosis from a dilute solution in the soil to a concentrated solution in the root hair cell.	Humans: Active transport allows sugar molecule to be absorbed from the small intensive when the sugar concentration is higher in the blood than in the small intensive. Plants: Active transport is used to absorb mineral ions into the root hair cells from more dilute solutions in the soil.



Factors that affect the rate of diffusion

1) Difference in concentration

The steeper the concentration gradient the faster the rate of diffusion.

2) Temperature

The higher the temperature, the faster the rate of diffusion.

3) Surface area of the membrane

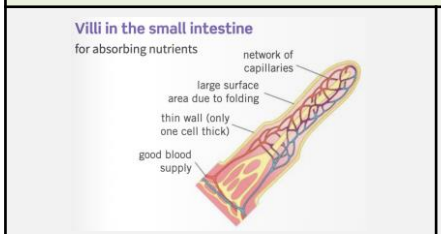
The larger the membrane surface area the faster the rate of diffusion.

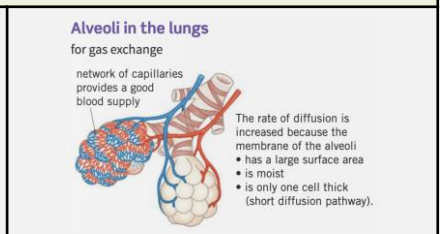
Adaptations for exchanging substances

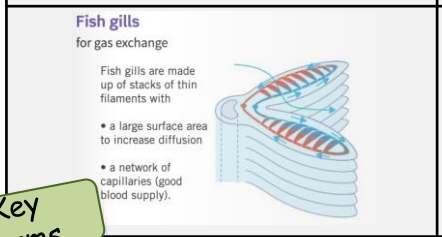
Single-celled organisms have a large surface area-to-volume ratio. This allows enough molecules to move across their cell membranes to meet their needs.

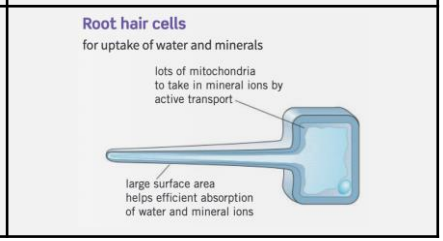
Multicellular organisms have a small surface area-to-volume ratio. This means they need specialized organs systems and cells to be transported into and out of their cells.

Exchange surfaces work most efficiently when they have a large surface area, a thin membrane, and a good blood supply.









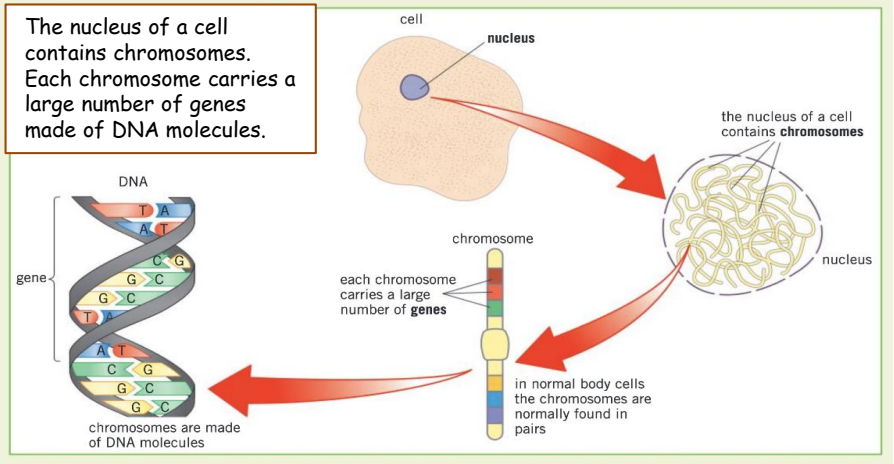
Key terms

concentration partially permeable membrane passive process gradient stomata urea villi capillaries alveoli diffusion active transport dilute

Cell Division Knowledge Organiser

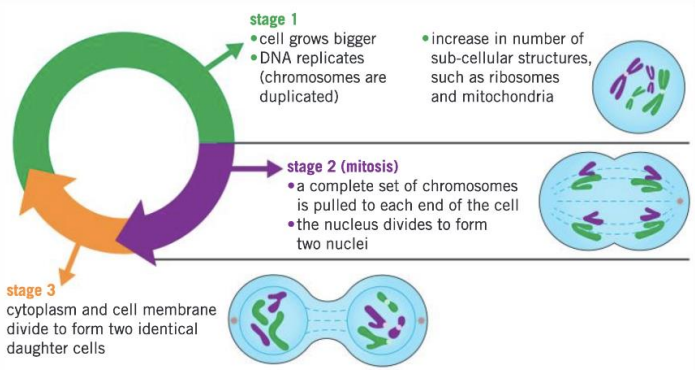
Chromosomes

The nucleus of a cell contains chromosomes. Each chromosome carries a large number of genes made of DNA molecules.



The Cell Cycle

Body cells divide to form two identical daughter cells by going through a series of stages known as the cell cycle.
Cell division by mitosis is important for the growth and repair of cells, for example, the replacement of skin cells. Mitosis is also used for asexual reproduction.
There are three main stages in the cell cycle.



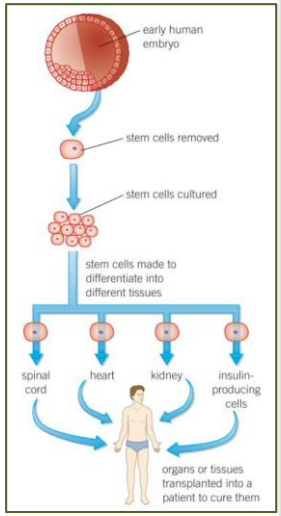
Stem cells in medicine

Type of stem cell	Where are they found?	What can they differentiate into?	Advantages	Disadvantages
Adult stem cells	Specific parts of the body in adults and children – for example bone marrow	Can only differentiate to form certain types of cells – for example stem cells in the bone marrow can only differentiate into types of blood cell	• Fewer ethical issues – adults can consent to have their stem cells removed and used. • An already established technique for treating diseases such as leukemia. • Relatively safe to use as a treatment and donors recover quickly	• Requires a donor. Potentially meaning a long wait time to find someone suitable • Can only differentiate into certain types of specialised cells, so can be used to treat fewer diseases
Embryonic stem cells	Early human embryos (often taken from spare embryos from fertility clinics)	Can differentiate into any type of specialised cell in the body – for example, a nerve cell of a muscle cell.	• Can treat a wide range of diseases as can form any specialised cell • May be possible to grow whole replacement organs • Usually no donor needed as they are obtained from spare embryos from fertility clinics	• Ethical issues as the embryo is destroyed and each embryo is a potential human life • Risk of transferring viral infections to the patient • Newer treatment so relatively under-researched – not yet clear if they can cure as many diseases as thought
Plant meristem	Meristem regions in the roots and shoots of plants	Can differentiate into all cell types – they can be used to create clones of whole plants	• Rare species of plants can be cloned to prevent extinction • Plants with desirable traits, such as disease resistance, can be cloned to produce large number of identical plants • Fast and low-cost production of large number of plants	• Cloned plants are genetically identical, so a whole crop is at risk of being destroyed by a single disease or genetic defect

Therapeutic Cloning

In therapeutic cloning:

- Cells from a patient's own body are used to create a cloned early embryo of themselves
- Stem cells from this embryo can be used for medical treatments and growing new organs
- These stem cells have the same genes as the patient, so are less likely to be rejected when transplanted.



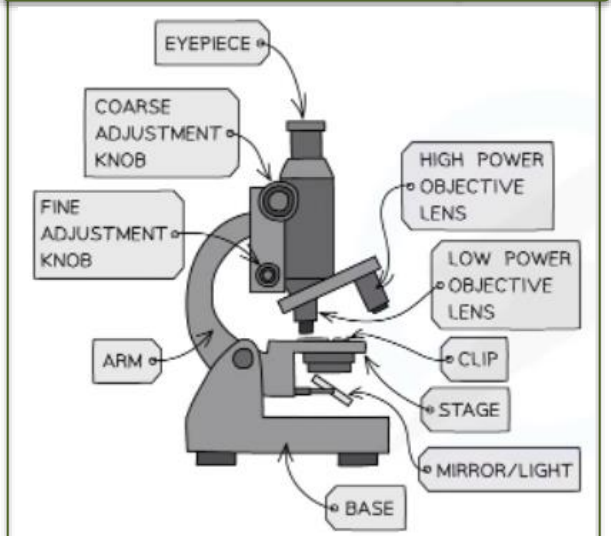
Key terms

mitosis daughter cells gene meristem nucleus chromosome therapeutic cloning clone embryonic stem cell

Using a microscope – Science – Year 11

Knowledge Organiser

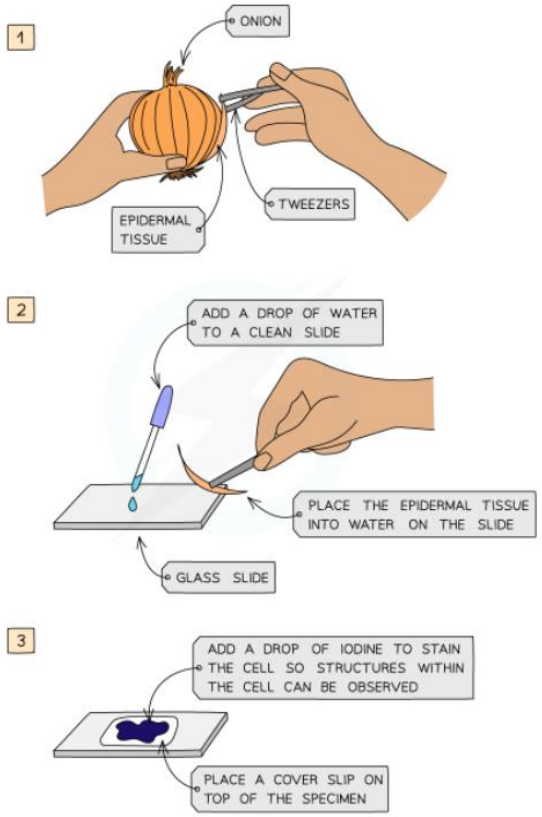
Parts of a microscope



Using a microscope

1. Clip slide onto the stage
2. Ensure the lowest powered objective lens is over the slide.
3. Use the coarse adjustment knob to bring the stage up just below the lens.
4. Look down the eye piece and gradually move the stage downwards using the coarse adjustment knob. Stop when the image is roughly in focus.
5. To bring the image into focus adjust the fine adjustment knob until a clear image is obtained.
6. To observe the image with a higher magnification, change the objective lens to a higher power and readjust the stage using the coarse and fine adjustment knobs.

Making an onion slide



Conversions

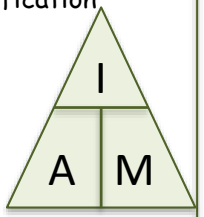
To convert micrometres into millimetres you should divide the measurement by 1000.
To convert millimetres into micrometres you should multiply the measurement by 1000.

Calculations

magnification = image size / actual size

actual size = image size / magnification

image size = actual size x magnification



total magnification = eye piece x objective

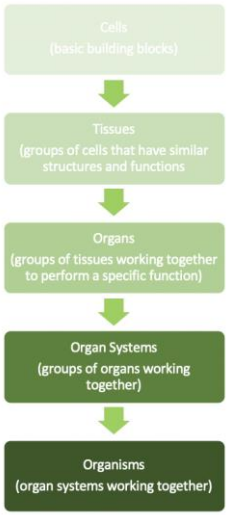
Microscopes

Light microscope	Electron microscope
Uses light to form images	Uses a beam of electrons to form images
Living samples can be views	Samples cannot be living
Relatively cheap	expensive
Low magnification	High magnification
Low resolution	High resolution

Organisation
Knowledge Organiser – Science – year 11

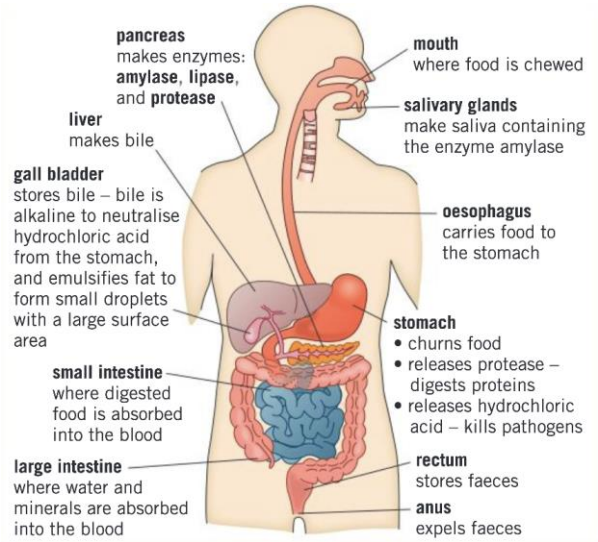
Organisation of living things

There are five levels of organisation in living organisms:



The Digestive System

The role of the digestive system is to break large insoluble molecules into smaller soluble molecules. Here are the organs that make up the digestive system and their roles in digestion.



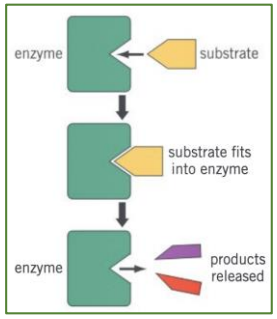
Enzymes

Enzymes are large proteins that catalyse (speed up) reactions. Enzymes are not changed in the reactions they catalyse.

Lock and Key Model

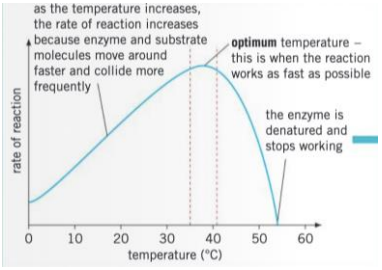
This is a simple model of how enzymes work:

1) The enzyme's active site (where the reaction occurs) is a specific shape.
2) The enzyme (the lock) will only catalyse a specific reaction because the substrate (the key) fits into its active site.
3) At the active site, enzymes can break molecules down into smaller ones or bind small molecules together to form larger ones.
4) When the products have been released, the enzyme's active site can accept another substrate molecule.

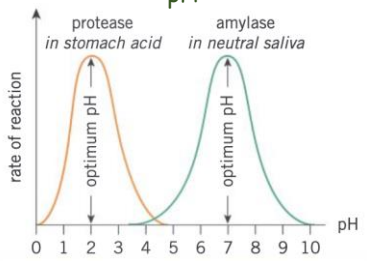


Factors affecting enzymes

Temperature



pH



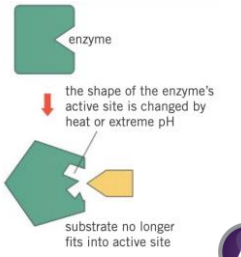
Digestive Enzymes

Enzyme	Sites of production	Reaction catalysed
Amylase	salivary glands pancreas small intestine	Starch → glucose (a simple sugar)
Proteases	stomach pancreas small intestine	Proteins → amino acids
Lipases	pancreas small intestine	Lipids → fatty acids and glycerol

Denaturation

At extremes of pH or at very high temperatures the shape of an enzyme's active site can change.

The substrate can no longer bind to the active site, so the enzyme cannot catalyse the reaction – the enzyme has been denatured.



Key terms

active site amylase catalyse denatured enzyme lipase optimum protease substrate

Organisation
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The blood

The blood is a tissue made up of four main components:

1. **Red blood cells** – bind to oxygen and transport it around the body.
2. **Plasma** – transports substances and blood cells around the body.
3. **Platelets** – form blood clots to create barriers to infections.
4. **White blood cells** – part of the immune system to defend the body against pathogens.

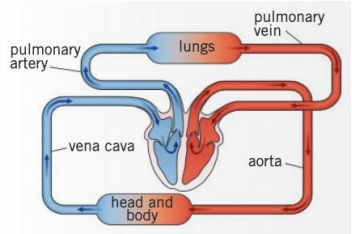
The blood vessels

Vessel	Function	Structure	Diagram
artery	carries blood away from the heart under high pressure	- Thick, muscular and elastic walls - Walls that stretch to withstand high pressure - Small lumen	
vein	carries blood to the heart under low pressure	- Have valves to stop blood flowing the wrong way - Thin walls - Large lumen	
capillary	carries blood to tissues and cells and connects arteries and veins	One cell thick – short diffusion distance for substances to move between the blood and tissues (e.g., oxygen into cells and carbon dioxide out) - Very narrow lumen	

Double circulatory system

The human circulatory system is described as a double circulatory system because blood passes through the heart twice for every circuit around the body:

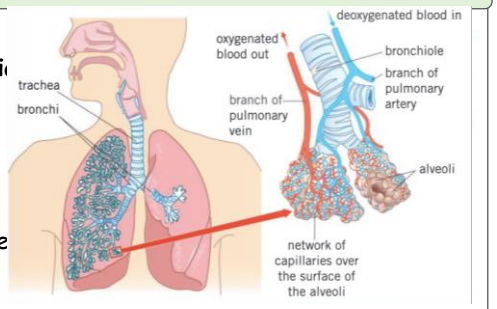
- The right ventricle pumps blood to the lungs where gas exchange takes place
- The left ventricle pumps blood around the rest of the body.



The heart

The heart is an organ that pumps blood around your body. It is made from **cardi** muscle tissue, which is supplied with oxygen by the **coronary artery**.

Heart rate is controlled by a group of cells in the right **atrium** that generate electrical impulses, acting as a pacemake Artificial pacemakers can be used to control irregular heartbeats.



Coronary heart disease

Coronary heart disease (CHD) occurs when the coronary arteries became narrowed by the build-up of layers of fatty material within them.
This reduces the flow of blood, resulting in less oxygen for the heart muscle, which can lead to heart attacks.

	Description	Advantages	Disadvantages
Stent	Inserted into blocked coronary arteries to keep them open.	- Widens the artery – allows more blood to flow - Less serious surgery	- Can involve major surgery – risk of infection, blood loss and blot clots - Risks from anaesthetic
Statins	Drugs that reduce blood cholesterol levels, slowing down the deposit of fatty material in the arteries	- Effective - No need for surgery - Can prevent CHD from developing	- Possible side effects such as muscle pain, headaches and sickness - Cannot cure CHD, so patient will have to take tablets for many years.
Replacement heart valves	Heart valves that leak or do not open fully, preventing control of blood flow though the heart, can be replaced with biological or mechanical valves.	- Allows control of blood flow through the heart - Long-term cure for faulty heart valves	Risks related to surgery (as with stents)
Transplants	If the heart fails a donor heart, or heart and lungs, can be transplanted. Artificial hearts can be used to keep patients alive whilst waiting for a transplant, or to allow the heart to rest during recovery.	- Long-term cure for the most serious heart conditions - Treats problems that cannot be treated in other ways.	- Transplants may be rejected if the donor is not a match. - Lengthy process - Risks related to surgery (as with stents)

Organisation
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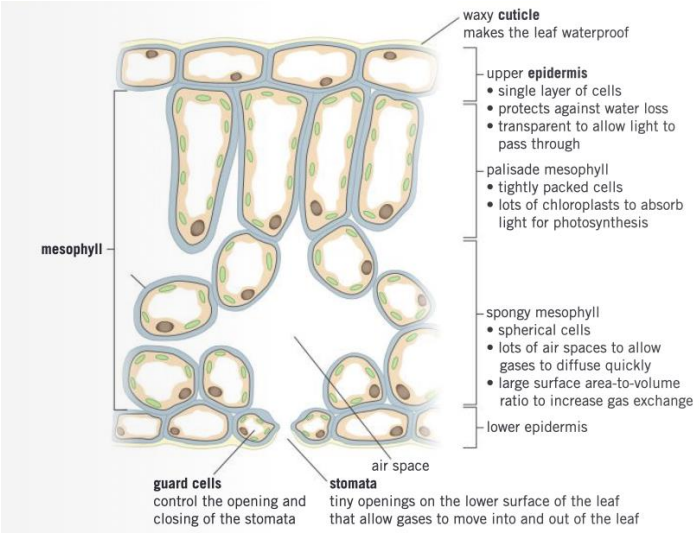
Tissues in a leaf

Leaves are organs because they contain many tissues that work together to perform photosynthesis.



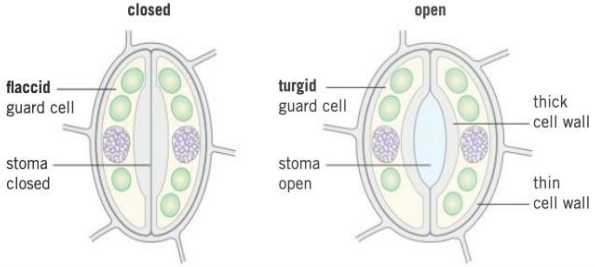
Stomata

Stomata are tiny openings in the undersides of leaves – this placement reduces water loss through evaporation.

They control gas exchange and water loss from leaves by:
- Allowing diffusions of carbon dioxide into the plant for photosynthesis
- Allowing diffusion of oxygen out of the plant

Guard cells are used to open and close the stomata.

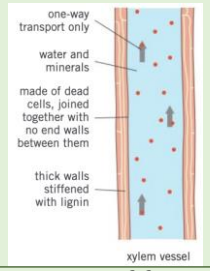
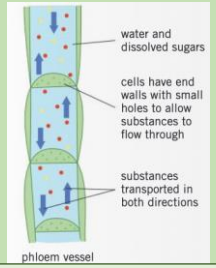
When a plant has plenty of water, the guard cells become turgid. The cell wall on the inner surface is very thick, so it cannot stretch as much as the outer surface. So as the guard cells swell up, they curve away from each other, opening the stoma.



Key terms

cuticle epidermis flaccid mesophyll stomata phloem xylem turgid translocation transpiration guard cell

Transportation in plants

	Transpiration	Translocation
Description	Water is lost through the stomata by evaporation. This pulls water up from the roots through the xylem and is called transpiration. The constant movement of water up the plant is called the transpiration stream.	The movement of dissolved sugars from the leaves to the rest of the plant through the phloem.
Importance	Provides water to cells to keep them turgid. Provides water to cells for photosynthesis Transports mineral ions to leaves.	Moves dissolved sugars made during photosynthesis to other parts of the plant. This allows for respiration, growth and glucose storage.
Specialised Tissues		

Factors affecting the rate of transpiration

Factor	Effect on transpiration	Because…
temperature	higher temperatures increase the rate of transpiration	water evaporates faster at higher temperatures
humidity	lower humidity increases the rate of transpiration	the drier the air the steeper the concentration gradient of water molecules between the air and the leaf
wind speed	more wind increases the rate of transpiration	wind removes the water vapour quickly, maintaining a steeper concentration gradient
light intensity	Higher light intensity increases the rate of transpiration	stomata open wider to let more carbo dioxide into the leaf for photosynthesis

Organisation
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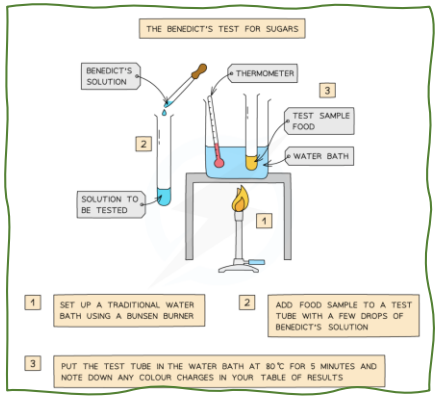
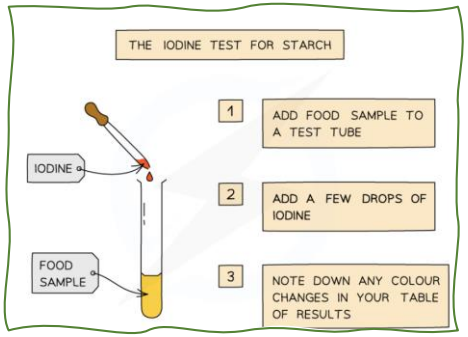
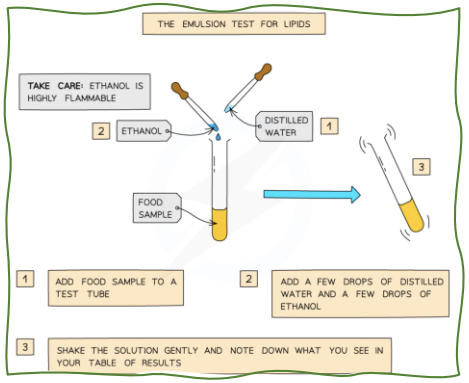
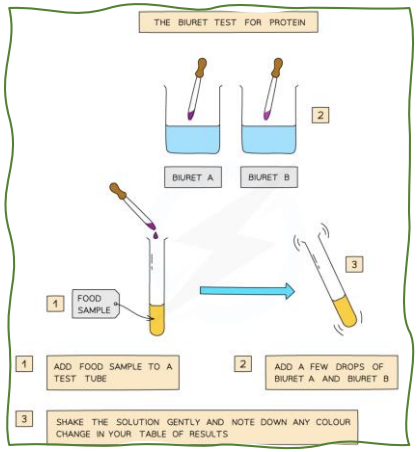
Testing Foods







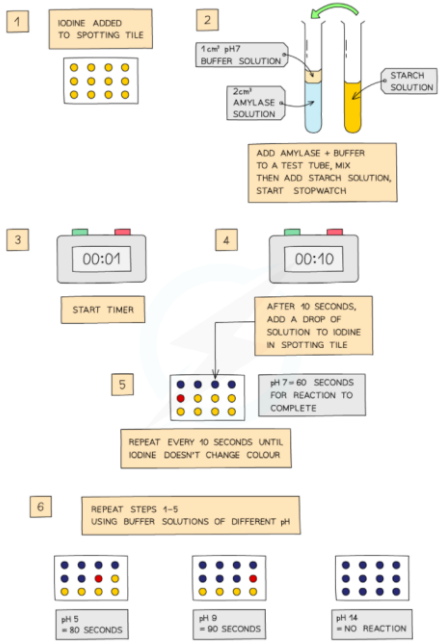


Food Test	Colour of reagent	Positive test result	Negative test result
Iodine for starch	orange–brown	blue–black	orange–brown (no change)
Benedict's for sugar	light blue	green to brick–red	light blue (no change)
Ethanol for lipid	colourless	cloudy emulsion	colourless (no change)
Biuret for protein	blue	lilac–purple	blue (no change)

Investigating Enzymes

Method

- Place single drops of iodine solution in rows on the tile
- Label a test tube with the pH to be tested
- Use the syringe to place 2cm3 of amylase in the test tube
- Add 1cm3 of buffer solution to the test tube using a syringe
- Use another test tube to add 2cm3 of starch solution to the amylase and buffer solution, start the stopwatch whilst mixing using a pipette
- After 10 seconds, use a pipette to place one drop of the mixture on the first drop of iodine, which should turn blue-black
- Wait another 10 seconds and place another drop of the mixture on the second drop of iodine
- Repeat every 10 seconds until iodine solution remains orange-brown
- Repeat experiment at different pH values – the less time the iodine solution takes to remain orange-brown, the quicker all the starch has been digested and so the better the enzyme works at that pH



Key terms

active site amylase catalyse denatured enzyme lipase optimum protease substrate

Health and Communicable Disease
Knowledge Organiser

Communicable disease

A communicable disease is one caused by pathogens that can be passed from organism to organism. A pathogen is a microorganism that causes a disease. Examples of pathogens are: bacteria, fungi, viruses and protists.

Viruses live and reproduce rapidly inside an organism's cells. This can damage or destroy the cells.
Bacteria reproduce rapidly inside organisms and may produce toxins that damage tissues and cause illness.

Pathogens can be spread in the air, water or by direct contact.

Viruses

	Spread by	Symptoms	Prevention and treatment
measles	inhalation of droplets that are produced by infected people sneezing and coughing	• fever • red skin rash • complications can be fatal	• painkillers to treat the symptoms • young children are vaccinated to immunise them against measles
HIV	Exchange of body fluids such as: • sexual contact • blood when drug users share needles	• flu-like symptoms at first • virus attacks the body's immune cells, which can lead to AIDS – when the immune system is so damaged that it cannot fight off infections.	• antiretroviral drugs – are very damaging to the body • barrier methods of contraception, such as condoms • using clean needles
TMV	• direct contact of plants with infected plant material • animal and plant vectors • soil: the pathogen can remain in soil for decades	• mosaic pattern of discolouration on the leaves – where chlorophyll is destroyed • reduces plant's ability to photosynthesise, affecting growth	• removing infected plants

Bacteria

	Spread by	Symptoms	Prevention and treatment
Salmonella	bacteria in or on food being ingested	Salmonella bacteria and the toxins they produce cause • fever • abdominal pains • vomiting • diarrhoea	• poultry are vaccinated against Salmonella bacteria to control spread
Gonorrhoea	direct sexual contact – gonorrhoea is a sexually transmitted disease (STD)	• thick yellow or green discharge from the vagina or penis • pain when urinating	• treatment with antibiotics (many antibiotic-resistant strains have appeared) • barrier methods of contraception

Fungi

	Spread by	Symptoms	Prevention and treatment
Rose black spot	Water and wind	• purple or black spots on leaves, which turn yellow and drop early • reduces plant's ability to photosynthesise, affecting growth	• **fungicides** • affected leaves removed and destroyed

Protists

	Spread by	Symptoms	Prevention and treatment
Malaria	Mosquitos feed on the blood of infected people and spread the protist pathogen when they feed on another person – organisms that spread disease by carrying pathogens are known as vectors	• recurrent episodes of fever • can be fatal	• prevent mosquito vectors breeding • mosquito nets to prevent bites • anti-malarial medicine

Controlling the spread of communicable disease

There are a number of ways to prevent the spread of communicable diseases from one organism to another.

Hygiene
Hand washing, disinfecting surfaces and machinery, keeping raw meat separate, covering mouth when coughing/sneezing.

Isolation
Isolation of infected individuals – people, animals, and plants can be isolated to stop the spread of disease.

Controlling Vectors
If a vector spreads a disease, destroying or controlling the population of the vector can limit the spread of disease.

Vaccination
Vaccination can protect large numbers of individuals against diseases. It cannot be used in plants as they don't have an immune system.

Vaccination involves injecting small quantities of dead or inactive form of a pathogen into the body

↓

This stimulates lymphocytes to produce the correct antibodies for that pathogen

↓

If the same pathogen re-enters the body, the correct antibodies can be produced quickly to prevent infection.

Herd immunity

If a large proportion of a population is vaccinated against a disease, the disease is less likely to spread even if there are some unvaccinated individuals.

Key terms

Bacterium communicable disease fungicide fungus herd immunity pathogen protist sexually transmitted disease (STD) toxin vaccination vector virus

Health and Communicable Disease
Knowledge Organiser

Detection and identification of plant diseases

Signs that a plant is diseased:
- stunted growth
- spots on leaves
- areas of rot or decay
- growths
- malformed stems or leaves
- discolouration
- pest infestation

Ways of identifying plant diseases

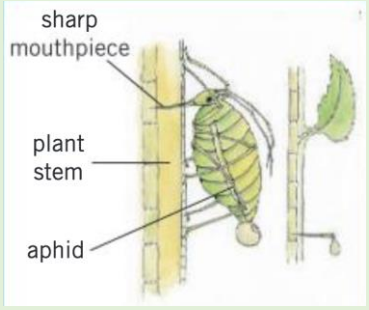
- gardening manuals and websites
- laboratory testing of infected plants
- testing kits containing monoclonal antibodies

Plant diseases and insects

Plant diseases can also be directly caused by insects.

Aphids are insects that suck sap from the stems of plants. This results in

- reduced rate of growth
- wilting
- discolouration of leaves.



Ladybirds can be used to control aphid infestations as ladybirds larvae eat aphids.

Plant defences

Physical barriers

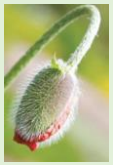
- cellulose cell walls – provide a barrier to infection
- tough waxy cuticle on leaves
- bark on trees – a layer of dead cells that can fall off

Chemical barriers

- many plants produce antibacterial chemicals
- poison production stops animals eating plants

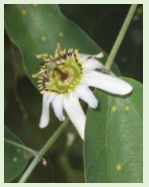
Mechanical adaptations

- thorns and hairs stop animals eating plants



- leaves that droop curl when touched to scare herbivores or dislodge insects

- some plants mimic the appearance of unhealthy or poisonous plants to deter insects or herbivores



Key terms

aphid mimic

Health and Infectious Disease
Knowledge Organiser

Health

Health is a state of physical and mental well-being.

The following factors can affect health:

- Communicable and non-communicable diseases
- Diet
- Stress
- Exercise
- Life situation

Different types of disease may interact, for example:

- Defects in the immune system make an individual more likely to suffer from infectious diseases
- Viral infection can trigger cancers
- Immune reactions initially caused by a pathogen can trigger allergies, for example skin rashes and asthma
- Severe physical ill health can lead to depression and other mental illnesses.

Cancer

Cancer is the result of changes in cells that lead to uncontrolled growth and division by mitosis.

Rapid division of abnormal cells can form a tumour.

Malignant tumours are cancerous tumours that invade neighbouring tissues and spread to other parts of the body in the blood, forming secondary tumours.

Benign tumours are non-cancerous tumours that do not spread in the body.

Risk factors and non-communicable diseases

Risk Factor	Disease	Effects of risk factor
Diet (obesity) and amount of exercise	Type 2 diabetes	Body does not respond properly to the production of insulin, so blood glucose levels can not be controlled
	Cardiovascular disease	Increased blood cholesterol can lead to CHD
Alcohol	Impaired liver function	Long-term alcohol use causes liver cirrhosis (scarring), meaning the liver cannot remove toxins from the body or produce sufficient bile
	Impaired brain function	Damages the brain and can cause anxiety and depression
	Affected development of unborn babies	Alcohol can pass through the placenta, risking miscarriages, premature births and birth defects
Smoking	Lung disease and cancers	Cigarettes contain carcinogens, which can cause cancers
	Affected development of unborn babies	Chemicals can pass through the placenta, risking premature births and birth. defects
Carcinogens, such as ionising radiation, and genetic risk factors	Cancers	For example, tar in cigarettes and ultraviolet rays from the Sun can cause cancers
		Some genetic factors make an individual more likely to develop certain cancers

Treatment of non-communicable diseases linked to lifestyle risk factors – such as poor diet, drinking alcohol, and smoking – can be very costly, both to individuals and to the Government.

A high incidence of these lifestyle risk factors can cause high rates of non-communicable diseases in a population.

Key terms artificial heart benign carcinogen cholesterol coronary heart disease health malignant risk factor statin stent transplant

Health and Communicable Disease
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Non-specific defences

Non-specific defences of the human body against all pathogens include:

Skin
- physical barrier to infection
- produces antimicrobial secretions
- Microorganisms that normally live on the skin prevent pathogens growing

Nose
Cilia and mucus trap particle in the air, preventing them from entering the lungs. Trachea and bronchi produce mucus, which is moved away from the lungs to the back of the throat by the cilia, where it is expelled.

Stomach
Produces strong acid (pH2) that destroys pathogens in mucus, food and drinks.

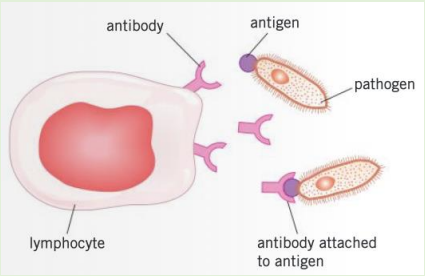
White blood cells

If a pathogen enters the body, the immune system tries to destroy the pathogen.
The function of white blood cells is to fight pathogens.
There are two main types of white blood cell - lymphocytes and phagocytes.

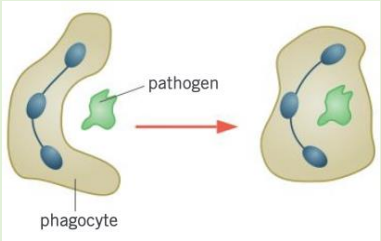
Lymphocytes fight pathogens in two ways:

Antitoxins
Lymphocytes produce **antitoxins** that bind to the toxins produced by some pathogen (usually bacteria). This *neutralises* the toxins.

Antibodies
Lymphocytes produce antibodies that target and help to destroy specific pathogens by binding to antigens (proteins) on the pathogen's surface's.



1. **Phagocytes** are attracted to areas of infection.
2. The phagocyte surrounds the pathogen and engulfs it.
3. Enzymes that digest and destroy the pathogen are released.



Key terms

Bacterium communicable disease fungicide fungus herd immunity pathogen protist sexually transmitted disease (STD) toxin vaccination vector virus

Health and Communicable Disease
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Producing monoclonal antibodies

Monoclonal antibodies are produced from a single clone of cells.

1 Mice are injected to stimulate the production of **lymphocytes** that make specific antibodies.

Lymphocytes make antibodies but *cannot* divide to form clones

2 Tumour cells are cultured. These cells can divide and grow endlessly.

Tumour cells *can* divide to form clones

3 The lymphocytes are fused with the tumour cells to create **hybridoma** cells.

A single hybridoma cell can divide to make a large number of identical cells called a clone.

All the cloned cells can make the antibody.

4 A large amount of the monoclonal antibody can then be produced, collected, and purified for use.

Use of monoclonal antibodies

Monoclonal antibodies are specific to a single binding site on a specific protein antigen.

This means they can be used to target specific chemicals or cells.

Diagnostic testing

Monoclonal antibodies can be used to measure the levels of a particular chemical in the blood or to detect pathogens

Research

Specific molecules can be located in cells and tissues by using monoclonal antibodies to bind them to a florescent dye.

Treatment

Monoclonal antibodies can deliver toxic chemicals and drugs specifically to cancer cells, limiting their harm to other cells in the body

Pregnancy tests

Pregnant women produce the hormone HCG, which is excreted in their urine.
Monoclonal antibodies can be used to detect HCG in a pregnant woman's urine:

1) Urine is applied to the end of the stick

2) The test stick contains monoclonal antibodies that only bind HCG, attached to a dye.

3) If HCG is present in the urine, the monoclonal antibodies cause a line of dye to appear. This means the pregnancy test is positive.

4) A second line appears in the control zone to show the test is valid, even if the result is negative.

Treating diseases

Antibiotics

- **Antibiotics** are medicines that can kill *bacteria* in the body.
- Specific bacteria need to be treated by specific antibiotics
- Antibiotics have greatly reduced deaths from infectious bacterial diseases, but antibiotic-resistant strains of bacteria are emerging.

Treating viral diseases

- Antibiotics *do not* affect viruses.
- Drugs that kill viruses often damage the body's tissues.
- Painkillers treat the symptoms of viral diseases but do not kill pathogens.

Discovering and developing new drugs

New drugs are extensively tested and trailed for

- Toxicity – is it harmful?
- Efficacy – does it work?
- Dose – what amount is safe and effective to give

Stages of clinical trials

Pre-clinical trials

Drug is tested in cells, tissues, and live animals.

Clinical trials

1. Healthy volunteers receive vary low doses to test whether the drugs is safe and effective.
2. If safe, large numbers of healthy volunteers and patients receive the drugs to find the optimum dose.

Peer review

Before being published, the results of clinical trials will be tested and checked by independent researchers. This is called **peer review**.

Double-blind trials

Some clinical trials give some of their patients a placebo drug – one that is known to have no effect.
Double-blind trials are when neither the patients nor the doctors know who has been given the real drug and who has been given the placebo. This reduces biases in the trail.

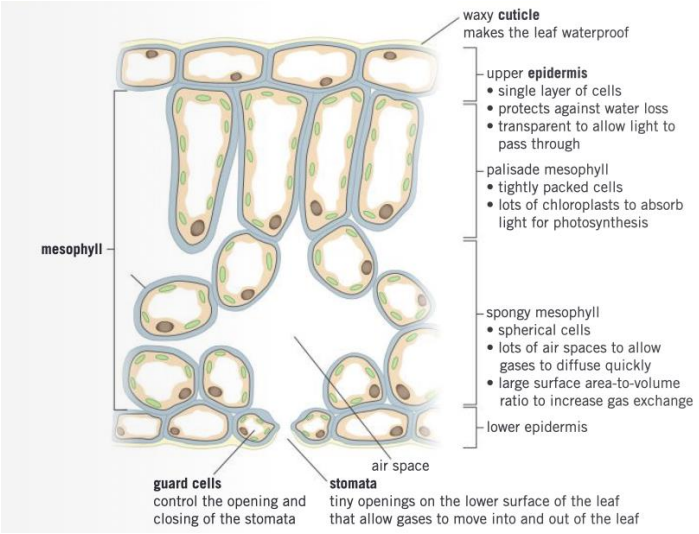
terms

Bacterium communicable disease fungicide fungus herd immunity pathogen prot
sexually transmitted disease (STD) toxin vaccination vector virus

Plant Tissues
Knowledge Organiser – Science – year 11

Tissues in a leaf

Leaves are organs because they contain many tissues that work together to perform photosynthesis.



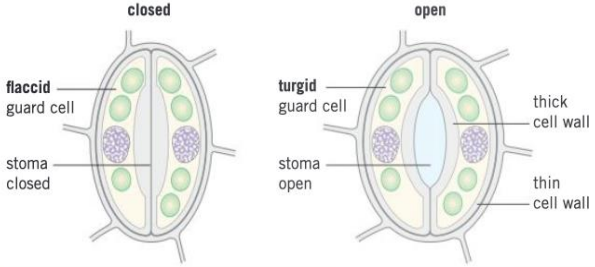
Stomata

Stomata are tiny openings in the undersides of leaves – this placement reduces water loss through evaporation.

They control gas exchange and water loss from leaves by:
- Allowing diffusions of carbon dioxide into the plant for photosynthesis
- Allowing diffusion of oxygen out of the plant

Guard cells are used to open and close the stomata.

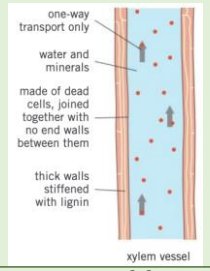
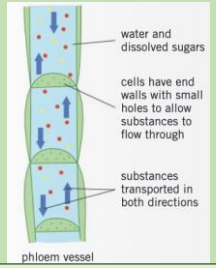
When a plant has plenty of water, the guard cells become turgid. The cell wall on the inner surface is very thick, so it cannot stretch as much as the outer surface. So as the guard cells swell up, they curve away from each other, opening the stoma.



Key terms

cuticle epidermis flaccid mesophyll stomata phloem xylem turgid translocation transpiration guard cell

Transportation in plants

	Transpiration	Translocation
Description	Water is lost through the stomata by evaporation. This pulls water up from the roots through the xylem and is called transpiration. The constant movement of water up the plant is called the transpiration stream.	The movement of dissolved sugars from the leaves to the rest of the plant through the phloem.
Importance	Provides water to cells to keep them turgid. Provides water to cells for photosynthesis Transports mineral ions to leaves.	Moves dissolved sugars made during photosynthesis to other parts of the plant. This allows for respiration, growth and glucose storage.
Specialised Tissues		

Factors affecting the rate of transpiration

Factor	Effect on transpiration	Because…
temperature	higher temperatures increase the rate of transpiration	water evaporates faster at higher temperatures
humidity	lower humidity increases the rate of transpiration	the drier the air the steeper the concentration gradient of water molecules between the air and the leaf
wind speed	more wind increases the rate of transpiration	wind removes the water vapour quickly, maintaining a steeper concentration gradient
light intensity	Higher light intensity increases the rate of transpiration	stomata open wider to let more carbo dioxide into the leaf for photosynthesis

Photosynthesis
Knowledge Organiser - Science – year 11

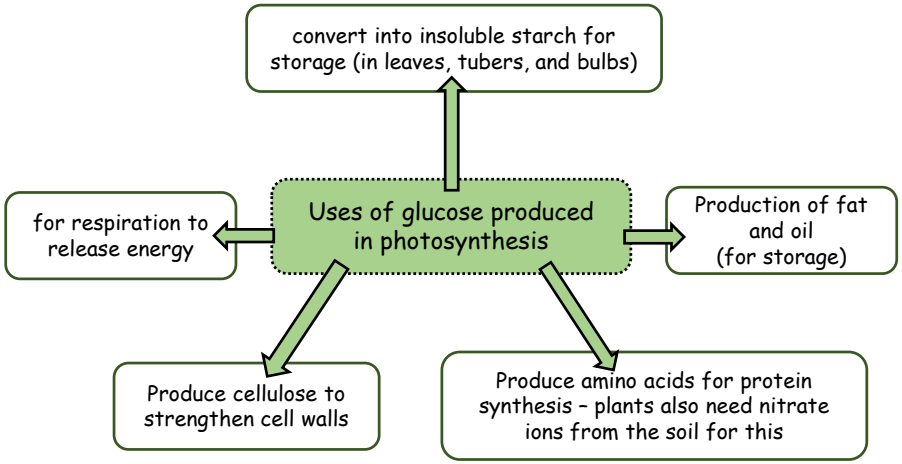
Photosynthesis reaction

Photosynthesis is a chemical reaction in which energy is transferred from the environment as light from the Sun to the leaves of a plant. This is an endothermic reaction.

Chlorophyll, the green pigment in chloroplasts in the leaves, absorbs the light energy. Leaves are well adapted to increase the rate of photosynthesis when needed.

carbon dioxide + water $\xrightarrow{\text{light}}$ **glucose** + oxygen

$6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2$



Inverse square law

As the distance of a light source from a plant increases, the light intensity decreases – this is called an inverse relationship. This relationship is not linear, as light intensity varies in inverse proportion to the square of the distance:

$$\text{light intensity} \propto \frac{1}{\text{distance}^2}$$

For example, if you double the distance between a light source and a plant, light intensity falls by three quarters.

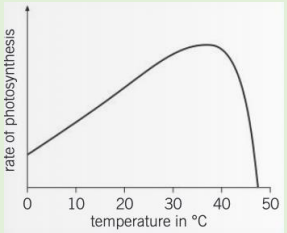
Rate of photosynthesis

A limiting factor is anything that limits the rate of a reaction when it is in short supply.

The limiting factors for photosynthesis are
- Temperature
- Carbon dioxide concentration
- Light intensity
- Amount of chlorophyll

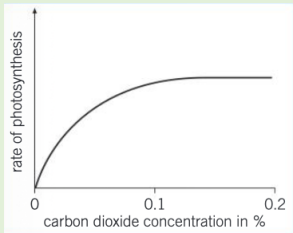
Less chlorophyll in the leaves reduces the rate of photosynthesis. More chlorophyll may be produced by plants in well-lit areas to increase the photosynthesis rate.

Limiting factors and photosynthesis rate



At low temperatures the rate of photosynthesis is low because the reactant molecules have less kinetic energy.

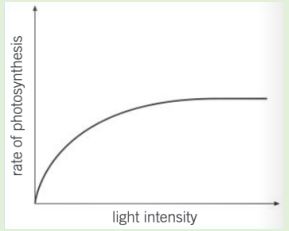
Photosynthesis is an enzyme-controlled reaction, so at high temperatures the enzymes are denatured and the rate quickly decreases.



Carbon dioxide is used up in photosynthesis, so increasing carbon dioxide concentration increases the rate of photosynthesis.

At a certain point, another factor becomes limiting.

Carbon dioxide is often the limiting factor for photosynthesis.



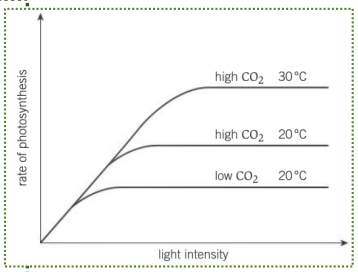
Light energy is needed for photosynthesis, so increasing light intensity increases the rate of photosynthesis.

At a certain point, another factor becomes limiting.

Photosynthesis will stop if there is little or no light.

Interaction of limiting factors

Limiting factors often interact, and any one may be limiting photosynthesis.
For example, on the graph the lowest curve has both carbon dioxide and temperature limiting photosynthesis. Temperature is limiting for the middle curve, and the highest curve shows photosynthesis rate increases when both temperature and carbon dioxide are increased until another factor becomes limiting.



Greenhouse economics

Commercial greenhouses control limiting factors to get the highest possible rates of photosynthesis so they can grow plants as quickly as possible or produce the highest yields, whilst making a profit.

Key terms

carbon dioxide | chlorophyll | chloroplast | endothermic | glucose | inverse square law | limiting factor | photosynthesis

Respiration
Knowledge Organiser - Science – year 11

Cellular respiration

Cellular respiration is an exothermic reaction that occurs continuously in the mitochondria of living cells to supply the cells with energy.

The energy released during respiration is needed for all living processes, including

- chemical reactions to build larger molecules, for example, making proteins from amino acids
- muscle contraction for movement
- keeping warm

Respiration in cells can take place aerobically (using oxygen) or anaerobically (without oxygen).

Type of respiration	Oxygen required?	Relative amount of energy transferred
aerobic	✔	Complete **oxidation** of glucose – large amount of energy is released
anaerobic	✘	Incomplete oxidation of glucose – much less energy is released per glucose molecule than in aerobic respiration

Aerobic respiration

glucose + oxygen → carbon dioxide + water

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

Anaerobic respiration in muscles

glucose → lactic acid

$C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$

Fermentation

Anaerobic respiration in plant and yeast cells is represented by the equation:

glucose → ethanol + carbon dioxide (energy transferred to the environment)

Anaerobic respiration in yeast cells is called fermentation.

The products of fermentation are important in the manufacturing of bread and alcoholic drinks.

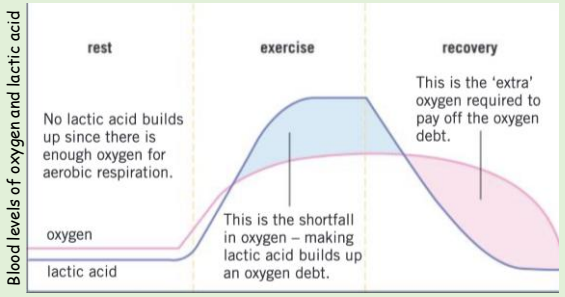
Response to exercise

During exercise the human body reacts to the increased demand for energy.

To supply the muscles with more oxygenated blood, heart rate, breathing rate, and breath volume all increase.

If insufficient oxygen is supplied, anaerobic respiration takes place instead, leading to the build up of lactic acid.

During long periods of vigorous exercise, muscles become fatigued and stop contracting efficiently.



After exercise, the lactic acid accumulated during anaerobic respiration needs to be removed. Oxygen debt is the amount of oxygen needed to react with the lactic acid to remove it from cells.

Removal of lactic acid

Lactic acid in the muscles ⇩ Transported to the liver in the blood ⇩ Lactic acid is converted back to glucose

Metabolism

Metabolism is the sum of all the reactions in the body.

The energy released by respiration in cells is used for the continual enzyme-controlled processes of metabolism that produce new molecules.

Metabolic processes include the synthesis and breakdown of:

Carbohydrates
- synthesis of larger carbohydrates from sugars (starch, glycogen and cellulose)
- breakdown of glucose in respiration to release energy

Proteins
- synthesis of amino acids from glucose and nitrate ions
- amino acids used to form proteins
- excess proteins broken down to form urea for excretion

Lipids
- synthesis of lipids from one molecule of glycerol and three molecules of fatty acid

Key terms

aerobic anaerobic exothermic fermentation lactic acid metabolism mitochondria oxidation oxygen debt respiration

Investigating Photosynthesis

Knowledge Organiser - Science – year 11

Aim

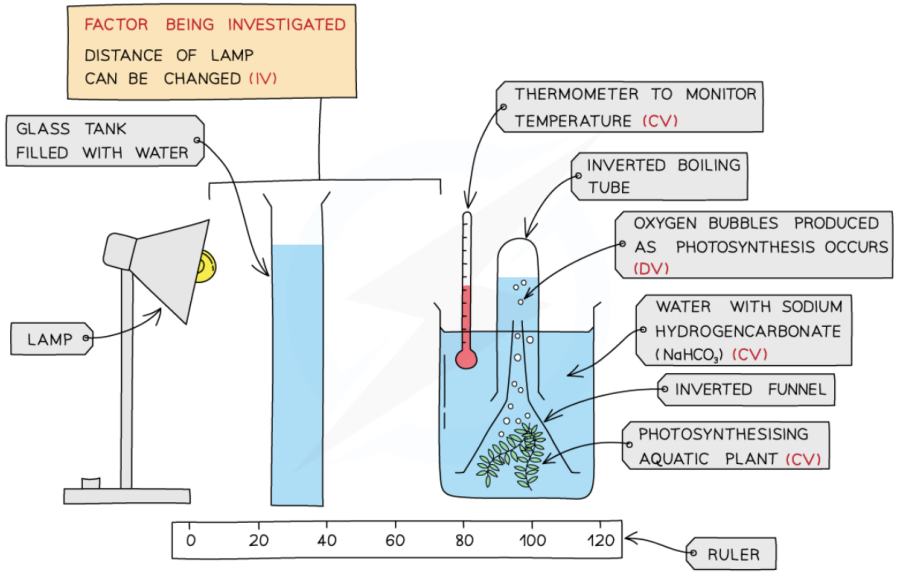
Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed

Variables

Dependent – The number of bubbles / volume of oxygen produced
Independent – Distance between light source and plant / light intensity.
Control – Temperature (can be controlled using and LED bulb or a heat shield, carbon dioxide concentration, type of plant, length of plant, mass of plant.

Method

Place a piece of pondweed (Elodea or Cabomba are often used), into a beaker of water
Use a light a set distance from the plant
Record the number of bubbles observed in three minutes
Repeat steps for different distances



Improvements

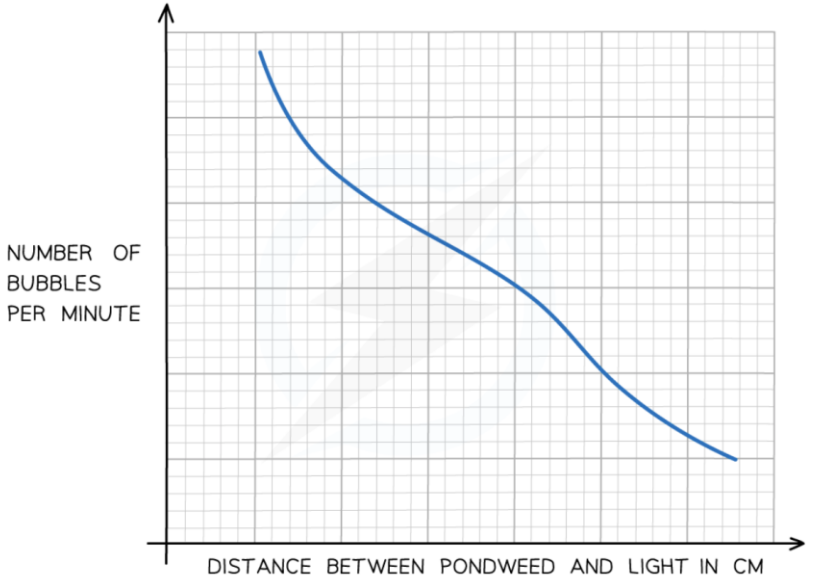
- Use a gas syringe to collect the volume of gas produced
- Repeat the experiment at least twice for each distance and calculate the mean number of bubbles
- Use of a glass tank between lamp and plant to prevent heating of the plant, or using an LED bulb that releases very little heat energy

Changing the Independent Variable

- To investigate the impact of carbon dioxide concentration the concentration of sodium hydrogen carbonate can be changed.
- Use different temperatures of sodium hydrogen carbonate solution.

Results

- As the distance between the plant and light source increases the number of bubbles decreases. This shows that the rate of photosynthesis decreases at lower light intensities.



Key terms

carbon dioxide chlorophyll chloroplast endothermic glucose inverse square law limiting factor photosynthesis

Biology

- Paper 2

Homeostasis and the nervous system
Knowledge Organiser

The nervous system

Function

The nervous system enables humans to react to their surroundings and to coordinate their behaviour – this includes both voluntary and involuntary actions.

Structure

The nervous system is made up of the central nervous system (CNS) and a network of nerves.
The CNS comprises the brain and the spinal cord.

Stimulus
A change in the environment (stimulus) is detected by receptors

Receptor
Information from receptors passes along cells (neurones) to the CNS as electrical impulses

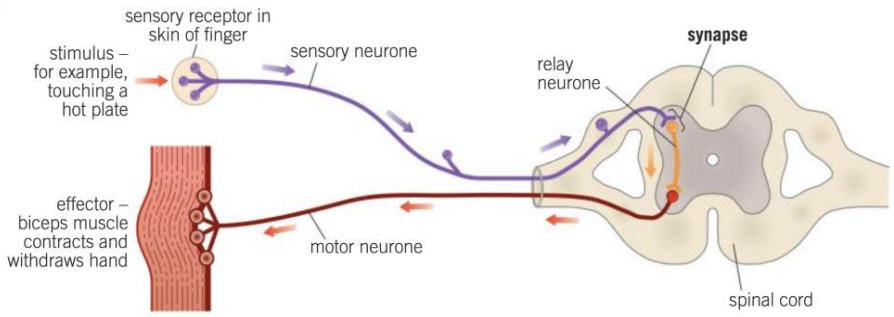
Coordinator
The CNS coordinates the body's response to the stimulus

Effector
Effectors bring about a response, such as glands secreting hormones or muscles contracting

Response
The body responds to the stimulus

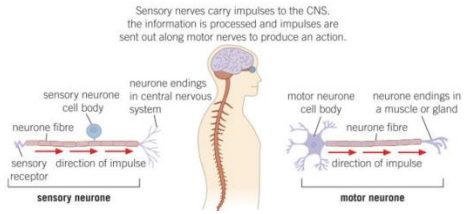
Reflex arcs

Reflex actions of the nervous system are automatic and rapid – they do not involve the conscious part of the brain.
Reflex actions are important for survival because they help prevent damage to the body.

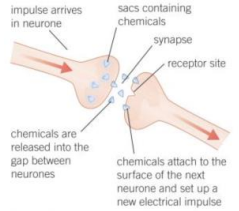


Reflex arc structures

Neurones
Carry electrical impulses around the body – relay neurones connect sensory neurones to motor neurones

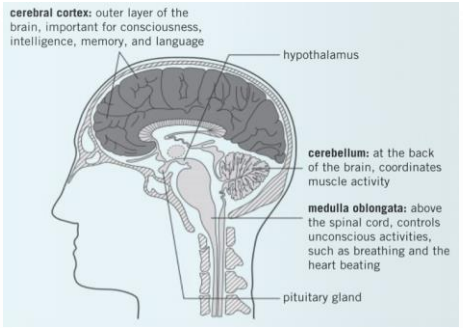


Synapses
Gaps between neurones, which allow electrical impulses in the nervous system to cross between neurones.



The Brain

The brain controls complex behaviour. It is made of billions of interconnected neurones, with different regions that carry out different functions.



Research on the brain

Neuroscientists have mapped the regions of the brain to particular functions by studying patients with brain damage, using MRI scanning techniques, and electrically stimulating parts of the brain.

The brain is very complex and delicate, making investigating and treating brain disorders difficult.

Brain damage and diseases can involve many different neurones, chemicals, and areas of the brain. Treatment is difficult because

- It is not fully understood what each area of the brain does
- Drugs do not always reach the brain through its membranes
- Surgery can easily cause unintended damage.

Key terms

brain | central nervous system | coordination centre | effectors | homeostasis | involuntary | neurones | receptors | reflex action | spinal cord | stimulus | synapse

Homeostasis and the nervous system
Knowledge Organiser

Homeostasis

Homeostasis is the regulation of internal conditions (of a cell or whole organism) in response to internal and external changes, to maintain optimum conditions for functioning.

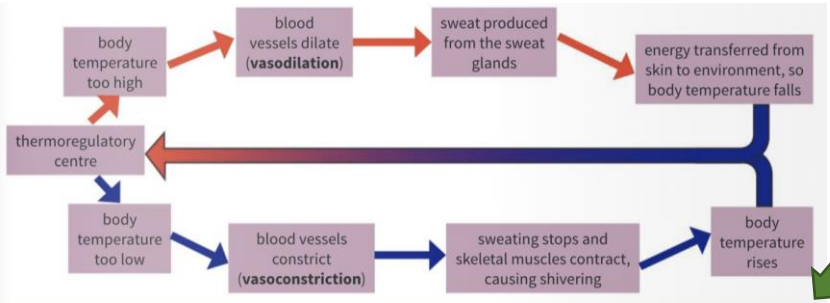
This maintains optimum conditions for all cell functions and enzyme action.

In the human body, this includes control of
- blood glucose concentration
- body temperature
- water levels

The automatic control systems of homeostasis may involve nervous responses or chemical responses.

All control systems involve
- Receptor cells, which detect stimuli (changes in the environment)
- Coordination centres (such as the brain, spinal cord, or pancreas), which receive and process information from receptors
- Effectors (muscles or glands), which produce responses to restore optimum conditions.

Controlling Body Temperature

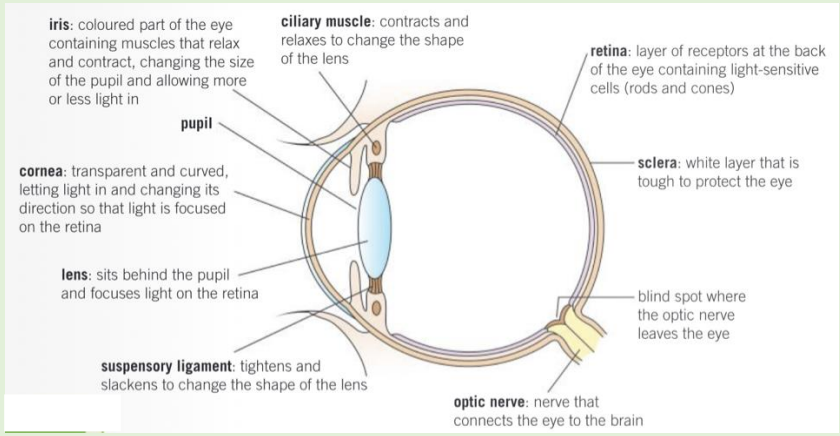


Body temperature is monitored and controlled by the thermoregulatory centre in the brain. The centre contains receptors sensitive to the blood temperature.
The skin also contains temperature receptors and sends nervous impulses to the thermoregulatory centre.

Treatment of eye defects
- Spectacle lenses to refract light rays to focus on the retina
- hard and soft contact lenses
- laser eye surgery- to change the shape of the cornea
- replacement lenses – adding another lens inside the eye

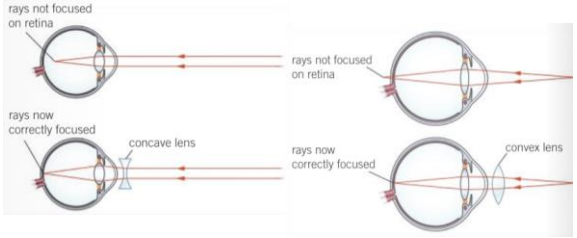
Structure of the eye

The eye is a sense organ containing receptors sensitive to light intensity and colour.



Common defects of the eye

Hyperopia
Long-sightedness, when near objects look blurred because rays of light focus behind the retina. This is corrected using convex lenses.



Accommodation
Accommodation is the process of changing the shape of the lens to focus on near or distant objects.

To focus on a near object:
- ciliary muscles contract
- suspensory ligaments are slack
- so the lens is thicker and more curved, and refracts light rays more strongly.

to focus on a distant object
- ciliary muscles relax
- suspensory ligaments are pulled tight
- so lens is thinner and flatter, and only refracts light rays slightly.

Key terms

brain central nervous system coordination centre effectors homeostasis involuntary neurones receptors reflex action spinal cord stimulus synapse accommodation cancave. convex. hyperopia. myopia thermoregulatory centre vasoconstriction. vasodilation

Hormonal Control
Knowledge Organiser

Human endocrine system

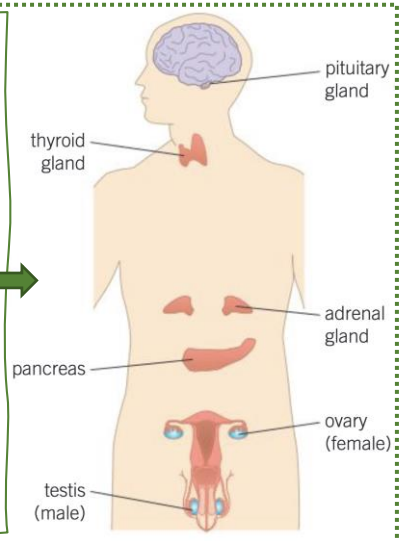
The endocrine system is composed of glands that secrete chemicals called hormones into the bloodstream.

The blood carries hormones to a target organ, where an effect is produced.

Compared to the nervous system, the effects caused by the endocrine system are slower but act for longer.

The pituitary gland, located in the brain, is known s a 'master gland', because it secretes several hormones into the blood.

These hormones then act on other glands to stimulate the release of other hormones, and bring about effects.

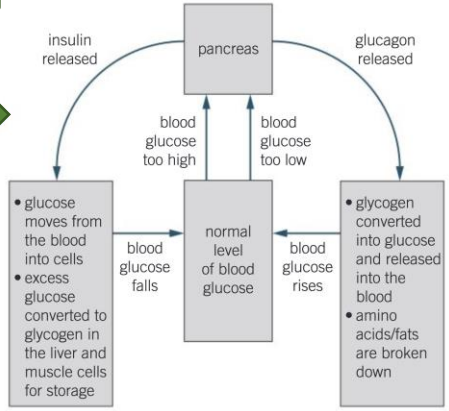


Endocrine gland	Role of the hormone
Pituitary	• Controls growth in children • Stimulates the thyroid gland to make thyroxine to control metabolic rate • In females – stimulates the ovaries to make and release eggs • In males – stimulate the testes to make sperm
Thyroid	• Controls the rate of metabolism
Pancreas	• Controls blood glucose levels
Adrenal	• Prepares the body for stress • Involved in the 'fight or flight' response
Ovaries	• Controls the development of female secondary sexual characteristics • Controls the menstrual cycle
Testes	• Controls the development of male secondary sexual characteristics • Involved in the production of sperm

Control of blood glucose levels

Blood glucose (sugar) concentration is monitored and controlled by the pancreas.

This is an example of negative feedback control, as the pancreas switches production between the hormones insulin and glucagon to control blood glucose levels.



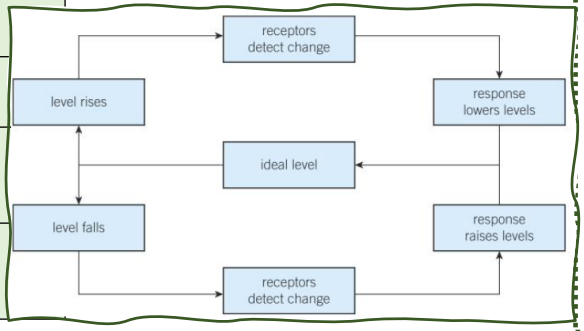
Diabetes

Diabetes is a non-communicable disease where the body either cannot produce or respond to insulin, leading to uncontrolled blood glucose concentrations.

Type 1 diabetes	Type 2 diabetes
Early onset	Usually later onset, obesity is a risk factor
Pancreas stops producing sufficient insulin	Body doesn't respond to the insulin produced
Commonly treated through insulin injections, also diet control and exercise	Commonly treated through a carbohydrate controlled diet and exercise

Negative feedback – HT Only

Negative feedback systems work to maintain a steady state. For example, blood glucose, water, and thyroxine levels are all controlled in the body by negative feedback.



Adrenaline
- produced by adrenal glands in time of fear or stress
- Increases heart rate
- Boosts delivery of oxygen and glucose to brain and muscles
- Prepares the body for 'fight or flight' response
- Does not involve negative feedback, as adrenal glands stop producing adrenaline

Thyroxine
- Produced by the thyroid gland
- Regulates how quickly your body uses energy and makes proteins (metabolic rate)
- Important for growth and development
- Levels controlled by negative feedback

Key terms: brain, central nervous system, coordination centre, effectors, homeostasis, involuntary, neurones, receptors, reflex action, spinal cord, stimulus, synapse

Hormonal Control
Knowledge Organiser

Hormones in human reproduction

During puberty, reproductive hormones cause the secondary sex characteristics to develop:

Oestrogen

- Main female reproductive hormone
- Produced in the ovary
- At puberty, eggs begin to mature and one is released every 28 days

Testosterone

- Main male reproductive hormone
- Produced by the testes
- Stimulates sperm production

Several hormones are involved in the menstrual cycle. Their functions are given in the table, and their levels vary as shown in the figures

Hormone	Released by	Function
Follicle stimulating hormone (FSH)	Pituitary gland	• Causes eggs to mature in the ovaries • Stimulates ovaries to produce oestrogen
Luteinising hormone (LH)	Pituitary gland	• Stimulates the release of mature eggs from the ovaries (ovulation)
Oestrogen	ovaries	• Causes lining of uterus wall to thicken • Inhibits release of FSH • Stimulates release of LH
Progesterone	ovaries	• Maintains thick uterus lining • Inhibits release of FSH and LH

Key terms

contraception follicle stimulating hormone infertility in vitro fertilisation oestrogen ovary luteinising hormone menstrual cycle ovulation progesterone testes uterus

Higher Tier Only: Treating infertility with hormones

Hormones are used in modern reproductive technologies to treating infertility.

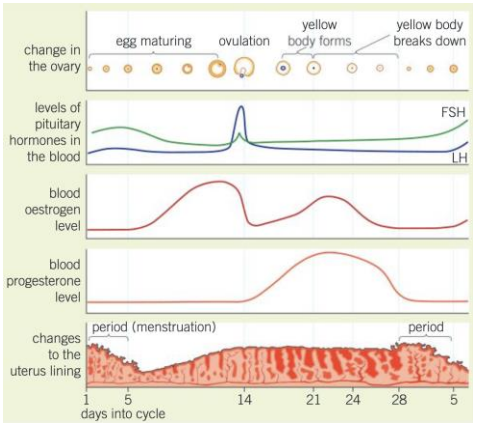
FSH and LH can be given as a drug to treat infertility, or in vitro fertilisation (IVF) treatment may be used.

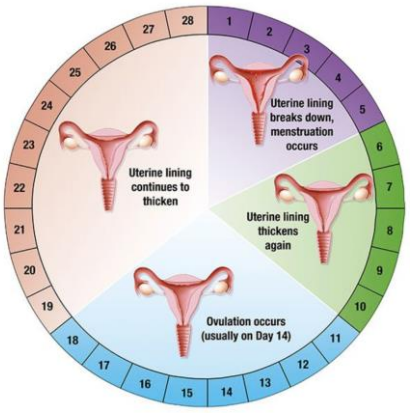
IVF treatment

1. Mother given FSH and LH to stimulate the maturation of several eggs
2. Eggs collected from the mother and fertilised by sperm from the father in a laboratory
3. Fertilised eggs develop into embryos
4. One or two embryos are inserted into the mother's uterus (womb) when the embryos are still tiny balls of cells.

Fertility treatment has some disadvantages:

- It is emotionally and physically stressful
- It has a low success rate
- It can lead to multiple births, which are a high risk to both the babies and the mother.





Contraception

Fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception.

Hormonal contraception

- Oral contraceptives – contain hormones to inhibit FSH production so no eggs mature
- Injection, implant, skin patch or intrauterine device (IUD) – slowly release progesterone to inhibit maturation and release of eggs; can last months or years

Non-hormonal contraception

- Barrier methods, for example, condoms and diaphragms – prevent sperm reaching the egg
- Copper IUD – prevents the implantation of an embryo
- Surgical methods of male and female sterilisation
- Spermicidal agents – kill or disable sperm
- Abstaining from intercourse when an egg may be in the oviduct

Inheritance
Knowledge Organiser – Year 10 – Science

Types of reproduction

Sexual	Asexual
Two parents	One parent
Cell division thorough meiosis	Cell division by mitosis
Joining of male and female sex cells (gametes) – sperm and egg in animals, pollen and ovule in plants	No fusion of gametes
Produces non-identical offspring that are genetically different to parents	Produces offspring that are genetically identical to parent (clones)
Results in wide variation within offspring and species	No mixing of genetic information
Advantages: • Produces variation in offspring • If the environment changes, the offspring may have a survival advantage by natural selection due to their genetic variation.	Advantages: • Only one parent needed • Time and energy efficient as do not need to find a mate • Faster than sexual reproduction • Many identical offspring can be produced when conditions are favourable • Successful traits passed on as offspring are identical
Disadvantages • Finding a mate and reproducing is time consuming and requires lots of energy • Much slower than asexual reproduction	Disadvantages • Reduced genetic variation – if the environment changes, the offspring may have a survival disadvantage • Harmful mutations in parent would be passed on to all offspring

Depending on the circumstances, some organisms reproduce by both methods. For example:

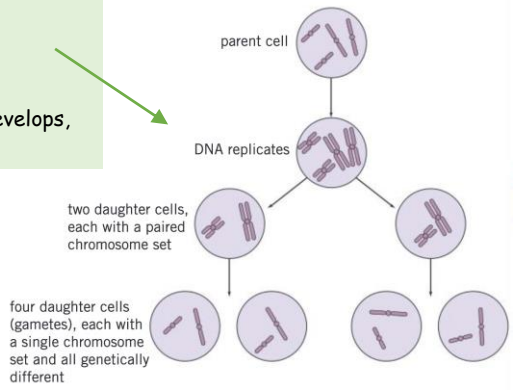
- malaria parasites reproduce asexually in human hosts, but sexually in mosquitoes
- many fungi reproduce asexually by spores, but also sexually to give variation.
- many plants produce seeds sexually, but also reproduce asexually by bulb division (daffodils) or runners (strawberry plants).

Meiosis

Meiosis is a type of cell division that makes gametes in the reproductive organs.

Meiosis halves the number of chromosomes in gametes, and fertilisation (joining of two gametes) restores the full number of chromosomes.

The fertilised cell divides by mitosis, producing more cells. As the embryo develops, the cells differentiate.



Genetic inheritance

You need to be able to explain these terms about genetic inheritance:

gamete	Specialised sex cell formed by meiosis
chromosomes	Long molecule made from DNA found in the nucleus of cells
gene	Part of a chromosome that codes for a protein – some characteristics are controlled by a single gene (e.g. fur colour in mice and red-green colour blindness in humans), but most are controlled by multiple genes interacting
allele	Different forms of the same gene
dominant	Allele that only needs one copy present to be expressed
recessive	Allele that needs two copies to present to be expressed
homozygous	When an individual carries two copies of the same allele for a trait
heterozygous	When an individual carriers two alleles for a trait
genotype	Combination of alleles an individual has
phenotype	Physical expression of the genotype – the characteristic shown

Key terms

allele chromosomes clone DNA dominant double helix fertilisation gamete gene genetic cross genome genotype homozygous heterozygous meiosis mitosis phenotype Punnett square recessive

Inheritance
Knowledge Organiser – Year 10 – Science

DNA and the genome

Genetic material in the nucleus of a cell is composed of DNA.

DNA is made up of two strands forming a double helix.

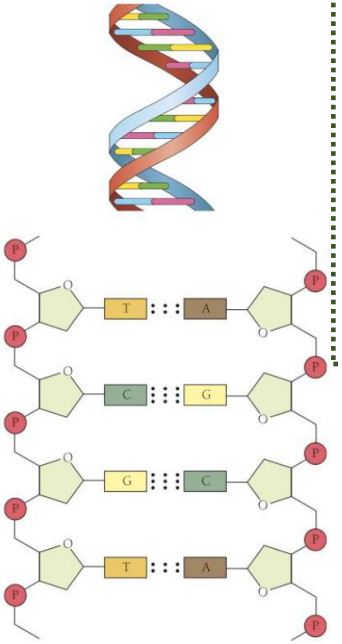
DNA is contained in structures called chromosomes.

A gene is a small section of DNA on a chromosome that codes for a specific sequence of amino acids, to produce a specific protein.

The genome of an organism is the entire genetic material of that organism.

The whole human genome has been studied, and this has allowed scientists to:
- Search for genes linked to different diseases
- Understand and treat inherited disorders
- Trace human migration patterns from the past.

Structure of DNA



DNA is a polymer made from four different nucleotides.

A nucleotide is a molecule made of phosphate, a sugar, and one of four organic bases (A, C, G and T).

A sequence of three bases codes for a particular amnio acid.

The order of the bases determines the order in which amino acids are assembled to produce a specific protein.

In complementary DNA strands, a C base is always linked to a G base on the opposite strand, and a T to an A.

Inherited disorders

Some disorders are due to the inheritance of certain alleles:
- Polydactyly (extra finger or toe) is caused by a dominant allele.
- Cystic fibrosis (a disorder of cell membranes) is caused by a recessive allele.

Embryo screening and gene therapy may alleviate suffering from these disorders, but there are ethical issues surrounding their use.

Protein Synthesis

Proteins are synthesised on the ribosomes using a template of DNA.

Carrier molecules bring amino acids to add to the protein chain in the correct order.

When the protein is complete it folds up to form a specific shape, and this shape allows proteins to do a specific job (as enzymes and hormones, or forming structures).

Non-coding parts of DNA can control the expression of genes by switching them on and off.

Mutations and genetic variability

Mutations occur continuously and change the base code of DNA. In coding DNA they may alter the activity of a protein:
- Most do not alter the appearance of function of the protein the DNA produces.
- A change in DNA structure may change the amino acid order, causing a gene to synthesis a different protein.
- Some mutations alter the shape of the protein, so the protein may no longer fit the substrate binding site, or lose its strength if it is structural.

In non coding DNA, mutations may alter how genes are expressed.

Genetic crosses

A genetic cross is when you consider the offspring that might result from two known parents. Punnett squares can be used to predict the outcome of a genetic cross, for both the genotypes the offspring might have and their phenotypes.
For example, the cross bb (brown fur) x BB (black fur) in mice:

		mother	
		B	B
father	b	Bb	Bb
	b	Bb	Bb

Offspring genotype: 100% Bb
Offspring phenotype: all black fur

Sex determination

Normal human body cells contain 23 pairs of chromosomes-one of these pairs determines the sex of the offspring.
In human females the sex chromosomes are the same (XX) and in males there are different (XY).
A Punnett square can be used to determine the probability of offspring being male or female. The probability is always 50% in human as there are two XX and two XY outcomes.

		mother	
		X	X
father	X	XX	XX
	Y	XY	XY

Key terms

allele, chromosomes, clone, DNA, dominant, double helix, fertilisation, gamete, gene, genetic cross, genome, genotype, homozygous, heterozygous, meiosis, mitosis, phenotype, Punnett square, recessive

Evolution
Knowledge Organiser – Year 10 – Science

Classification of living organisms

Carl Linnaeus developed a system to classify living things into groups, based upon observable characteristics.

New models of classification were proposed as understanding of biochemical processes developed and improvements in microscopes led to discoveries of internal structures.

There is now a three-domain system developed by Carl Woese, dividing organisms into:

- Bacteria (true bacteria)
- Archea (primitive bacteria usually living in extreme conditions)
- Eukaryota (including protists, plants, fungi and animals).

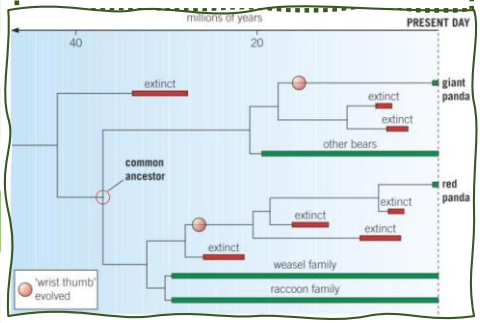
Kingdom
↓
Phylum
↓
Class
↓
Order
↓
Family
↓
Genus
↓
Species

Organisms are named by the binomial system of genus and species e.g. **Homo Sapiens**

Homo is our **Genus**
Sapien is our **Species**

Evolutionary Trees

Evolutionary trees use current classification data for living organisms and fossil data for extinct organisms to show how scientists believe organisms are related.

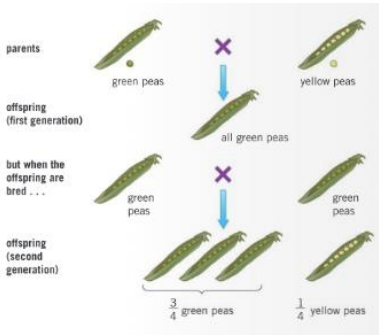


Understanding of genetics

Gregor Mendel development our understanding of genetics by carrying out breeding experiments on plants in the mid-nineteenth century.

For example, he showed that crossing a plant that produces yellow peas and a plant that produces green peas always bred offspring with green peas. But when crossing these offspring, some offspring of later generations might have yellow peas again.

Through experiments like these, Mendel observed that the inheritance of each characteristic is determined by units – later called genes – that are passed on unchanged to offspring and that these genes can be dominant or recessive.



The significance of Mendel's work was not recognised until after his death, because

- Most scientists believed in blended inheritance (e.g. a white flower and a purple flower producing a lilac flower).
- He published his work in an obscure journal so not many people saw it.
- He was a monk and not a scientist.

Development of gene theory

Further work by many scientists led to the development of gene theory.

In the late nineteenth century the behaviour of chromosomes during cell division was observed.

↓

In the early twentieth century genes and chromosomes were observed to behave similarly, leading to the idea that genes were located on chromosomes.

↓

In the mid-twentieth century the structure of DNA and mechanism of gene function were determined.

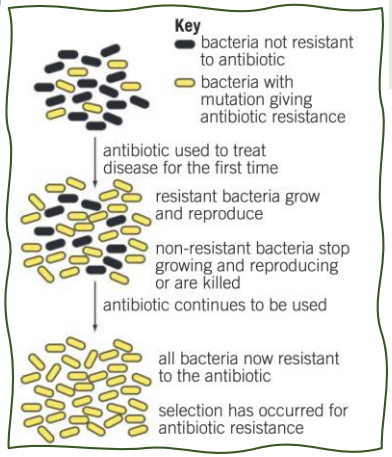
Resistant bacteria

Bacteria can evolve rapidly because the reproduce very quickly. This has lead to many strains of bacteria developing antibiotic resistance, such as MRSA. The development of antibiotic resistance is evidence for the theory of evolution by natural selection.

The development of new antibiotics is expensive and slow, so is unlikely to keep up with the emergence of new antibiotic-resistant bacteria strains.

To reduce the rise of antibiotic-resistant strains

- doctors should only prescribe antibiotics for serious bacterial infections
- patients should complete their courses of antibiotics so all bacteria are killed and non survive to form resistant strains.
- the use of antibiotics in farming and agriculture should be restricted.



Key terms: Antibiotic resistance | binomial system | evolution | evolutionary tree | extinction | fossil record | natural selection | three-domain system

Variation

Knowledge Organiser – Year 10 – Science

Variation in populations

Differences in the characteristics of individuals in a population are called variation.
Variation may be due to differences in:

- the genes they have inherited, for example eye colour (genetic causes)
- the environment in which they have developed, for example, language (environmental causes)
- a combination of genes and the environment.

Mutation

There is usually a lot of genetic variation within a population of species – this variation arises from mutations.
A mutation is a change in a DNA sequence:

- mutations occur continuously
- very rarely a mutation will lead to a new phenotype
- some mutations may change an existing phenotype and most have no effect
- if a phenotype is suited to an environmental change, it can lead to a relatively rapid change in the species – this is the theory of evolution by natural selection.

Methods of Cloning

Tissues culture
Small groups of cells from part of a plant are used to grow identical new plants. This is important for preserving rare plant species and growing plants commercially in nurseries.
Cutting
An older, simple method used by gardeners to produce many identical plants from a parent plant.
Embryo transplant
Cells are split apart from developing animal embryo before they become specialised, then the identical embryos are transplanted into host mothers.

Benefits	Risks
• Large number of identical offspring produced • Quick and economical • Desired characteristics guaranteed	• Limits variation and causes reduction in gene pool • Clones may be vulnerable to diseases/changes in the environment • Ethical considerations around cloning living organisms

Selective Breeding

Selective breeding (artificial selection) is the process by which humans breed plants and animals for particular genetic characteristics.
Humans have been using selective breeding for thousands of years, since breeding crops from wild plants and domesticating animals.

Process of selective breeding:

1. choose parents with the desired characteristics from a mixed population
2. breed them together
3. choose offspring with the desired characteristic and breed them together
4. continue over many generations until all offspring show the desired characteristic.

The characteristic targeted in selective breeding can be chosen for usefulness or appearance, for example

- disease resistance in food crops
- animals that produce more meat or milk
- domestic dogs with a gentle nature
- larger or unusual flowers.

Disadvantages of selective breeding:

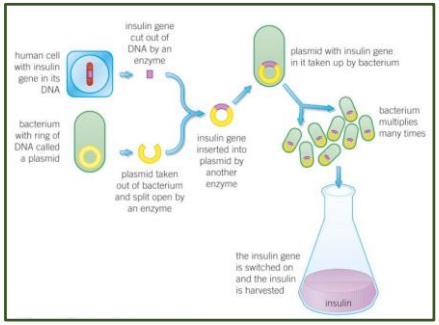
- can lead to inbreeding, where some breeds are particularly prone to inherited defects or diseases
- reduces variation, meaning all members of a species could be susceptible to certain diseases.

Genetic Engineering

Genetic engineering is a process that involves changing the genome of an organism by introducing a gene from another organism to produce a desired characteristic.

For example:

- Bacterial cells have been genetically engineered to produce useful substances, such as human insulin to treat diabetes.
- Plant crops have been genetically engineered to be resistant to diseases, insects, or herbicides, or to produce bigger and better fruits and higher crop yields. Crops that have undergone genetic engineering are called genetically modified (GM).

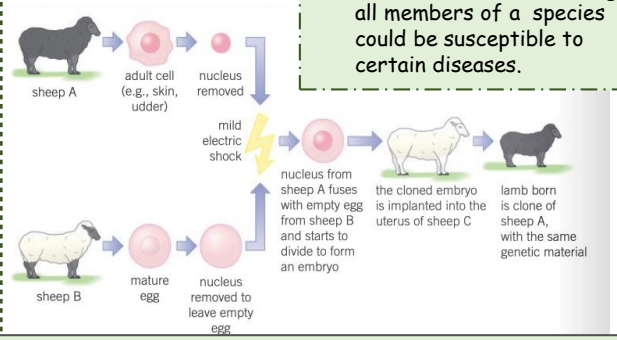


There are many benefits to genetic engineering in agriculture and medicine, but also some risks and moral objections.

Benefits	Risks
• Potential to overcome some inherited human diseases • Can lead to higher value of crops as GM crops have bigger yields than normal • Crops can be engineered to be resistant to herbicides, make their own pesticides, or be better adapted to environmental conditions.	• Genes from GM plants and animals may spread to other wildlife, which could have devastating effects on ecosystems • Potential negative impacts on populations of wild flowers and insects • Ethical concerns, for example, in the future people could manipulate the genes of foetuses to ensure certain characteristics • Some people believe the long-term effects on health of eating GM crops have not been fully explored.

Cloning

A clone is an individual that has been produced asexually and is genetically identical to its parent. There are several methods for producing both plant and animal clones, but there are benefits and risks associated with cloning.



Key terms genetically modified · genetic engineering · inbreeding · mutation · selective breeding · variation

Evolution
Knowledge Organiser – Year 10 – Science

Theory of evolution

Evolution is the gradual change in the inherited characteristics of a population over time.

Evolution occurs through the process of natural selection and may result in the formation of new species.

Process of natural selection

The theory of evolution by natural selection states that:

- Organisms within species show a wide variation in phenotype
- Individuals with characteristics most suited to the environment are more likely to survive and breed successfully
- These characteristics are then passed on to their offspring.

Speciation

Alfred Russel Wallace independently proposed the theory of evolution by natural selection.
He published joint writings with Darwin in 1858 on the subject, prompting Darwin to publish his book the next year.
Wallace worked worldwide gathering evidence for evolutionary theory.
He is best known for his work on warning colours in animals and for his pioneering work on the theory of speciation.

Speciation in the gradual formation of a new species as a result of evolution. More evidence and work from scientists over time have led to our current understanding of the theory of speciation.

1. Two populations of one species are isolated.
2. Natural selection occurs so that the better-adapted individuals reproduce and pass on the genes for these different characteristics
3. The populations have an increasing number of genetic mutations as they adapt to their different environments
4. Eventually the two populations are so genetically different they cannot breed to produce fertile offspring.

Darwin's work

Charles Darwin proposed the theory of evolution by natural selection after gathering evidence from a round-the-world expedition, experimentation and discussion.

This states that all living species evolved from a common ancestor that first developed more than three billion years ago.

Darwin published this theory in *On the Origin of the Species* (1859). His ideas were considered controversial and only gradually accepted because

- They challenged the idea that God made all of the Earth's animals and plants
- There was insufficient evidence at the time the theory was published, although much more evidence has been gathered since
- Mechanisms of inheritance and variation were not known at the time.
- Other theories, such as that of Jean-Baptiste Lamarck, were based on the idea that the changes that occur in an organism over its lifetime could be passed on to its offspring. We now know that in the majority of cases this type of inheritance cannot occur.

Evidence for evolution

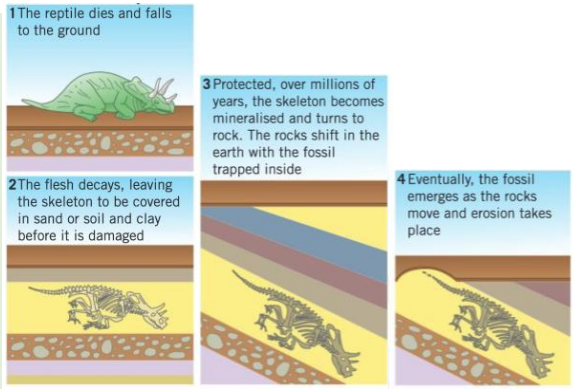
The theory of evolution by natural selection is now widely accepted because there are lots of data to support it, such as

- It has been shown that characteristics are passed on to offspring in genes
- Evidence from the fossil record
- The evolution of antibiotic resistance in bacteria

Fossils

Fossils are the remains of organisms from millions of years ago, which are found in rocks.
Fossils can be formed from:

- Parts of the organism that do not decay because one or more of the conditions needed for decay are absent
- Hard parts of an organism (e.g. bones) when replaced by minerals
- Preservation of the traces of organisms (e.g. burrows, footprints, and rootlet traces).



Extinction

Extinction is when there are no remaining individuals of a species still alive.
Factors that may contribute to a species' extinction include:

- new predators
- new diseases
- new competitors
- catastrophic events
- changes to the environment

Benefits of the fossil record	Problems with the fossil record
• Can tell scientists how individual species have changed over time • Fossils allow us to understand how life developed over the Earth's history • Fossils can be used to track the movement of a species or its ancestors across the world	• Many early organisms were soft-bodied, so most decayed before producing fossils • There are gaps in the fossil record as not all fossils have been found and others have been destroyed by geological or human activity – this means scientists cannot be certain about how life began on Earth.

Key terms

Antibiotic resistance | binomial system | evolution | evolutionary tree | extinction | fossil record | natural selection | three-domain system

Inheritance
Knowledge Organiser

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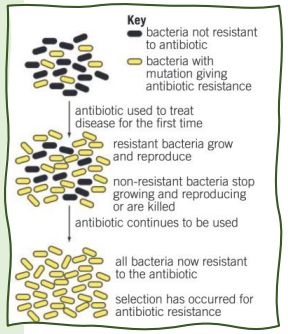

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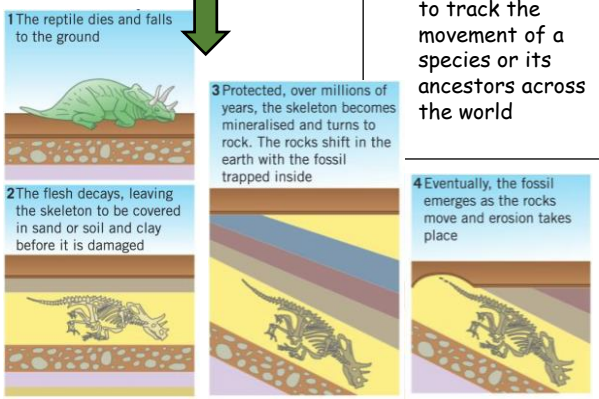

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Classification of living organisms

Kingdom → Phylum → Class → Order → Family → Genus → Species

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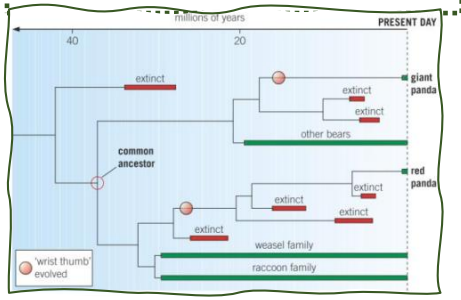

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Key terms: Antibiotic resistance | binomial system | evolution | evolutionary tree | extinction | fossil record | natural selection | three-domain system

Homeostasis and the nervous system
Knowledge Organiser

Homeostasis

Homeostasis is the regulation of internal conditions (of a cell or whole organism) in response to internal and external changes, to maintain optimum conditions for functioning.

This maintains optimum conditions for all cell functions and enzyme action.

In the human body, this includes control of
- blood glucose concentration
- body temperature
- water levels

The automatic control systems of homeostasis may involve nervous responses or chemical responses.

All control systems involve

- Receptor cells, which detect stimuli (changes in the environment)
- Coordination centres (such as the brain, spinal cord, or pancreas), which receive and process information from receptors
- Effectors (muscles or glands), which produce responses to restore optimum conditions.

The nervous system

Function

The nervous system enables humans to react to their surroundings and to coordinate their behaviour – this includes both voluntary and involuntary actions.

Structure

The nervous system is made up of the central nervous system (CNS) and a network of nerves.
The CNS comprises the brain and the spinal cord.

Stimulus
A change in the environment (stimulus) is detected by receptors

Receptor
Information from receptors passes along cells (neurones) to the CNS as electrical impulses

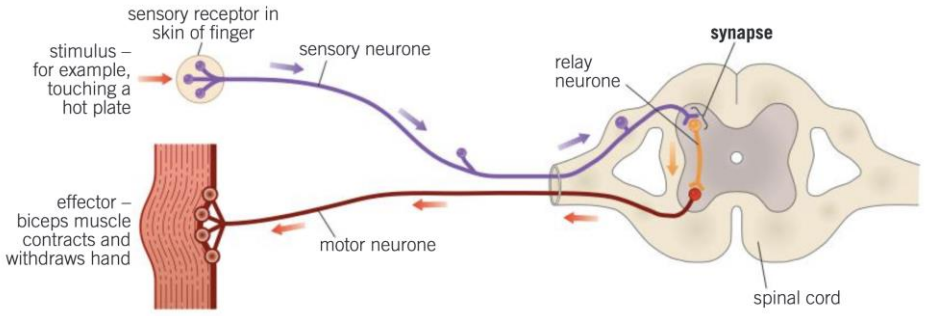
Coordinator
The CNS coordinates the body's response to the stimulus

Effector
Effectors bring about a response, such as glands secreting hormones or muscles contracting

Response
The body responds to the stimulus

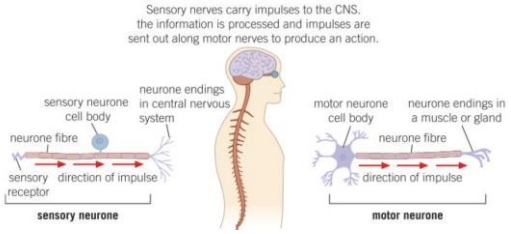
Reflex arcs

Reflex actions of the nervous system are automatic and rapid – they do not involve the conscious part of the brain.
Reflex actions are important for survival because they help prevent damage to the body.

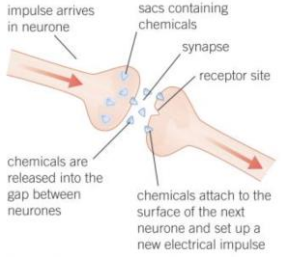


Reflex arc structures

Neurones
Carry electrical impulses around the body – relay neurones connect sensory neurones to motor neurones



Synapses
Gaps between neurones, which allow electrical impulses in the nervous system to cross between neurones.



Factors affecting reaction time

- Tiredness
- Distractions
- Caffeine
- Alcohol

Key terms

brain | central nervous system | coordination centre | effectors | homeostasis | involuntary | neurones | receptors | reflex action | spinal cord | stimulus | synapse

Hormonal Control
Knowledge Organiser

Human endocrine system

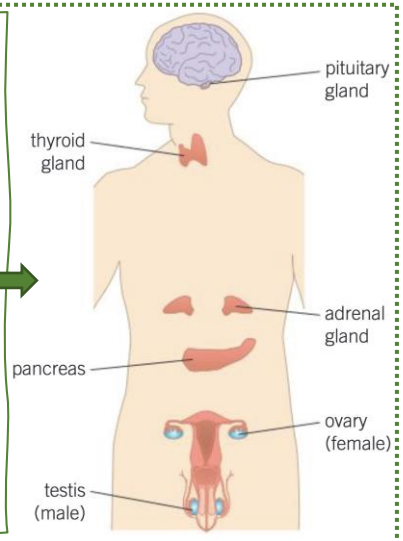
The endocrine system is composed of glands that secrete chemicals called hormones into the bloodstream.

The blood carries hormones to a target organ, where an effect is produced.

Compared to the nervous system, the effects caused by the endocrine system are slower but act for longer.

The pituitary gland, located in the brain, is known s a 'master gland', because it secretes several hormones into the blood.

These hormones then act on other glands to stimulate the release of other hormones, and bring about effects.

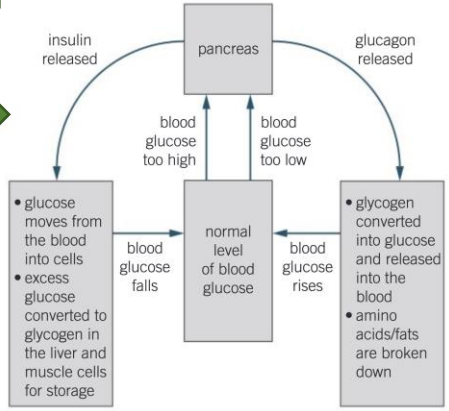


Endocrine gland	Role of the hormone
Pituitary	• Controls growth in children • Stimulates the thyroid gland to make thyroxine to control metabolic rate • In females – stimulates the ovaries to make and release eggs • In males – stimulate the testes to make sperm
Thyroid	• Controls the rate of metabolism
Pancreas	• Controls blood glucose levels
Adrenal	• Prepares the body for stress • Involved in the 'fight or flight' response
Ovaries	• Controls the development of female secondary sexual characteristics • Controls the menstrual cycle
Testes	• Controls the development of male secondary sexual characteristics • Involved in the production of sperm

Control of blood glucose levels

Blood glucose (sugar) concentration is monitored and controlled by the pancreas.

This is an example of negative feedback control, as the pancreas switches production between the hormones insulin and glucagon to control blood glucose levels.



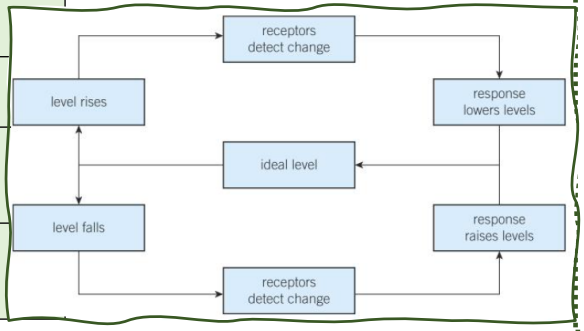
Diabetes

Diabetes is a non-communicable disease where the body either cannot produce or respond to insulin, leading to uncontrolled blood glucose concentrations.

Type 1 diabetes	Type 2 diabetes
Early onset	Usually later onset, obesity is a risk factor
Pancreas stops producing sufficient insulin	Body doesn't respond to the insulin produced
Commonly treated through insulin injections, also diet control and exercise	Commonly treated through a carbohydrate controlled diet and exercise

Negative feedback – HT Only

Negative feedback systems work to maintain a steady state. For example, blood glucose, water, and thyroxine levels are all controlled in the body by negative feedback.



Adrenaline
- produced by adrenal glands in time of fear or stress
- Increases heart rate
- Boosts delivery of oxygen and glucose to brain and muscles
- Prepares the body for 'fight or flight' response
- Does not involve negative feedback, as adrenal glands stop producing adrenaline

Thyroxine
- Produced by the thyroid gland
- Regulates how quickly your body uses energy and makes proteins (metabolic rate)
- Important for growth and development
- Levels controlled by negative feedback

Key terms: brain, central nervous system, coordination centre, effectors, homeostasis, involuntary, neurones, receptors, reflex action, spinal cord, stimulus, synapse

Hormonal Control
Knowledge Organiser

Hormones in human reproduction

During puberty, reproductive hormones cause the secondary sex characteristics to develop:

Oestrogen

- Main female reproductive hormone
- Produced in the ovary
- At puberty, eggs begin to mature and one is released every 28 days

Testosterone

- Main male reproductive hormone
- Produced by the testes
- Stimulates sperm production

Several hormones are involved in the menstrual cycle. Their functions are given in the table, and their levels vary as shown in the figures

Hormone	Released by	Function
Follicle stimulating hormone (FSH)	Pituitary gland	• Causes eggs to mature in the ovaries • Stimulates ovaries to produce oestrogen
Luteinising hormone (LH)	Pituitary gland	• Stimulates the release of mature eggs from the ovaries (ovulation)
Oestrogen	ovaries	• Causes lining of uterus wall to thicken • Inhibits release of FSH • Stimulates release of LH
Progesterone	ovaries	• Maintains thick uterus lining • Inhibits release of FSH and LH

Key terms

contraception follicle stimulating hormone infertility in vitro fertilisation oestrogen ovary luteinising hormone menstrual cycle ovulation progesterone testes uterus

Higher Tier Only: Treating infertility with hormones

Hormones are used in modern reproductive technologies to treating infertility.

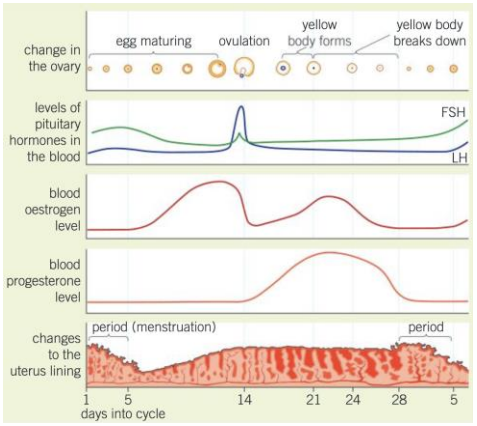
FSH and LH can be given as a drug to treat infertility, or in vitro fertilisation (IVF) treatment may be used.

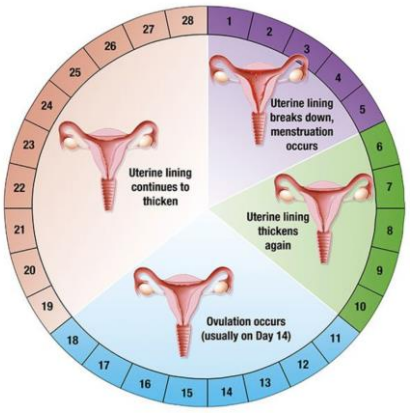
IVF treatment

1. Mother given FSH and LH to stimulate the maturation of several eggs
2. Eggs collected from the mother and fertilised by sperm from the father in a laboratory
3. Fertilised eggs develop into embryos
4. One or two embryos are inserted into the mother's uterus (womb) when the embryos are still tiny balls of cells.

Fertility treatment has some disadvantages:

- It is emotionally and physically stressful
- It has a low success rate
- It can lead to multiple births, which are a high risk to both the babies and the mother.





Contraception

Fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception.

Hormonal contraception

- Oral contraceptives – contain hormones to inhibit FSH production so no eggs mature
- Injection, implant, skin patch or intrauterine device (IUD) – slowly release progesterone to inhibit maturation and release of eggs; can last months or years

Non-hormonal contraception

- Barrier methods, for example, condoms and diaphragms – prevent sperm reaching the egg
- Copper IUD – prevents the implantation of an embryo
- Surgical methods of male and female sterilisation
- Spermicidal agents – kill or disable sperm
- Abstaining from intercourse when an egg may be in the oviduct

Relationships in an Ecosystem
Knowledge Organiser

Ecosystem organisation

Individual organisms

Population - the total number of organisms of the same species that live in one specific geographical area

Community – group of two or more populations of different species living in one specific geographical area

Ecosystem - the interaction of a community of living organisms with the non-living parts of their environment

A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant.

An example of this is the interaction between predator and prey populations, which rise and fall in a constant cycle so that each remains within a stable range

Competition

To survive and reproduce, organisms require a supply of resources from their surroundings and from the other living organisms there.

This can create competition, where organisms within a community compete for resources.

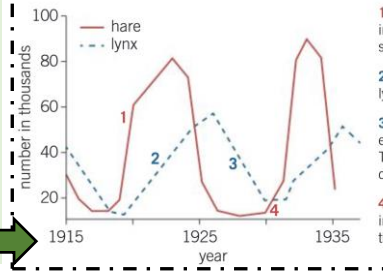
There are two types of competition – interspecific competition is between organisms of different species and intraspecific competition is between organisms of the same species.

Animals	Plants
• Food	• Light
• Mates	• Space
• Territory	• Water and mineral ions

Interdependence

Within a community each species interacts with many others and may depend on other species for things like food, shelter, pollination, and seed dispersal.

If one species is removed it can affect the whole community – this is called interdependence.



1 If the population of hares increases there is a larger food supply for the lynx.

2 This can therefore support more lynx, so more offspring survive.

3 The growing numbers of lynx eventually reduce the food supply. The number of predators starts to decrease.

4 The prey population starts to increase once more – the cycle then begins again.

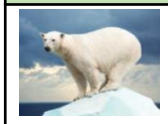
Adaptations of organisms

Organisms have features – adaptation – that enable them to survive in the condition in which they live. The adaptations of an organism may allow it to outcompete others, and provide it with an evolutionary advantage.

Structural
Physical features that allow an organism to successfully compete:
- sharp teeth to hunt prey
- colouring that may provide camouflage to hide from predators or to hunt prey
- a large or small body surface area-to-volume ratio.

Behavioural
The behaviour of an organism that gives it an advantage:
- making nests to shelter offspring or attract a mate
- courtship dances to attract a mate
- use of tools to obtain food
- working together in packs

Functional
Adaptations related to processes that allow an organism to survive:
- photosynthesis is plants
- production of poisons or venom to deter predators or kill prey
- changes in reproduction timings

Organism	Example adaptations
	- White fur for camouflage when hunting - Feet with large surface area to distribute weight on snow - Small ears to reduce heat loss - Thick fur for insulation
	- Feet with large surface to distribute weight on sand - Hump stores fat to provide energy when food is scarce - Tough mouth and tongue to allow camel to eat cacti - Long eyelashes to keep sand out of eyes.
	- Spines instead of leaves to reduce surface area and therefore water loss - Long roots to reach water underground - Large, fleshy stem to store water

Abiotic Factors
Abiotic factors are non-living factors in the ecosystem that can affect a community.
Too much or too little of the following abiotic factors can negatively affect the community in an ecosystem:

carbon dioxide level for plants, light intensity, moisture levels, oxygen levels for animals that live in water, soil pH and mineral content, temperature, wind intensity and direction

Biotic Factors
Biotic factors are living factors in the ecosystem that can affect a community.
For example, the following biotic factors would all negatively affect populations in a community:

decreased availability of food, new predators arriving, new pathogens, competition between species.

Some organisms are extremophiles, which means they live in environments that are very extreme where most other organisms could not survive. For example, areas with very high temperatures, extreme pressures, high salt concentrations, highly acidic or alkaline conditions, low levels of oxygen or water.

Key terms

abiotic factor adaptation biotic factor community ecosystem extremophile interaction interdependence interspecific intraspecific population

Ecology
Knowledge Organiser

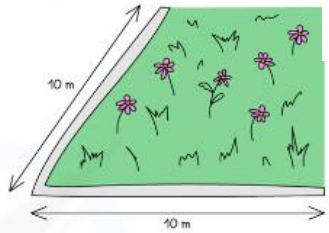
Investigating Distribution

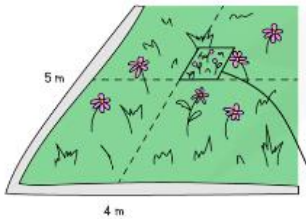
Aim: To measure the population size of a common species in a habitat and use sampling techniques to investigate the effect of a factor on the distribution of this species

You will:
- Use a quadrat to estimate the population size of a plant species in a survey area
- Use a transect line and a quadrat to investigate the effect of a factor on the number of plants in a survey are

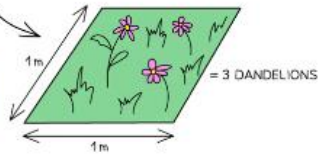
ESTIMATING POPULATION SIZE METHOD

1. USE TWO TAPE MEASURES TO LAY OUT A SURVEY AREA (e.g. 10 m × 10 m) IN YOUR CHOSEN HABITAT, SUCH AS THE SCHOOL FIELD.





2. USE A RANDOM NUMBER GENERATOR TO CREATE A SET OF COORDINATES TO PLACE YOUR FIRST QUADRAT. e.g. IF YOU GET A 4 AND A 5, PLACE YOUR QUADRAT 4 m ALONG THE x-AXIS AND 5 m ALONG THE y-AXIS.



3. COUNT THE NUMBER OF YOUR CHOSEN PLANT SPECIES (e.g. DANDELIONS) THAT ARE FOUND WITHIN THIS QUADRAT.

4. RECORD THIS NUMBER IN A RESULTS TABLE AND REPEAT STEPS 1–3 UNTIL YOU HAVE RECORDED THE NUMBER OF YOUR CHOSEN PLANT SPECIES IN 10 QUADRATS.

Quadrat	Number of dandelions
1	3
2	4
3	2
4	1
5	0
6	0
7	2
8	5
9	3
10	1
Total	21

5. ESTIMATE THE POPULATION OF DANDELIONS IN YOUR SURVEY AREA USING THE EQUATION:

$$\text{ESTIMATED POPULATION SIZE} = \frac{\text{TOTAL AREA}}{\text{AREA SAMPLED}} \times \text{TOTAL NUMBER OF DANDELIONS COUNTED}$$

TOTAL SURVEY AREA WAS 10 m × 10 m

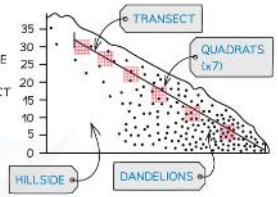
$= \frac{100}{10} \times 21$

$= 210$

EACH QUADRAT IS 1 m × 1m AND 10 QUADRATS WERE PLACED

INVESTIGATING THE EFFECT OF A FACTOR ON THE DISTRIBUTION OF A SPECIES METHOD

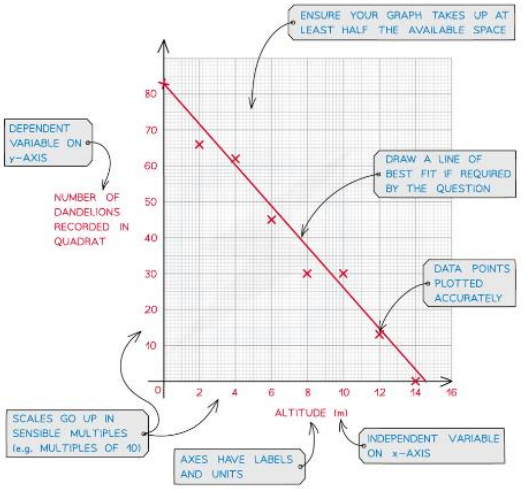
1. SET YOUR TRANSECT UP THROUGH THE AREA YOU ARE INVESTIGATING. IN THIS CASE, A 30 m TAPE MEASURE IS PLACED UP A HILLSIDE. PLACE A QUADRAT AT EQUAL INTERVALS (e.g. EVERY 5 m) ALONG THE TRANSECT.



Distance along transect (m)	Number of dandelions	Attitude (m)
0	84	2
5	66	4
10	62	6
15	45	8
20	30	10
25	30	12
30	13	14

2. RECORD THE NUMBER OF YOUR CHOSEN PLANT SPECIES INSIDE EACH QUADRAT. RECORD YOUR ABIOTIC FACTOR (e.g. ALTITUDE) AT EACH QUADRAT. RECORD YOUR RESULTS IN A TABLE.

3. PLOT YOUR DATA IN A GRAPH AND DESCRIBE ANY RELATIONSHIP THAT CAN BE OBSERVED.



Key terms

biodiversity biofuel biomass deforestation global warming peat bog pollution

Ecology
Knowledge Organiser

Biodiversity

Biodiversity is the variety of all the different species of organisms (plant, animal, and microorganism) on Earth, or within a specific ecosystem.

High biodiversity ensures the stability of an ecosystem because it reduces the dependence of one species on another for food or habitat maintenance.

The future of the human species depends on us maintaining a good level of biodiversity. Many human activities, such as deforestation, are reducing biodiversity, but only recently have measures been taken to try to prevent this.

Maintaining biodiversity

Many habitats are currently under threat due to human activities such as deforestation, climate change, and habitat destruction.

There are a number of ways in which scientists and concerned citizens are trying to maintain biodiversity and reduce the negative impact of humans on ecosystems, including

- breeding programmes in zoos for endangered species
- protection and regeneration of rare habitats (e.g., national parks)
- reintroduction of hedgerows in agricultural areas where single crop species are grown, as hedges provide habitat for many organisms
- government policies to reduce deforestation and carbon dioxide emissions
- recycling resources rather than dumping waste in landfill.

Waste Management

Rapid growth of the human population and increases in the standard of living mean that humans are using more resources and producing more waste.
Waste and chemical materials need to be properly handled in order to reduce the amount of pollution they cause. Pollution kills plants and animals, and can accumulate in food chains, reducing biodiversity.
Pollution can occur

- in water, from sewage, fertiliser run-off, or toxic chemicals (e.g., from factories)
- in air, from smoke and acidic gases
- on land, from landfill and toxic chemicals.

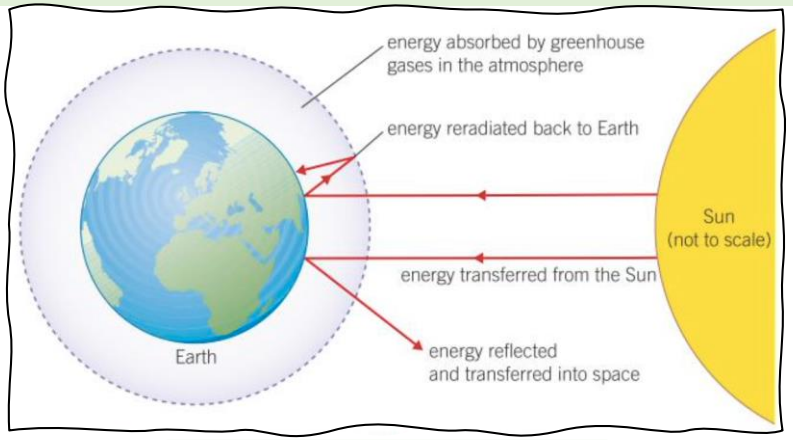
Key terms

biodiversity biofuel biomass deforestation global warming peat bog pollution

Global warming

Levels of carbon dioxide and methane in the atmosphere are increasing due to human activity, contributing to global warming and climate change.
Global warming is the gradual increase in the average temperature of the Earth. This scientific consensus is based on systematic reviews of thousands of peer-reviewed publications.
Global warming has resulted in

- large-scale habitat change and reduction, causing a decrease in biodiversity
- extreme weather and sea-level changes
- migration of species to different parts of the world, affecting ecosystems
- threats to the security and availability of food.



Land use and deforestation

Rapid population growth has led to humans using much more land for building, quarrying, farming, and dumping waste. This reduces the area in which animals can live and can further destroy habitats through pollution.
For example, the destruction of peat bogs (areas of partially decayed vegetation) to produce garden compost has decreased the amount of this important habitat, and the biodiversity it supports. The decay or burning of peat for energy also releases carbon dioxide into the atmosphere, contributing to global warming.
Large-scale deforestation in tropical areas has been carried out to provide land for cattle and rice fields, and to grow crops for biofuels.

This has resulted in

- large amounts of carbon dioxide being released into the atmosphere due to burning of trees.
- extinctions and reductions in biodiversity as habitats are destroyed
- climate change, as trees absorb carbon dioxide and release water vapour.

Biology

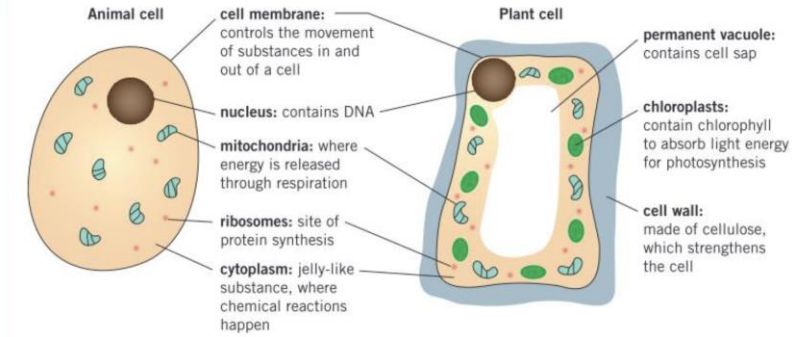
- Paper 1

Cell Structure – Science – Year 11

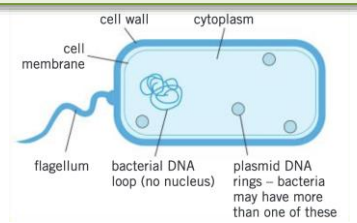
Knowledge Organiser

Animal and Plant Cells

Animal and plant cells are eukaryotic cells. They have genetic material (DNA) that forms chromosomes and is contained within a nucleus.



Bacterial cells



Bacteria have the following characteristics:

- Single-celled
- No nucleus – have a single loop of DNA
- Have small rings of DNA called plasmids
- Smaller that eukaryotic cells

Comparing sub-cellular structures

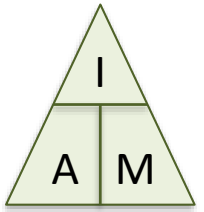
Structure	Animal	Plant	Bacteria
cell membrane	/	/	/
cytoplasm	/	/	/
nucleus	/	/	-
cell wall	-	/	/
chloroplasts	-	/	-
permanent vacuole	-	/	-
DNA free in cytoplasm	-	-	/
plasmids	-	-	/

Key terms

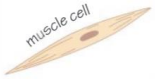
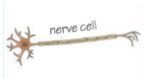
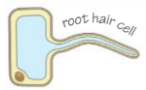
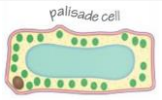
chloroplast chromosome cytoplasm eukaryotic prokaryotic resolution ribosome

Microscopes

Light microscope	Electron microscope
Uses light to form images	Uses a beam of electrons to form images
Living samples can be views	Samples cannot be living
Relatively cheap	expensive
Low magnification	High magnification
Low resolution	High resolution



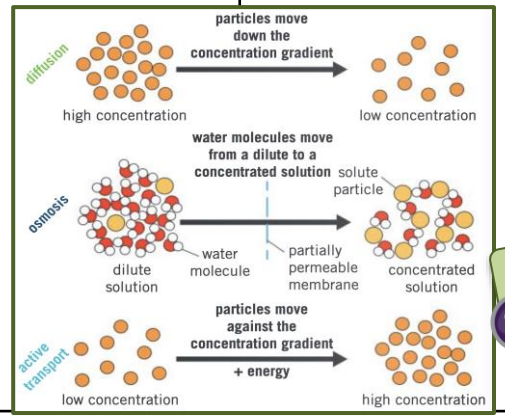
Specialised cells

Specialised cell	Function	Adaptations
	Fertlise an ovum (egg)	- Tail to swim to the ovum and fertilse it - Lots of mitochondria to release energy from respiration, enabling the sperm to swim to the ovum
	Transport oxygen around the body	- No nucleus so more room to carry oxygen - Contain a red pigment called hemoglobin that binds to oxygen molecules - Flat bi-concaved disc shape to increase surface area-to-volume ratio
	Contract and relax to allow movement	- Contains protein fibres, which can contract to make the cells shorter - Contains lots of mitochondria to release energy from respiration, allowing the muscles to contract
	Carry electrical impulses around the body	- Branched endings, called dendrites, to make connections with other neurones or effectors - Myelin sheath insulates the axon to increase the transmission speed of the electrical impulses.
	Absorb mineral ions and water from the soil	- Long projection speeds up the absorption of water and mineral ions by increasing the surface area of the cell - Lots of mitochondria to release energy for the active transport of mineral ions from the soil
	Enable photosynthesis in the leaf	- Lots of chloroplasts containing chlorophyll to absorb light energy - Located at the top surface of the leaf where it can absorb the most light energy

Cell Structure – Science – Year 11

Knowledge Organiser

	Diffusion	Osmosis	Active Transport
Definition	The spreading out of particles, resulting in a net movement from an area of higher **concentration** to an area of lower concentration.	The diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.	The movement of particles from a more dilute solution to a more concentrated solution using energy from respiration.
Movement of particles	Particles move down the concentration gradient – from an area of high concentration to an area of low concentration.	Water moves from an area of lower solute concentration to an area of higher solute concentration.	Particles move against the concentration gradient – from an area of low concentration to and area of high concentration.
Energy required?	No – passive process	No – passive process	Yes – using energy released during respiration
Examples	Humans: • Nutrients in the small intestine diffuse into the blood in the capillaries through the villi. • Oxygen diffuses from the air in alveoli into the blood in the capillaries. Carbon dioxide diffuses from the blood in the capillaries into the air in the alveoli. • Urea diffuses from cells into the blood for excretion by the kidney. Fish: • Oxygen from water passing over the gills diffuses into the blood in the gill filaments. • Carbon dioxide diffuses from the blood in the gill filaments into the water. Plants: • Carbon dioxide used for photosynthesis diffuses into leaves through the stomata. • Oxygen produced during photosynthesis diffuses out of the leaves through the stomata	Plants: Water moves osmosis from a dilute solution in the soil to a concentrated solution in the root hair cell.	Humans: Active transport allows sugar molecule to be absorbed from the small intensive when the sugar concentration is higher in the blood than in the small intensive. Plants: Active transport is used to absorb mineral ions into the root hair cells from more dilute solutions in the soil.



Factors that affect the rate of diffusion

1) Difference in concentration

The steeper the concentration gradient the faster the rate of diffusion.

2) Temperature

The higher the temperature, the faster the rate of diffusion.

3) Surface area of the membrane

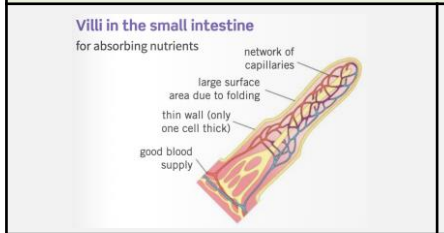
The larger the membrane surface area the faster the rate of diffusion.

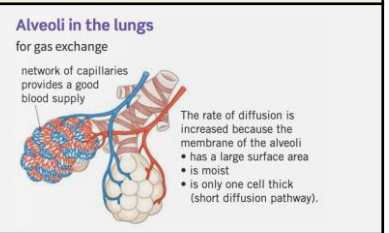
Adaptations for exchanging substances

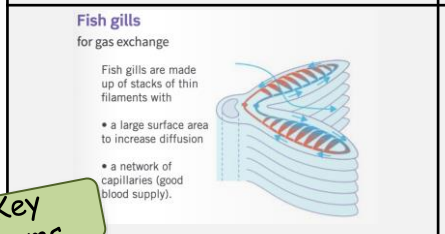
Single-celled organisms have a large surface area-to-volume ratio. This allows enough molecules to move across their cell membranes to meet their needs.

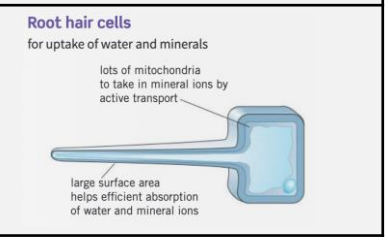
Multicellular organisms have a small surface area-to-volume ratio. This means they need specialized organs systems and cells to be transported into and out of their cells.

Exchange surfaces work most efficiently when they have a large surface area, a thin membrane, and a good blood supply.









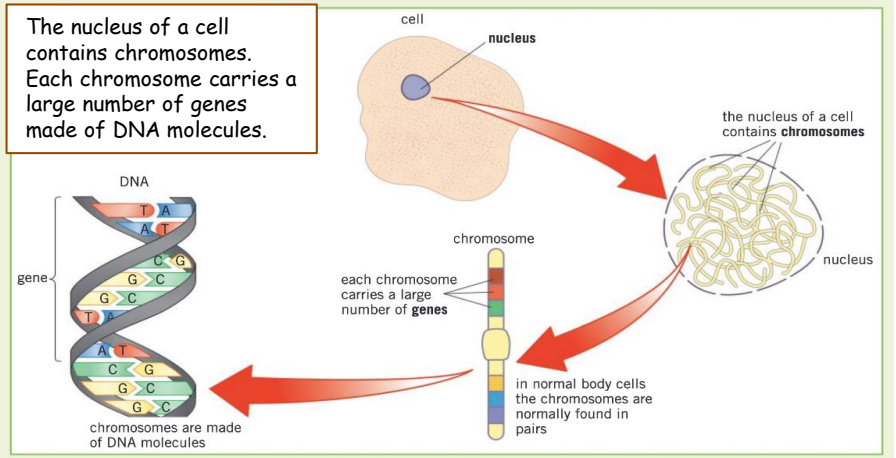
Key terms

concentration partially permeable membrane passive process gradient stomata urea villi capillaries alveoli diffusion active transport dilute

Cell Division Knowledge Organiser

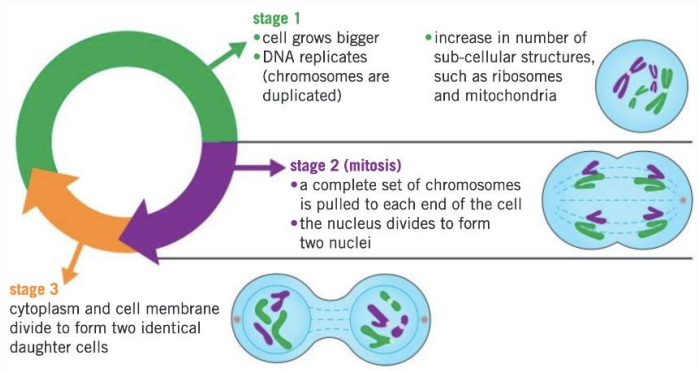
Chromosomes

The nucleus of a cell contains chromosomes. Each chromosome carries a large number of genes made of DNA molecules.



The Cell Cycle

Body cells divide to form two identical daughter cells by going through a series of stages known as the cell cycle.
Cell division by mitosis is important for the growth and repair of cells, for example, the replacement of skin cells. Mitosis is also used for asexual reproduction.
There are three main stages in the cell cycle.



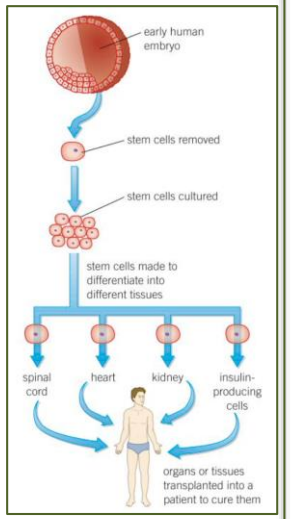
Stem cells in medicine

Type of stem cell	Where are they found?	What can they differentiate into?	Advantages	Disadvantages
Adult stem cells	Specific parts of the body in adults and children – for example bone marrow	Can only differentiate to form certain types of cells – for example stem cells in the bone marrow can only differentiate into types of blood cell	• Fewer ethical issues – adults can consent to have their stem cells removed and used. • An already established technique for treating diseases such as leukemia. • Relatively safe to use as a treatment and donors recover quickly	• Requires a donor. Potentially meaning a long wait time to find someone suitable • Can only differentiate into certain types of specialised cells, so can be used to treat fewer diseases
Embryonic stem cells	Early human embryos (often taken from spare embryos from fertility clinics)	Can differentiate into any type of specialised cell in the body – for example, a nerve cell of a muscle cell.	• Can treat a wide range of diseases as can form any specialised cell • May be possible to grow whole replacement organs • Usually no donor needed as they are obtained from spare embryos from fertility clinics	• Ethical issues as the embryo is destroyed and each embryo is a potential human life • Risk of transferring viral infections to the patient • Newer treatment so relatively under-researched – not yet clear if they can cure as many diseases as thought
Plant meristem	Meristem regions in the roots and shoots of plants	Can differentiate into all cell types – they can be used to create clones of whole plants	• Rare species of plants can be cloned to prevent extinction • Plants with desirable traits, such as disease resistance, can be cloned to produce large number of identical plants • Fast and low-cost production of large number of plants	• Cloned plants are genetically identical, so a whole crop is at risk of being destroyed by a single disease or genetic defect

Therapeutic Cloning

In therapeutic cloning:

- Cells from a patient's own body are used to create a cloned early embryo of themselves
- Stem cells from this embryo can be used for medical treatments and growing new organs
- These stem cells have the same genes as the patient, so are less likely to be rejected when transplanted.



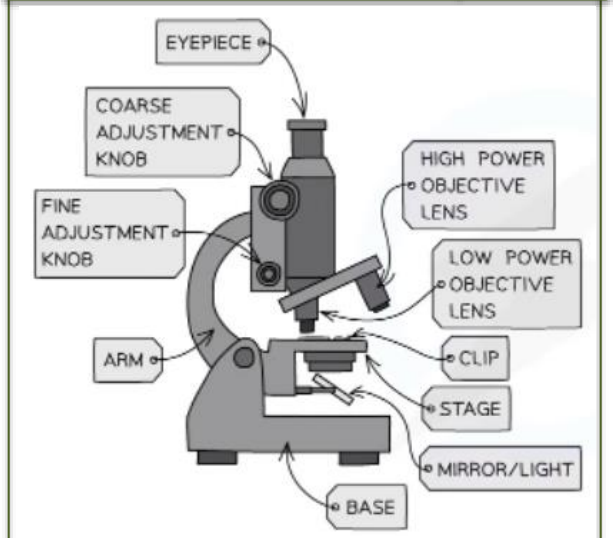
Key terms

mitosis daughter cells gene meristem nucleus chromosome therapeutic cloning clone embryonic stem cell

Using a microscope – Science – Year 11

Knowledge Organiser

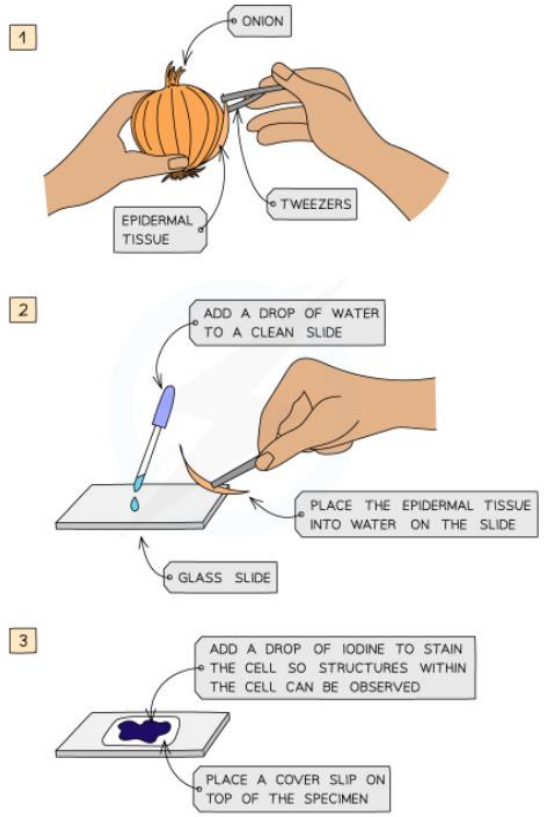
Parts of a microscope



Using a microscope

1. Clip slide onto the stage
2. Ensure the lowest powered objective lens is over the slide.
3. Use the coarse adjustment knob to bring the stage up just below the lens.
4. Look down the eye piece and gradually move the stage downwards using the coarse adjustment knob. Stop when the image is roughly in focus.
5. To bring the image into focus adjust the fine adjustment knob until a clear image is obtained.
6. To observe the image with a higher magnification, change the objective lens to a higher power and readjust the stage using the coarse and fine adjustment knobs.

Making an onion slide



Conversions

To convert micrometres into millimetres you should divide the measurement by 1000.

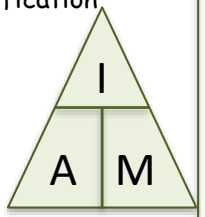
To convert millimetres into micrometres you should multiply the measurement by 1000.

Calculations

magnification = image size / actual size

actual size = image size / magnification

image size = actual size x magnification



total magnification = eye piece x objective

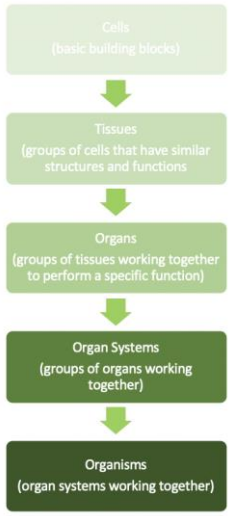
Microscopes

Light microscope	Electron microscope
Uses light to form images	Uses a beam of electrons to form images
Living samples can be views	Samples cannot be living
Relatively cheap	expensive
Low magnification	High magnification
Low resolution	High resolution

Organisation
Knowledge Organiser – Science – year 11

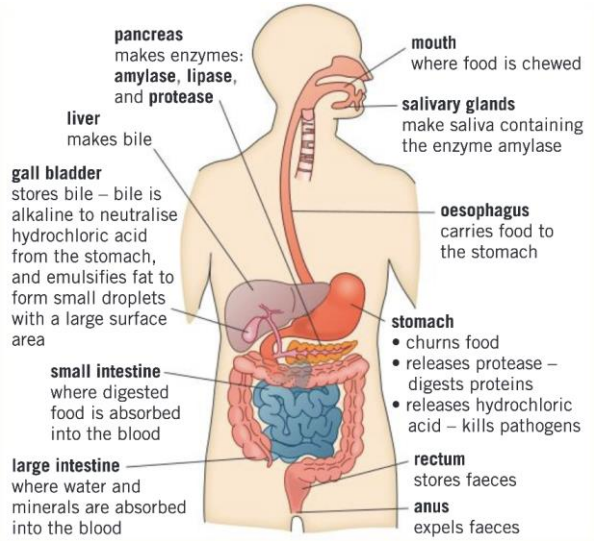
Organisation of living things

There are five levels of organisation in living organisms:



The Digestive System

The role of the digestive system is to break large insoluble molecules into smaller soluble molecules. Here are the organs that make up the digestive system and their roles in digestion.



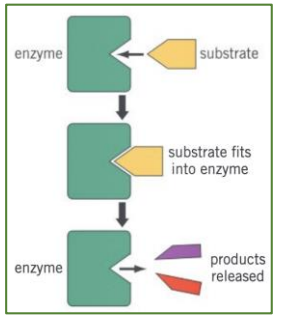
Enzymes

Enzymes are large proteins that catalyse (speed up) reactions. Enzymes are not changed in the reactions they catalyse.

Lock and Key Model

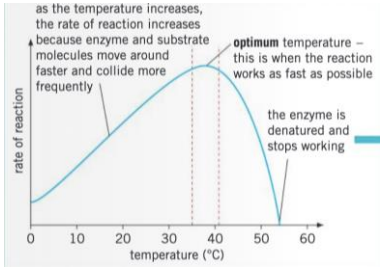
This is a simple model of how enzymes work:

1) The enzyme's active site (where the reaction occurs) is a specific shape.
2) The enzyme (the lock) will only catalyse a specific reaction because the substrate (the key) fits into its active site.
3) At the active site, enzymes can break molecules down into smaller ones or bind small molecules together to form larger ones.
4) When the products have been released, the enzyme's active site can accept another substrate molecule.

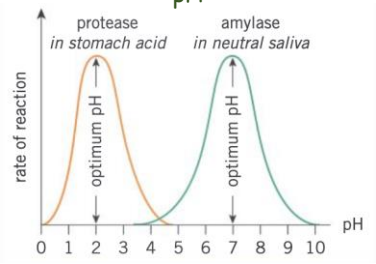


Factors affecting enzymes

Temperature



pH



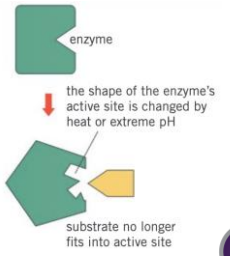
Digestive Enzymes

Enzyme	Sites of production	Reaction catalysed
Amylase	salivary glands pancreas small intestine	Starch → glucose (a simple sugar)
Proteases	stomach pancreas small intestine	Proteins → amino acids
Lipases	pancreas small intestine	Lipids → fatty acids and glycerol

Denaturation

At extremes of pH or at very high temperatures the shape of an enzyme's active site can change.

The substrate can no longer bind to the active site, so the enzyme cannot catalyse the reaction – the enzyme has been denatured.



Key terms

active site amylase catalyse denatured enzyme lipase optimum protease substrate

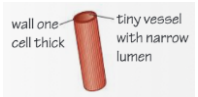
Organisation
Knowledge Organiser – Science – Year 11

The blood

The blood is a tissue made up of four main components:

1. **Red blood cells** – bind to oxygen and transport it around the body.
2. **Plasma** – transports substances and blood cells around the body.
3. **Platelets** – form blood clots to create barriers to infections.
4. **White blood cells** – part of the immune system to defend the body against pathogens.

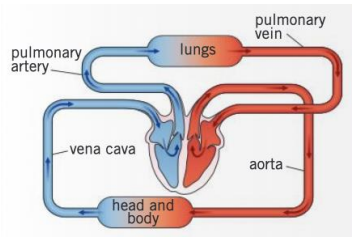
The blood vessels

Vessel	Function	Structure	Diagram
artery	carries blood away from the heart under high pressure	- Thick, muscular and elastic walls - Walls that stretch to withstand high pressure - Small lumen	
vein	carries blood to the heart under low pressure	- Have valves to stop blood flowing the wrong way - Thin walls - Large lumen	
capillary	carries blood to tissues and cells and connects arteries and veins	One cell thick – short diffusion distance for substances to move between the blood and tissues (e.g., oxygen into cells and carbon dioxide out) - Very narrow lumen	

Double circulatory system

The human circulatory system is described as a double circulatory system because blood passes through the heart twice for every circuit around the body:

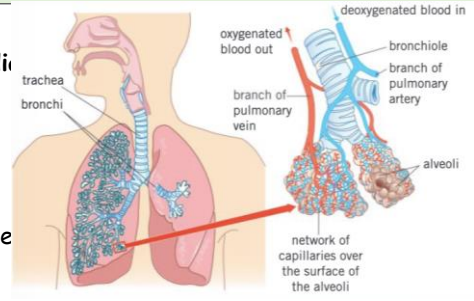
- The right ventricle pumps blood to the lungs where gas exchange takes place
- The left ventricle pumps blood around the rest of the body.



The heart

The heart is an organ that pumps blood around your body. It is made from **cardi** muscle tissue, which is supplied with oxygen by the **coronary artery**.

Heart rate is controlled by a group of cells in the right **atrium** that generate electrical impulses, acting as a pacemake Artificial pacemakers can be used to control irregular heartbeats.



Coronary heart disease

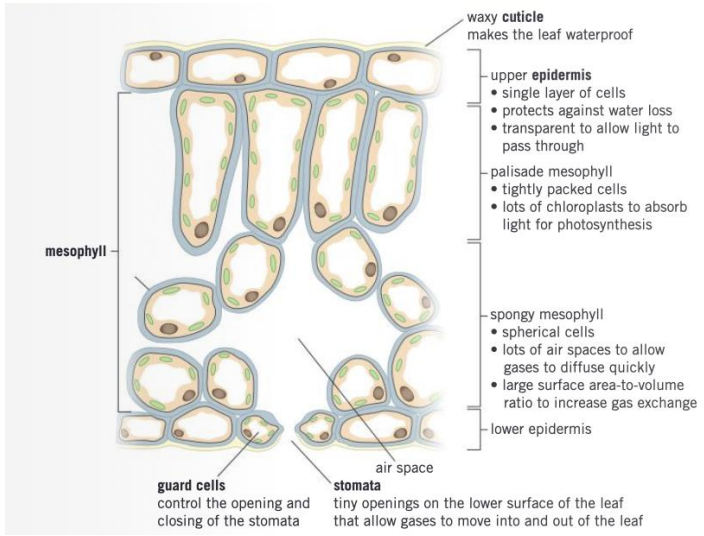
Coronary heart disease (CHD) occurs when the coronary arteries became narrowed by the build-up of layers of fatty material within them.
This reduces the flow of blood, resulting in less oxygen for the heart muscle, which can lead to heart attacks.

	Description	Advantages	Disadvantages
Stent	Inserted into blocked coronary arteries to keep them open.	- Widens the artery – allows more blood to flow - Less serious surgery	- Can involve major surgery – risk of infection, blood loss and blot clots - Risks from anaesthetic
Statins	Drugs that reduce blood cholesterol levels, slowing down the deposit of fatty material in the arteries	- Effective - No need for surgery - Can prevent CHD from developing	- Possible side effects such as muscle pain, headaches and sickness - Cannot cure CHD, so patient will have to take tablets for many years.
Replacement heart valves	Heart valves that leak or do not open fully, preventing control of blood flow though the heart, can be replaced with biological or mechanical valves.	- Allows control of blood flow through the heart - Long-term cure for faulty heart valves	Risks related to surgery (as with stents)
Transplants	If the heart fails a donor heart, or heart and lungs, can be transplanted. Artificial hearts can be used to keep patients alive whilst waiting for a transplant, or to allow the heart to rest during recovery.	- Long-term cure for the most serious heart conditions - Treats problems that cannot be treated in other ways.	- Transplants may be rejected if the donor is not a match. - Lengthy process - Risks related to surgery (as with stents)

Organisation
Knowledge Organiser – Science – year 11

Tissues in a leaf

Leaves are organs because they contain many tissues that work together to perform photosynthesis.



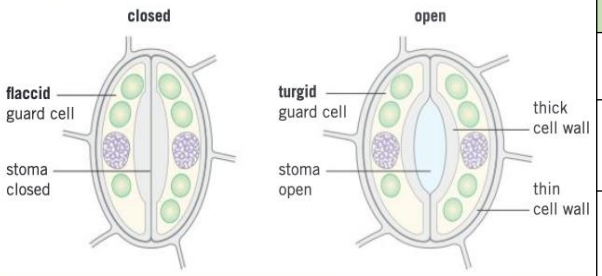
Stomata

Stomata are tiny openings in the undersides of leaves – this placement reduces water loss through evaporation.

They control gas exchange and water loss from leaves by:
- Allowing diffusions of carbon dioxide into the plant for photosynthesis
- Allowing diffusion of oxygen out of the plant

Guard cells are used to open and close the stomata.

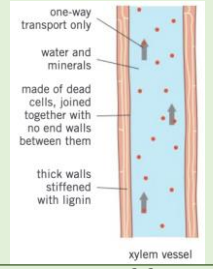
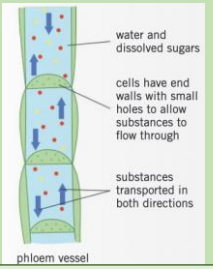
When a plant has plenty of water, the guard cells become turgid. The cell wall on the inner surface is very thick, so it cannot stretch as much as the outer surface. So as the guard cells swell up, they curve away from each other, opening the stoma.



Key terms

cuticle epidermis flaccid mesophyll stomata phloem xylem turgid translocation transpiration guard cell

Transportation in plants

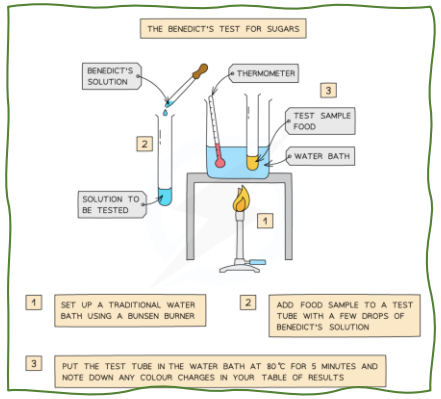
	Transpiration	Translocation
Description	Water is lost through the stomata by evaporation. This pulls water up from the roots through the xylem and is called transpiration. The constant movement of water up the plant is called the transpiration stream.	The movement of dissolved sugars from the leaves to the rest of the plant through the phloem.
Importance	Provides water to cells to keep them turgid. Provides water to cells for photosynthesis Transports mineral ions to leaves.	Moves dissolved sugars made during photosynthesis to other parts of the plant. This allows for respiration, growth and glucose storage.
Specialised Tissues		

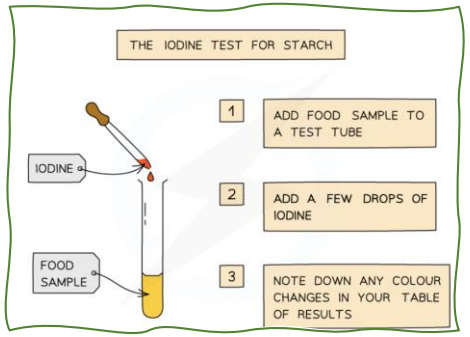
Factors affecting the rate of transpiration

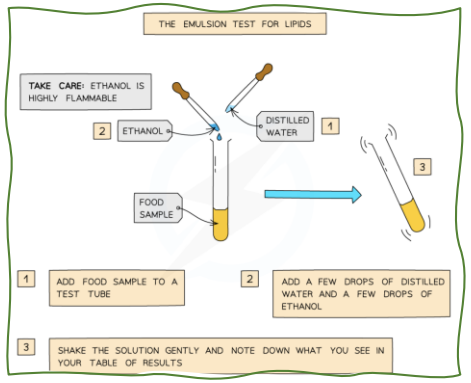
Factor	Effect on transpiration	Because…
temperature	higher temperatures increase the rate of transpiration	water evaporates faster at higher temperatures
humidity	lower humidity increases the rate of transpiration	the drier the air the steeper the concentration gradient of water molecules between the air and the leaf
wind speed	more wind increases the rate of transpiration	wind removes the water vapour quickly, maintaining a steeper concentration gradient
light intensity	Higher light intensity increases the rate of transpiration	stomata open wider to let more carbo dioxide into the leaf for photosynthesis

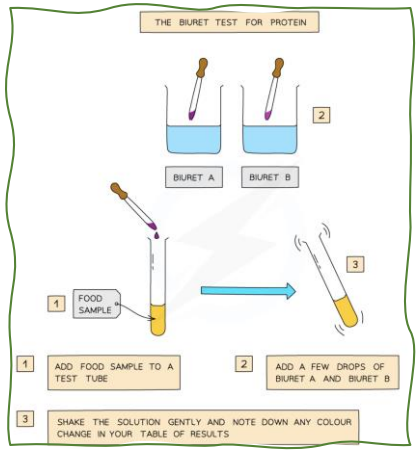
Organisation
Knowledge Organiser – Science Year 11

Testing Foods







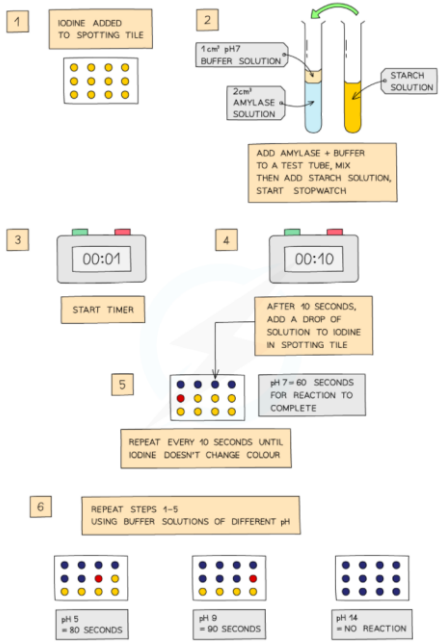


Food Test	Colour of reagent	Positive test result	Negative test result
Iodine for starch	orange–brown	blue–black	orange–brown (no change)
Benedict's for sugar	light blue	green to brick–red	light blue (no change)
Ethanol for lipid	colourless	cloudy emulsion	colourless (no change)
Biuret for protein	blue	lilac–purple	blue (no change)

Investigating Enzymes

Method

- Place single drops of iodine solution in rows on the tile
- Label a test tube with the pH to be tested
- Use the syringe to place 2cm3 of amylase in the test tube
- Add 1cm3 of buffer solution to the test tube using a syringe
- Use another test tube to add 2cm3 of starch solution to the amylase and buffer solution, start the stopwatch whilst mixing using a pipette
- After 10 seconds, use a pipette to place one drop of the mixture on the first drop of iodine, which should turn blue-black
- Wait another 10 seconds and place another drop of the mixture on the second drop of iodine
- Repeat every 10 seconds until iodine solution remains orange-brown
- Repeat experiment at different pH values – the less time the iodine solution takes to remain orange-brown, the quicker all the starch has been digested and so the better the enzyme works at that pH



Key terms

active site amylase catalyse denatured enzyme lipase optimum protease substrate

Health and Infectious Disease
Knowledge Organiser

Health

Health is a state of physical and mental well-being.

The following factors can affect health:

- Communicable and non-communicable diseases
- Diet
- Stress
- Exercise
- Life situation

Different types of disease may interact, for example:

- Defects in the immune system make an individual more likely to suffer from infectious diseases
- Viral infection can trigger cancers
- Immune reactions initially caused by a pathogen can trigger allergies, for example skin rashes and asthma
- Severe physical ill health can lead to depression and other mental illnesses.

Cancer

Cancer is the result of changes in cells that lead to uncontrolled growth and division by mitosis.

Rapid division of abnormal cells can form a tumour.

Malignant tumours are cancerous tumours that invade neighbouring tissues and spread to other parts of the body in the blood, forming secondary tumours.

Benign tumours are non-cancerous tumours that do not spread in the body.

Risk factors and non-communicable diseases

Risk Factor	Disease	Effects of risk factor
Diet (obesity) and amount of exercise	Type 2 diabetes	Body does not respond properly to the production of insulin, so blood glucose levels can not be controlled
	Cardiovascular disease	Increased blood cholesterol can lead to CHD
Alcohol	Impaired liver function	Long-term alcohol use causes liver cirrhosis (scarring), meaning the liver cannot remove toxins from the body or produce sufficient bile
	Impaired brain function	Damages the brain and can cause anxiety and depression
	Affected development of unborn babies	Alcohol can pass through the placenta, risking miscarriages, premature births and birth defects
Smoking	Lung disease and cancers	Cigarettes contain carcinogens, which can cause cancers
	Affected development of unborn babies	Chemicals can pass through the placenta, risking premature births and birth. defects
Carcinogens, such as ionising radiation, and genetic risk factors	Cancers	For example, tar in cigarettes and ultraviolet rays from the Sun can cause cancers
		Some genetic factors make an individual more likely to develop certain cancers

Treatment of non-communicable diseases linked to lifestyle risk factors – such as poor diet, drinking alcohol, and smoking – can be very costly, both to individuals and to the Government.

A high incidence of these lifestyle risk factors can cause high rates of non-communicable diseases in a population.

Key terms artificial heart benign carcinogen cholesterol coronary heart disease health malignant risk factor statin stent transplant

Health and Infectious Disease
Knowledge Organiser

Communicable disease

A communicable disease is one caused by pathogens that can be passed from organism to organism. A pathogen is a microorganism that causes a disease. Examples of pathogens are: bacteria, fungi, viruses and protists.

Viruses live and reproduce rapidly inside an organism's cells. This can damage or destroy the cells.
Bacteria reproduce rapidly inside organisms and may produce toxins that damage tissues and cause illness.

Pathogens can be spread in the air, water or by direct contact.

Viruses

	Spread by	Symptoms	Prevention and treatment
measles	inhalation of droplets that are produced by infected people sneezing and coughing	• fever • red skin rash • complications can be fatal	• painkillers to treat the symptoms • young children are vaccinated to immunise them against measles
HIV	Exchange of body fluids such as: • sexual contact • blood when drug users share needles	• flu-like symptoms at first • virus attacks the body's immune cells, which can lead to AIDS – when the immune system is so damaged that it cannot fight off infections.	• antiretroviral drugs – are very damaging to the body • barrier methods of contraception, such as condoms • using clean needles
TMV	• direct contact of plants with infected plant material • animal and plant vectors • soil: the pathogen can remain in soil for decades	• mosaic pattern of discolouration on the leaves – where chlorophyll is destroyed • reduces plant's ability to photosynthesise, affecting growth	• removing infected plants

Bacteria

	Spread by	Symptoms	Prevention and treatment
Salmonella	bacteria in or on food being ingested	Salmonella bacteria and the toxins they produce cause • fever • abdominal pains • vomiting • diarrhoea	• poultry are vaccinated against Salmonella bacteria to control spread
Gonorrhoea	direct sexual contact – gonorrhoea is a sexually transmitted disease (STD)	• thick yellow or green discharge from the vagina or penis • pain when urinating	• treatment with antibiotics (many antibiotic-resistant strains have appeared) • barrier methods of contraception

Fungi

	Spread by	Symptoms	Prevention and treatment
Rose black spot	Water and wind	• purple or black spots on leaves, which turn yellow and drop early • reduces plant's ability to photosynthesise, affecting growth	• **fungicides** • affected leaves removed and destroyed

Protists

	Spread by	Symptoms	Prevention and treatment
Malaria	Mosquitos feed on the blood of infected people and spread the protist pathogen when they feed on another person – organisms that spread disease by carrying pathogens are known as vectors	• recurrent episodes of fever • can be fatal	• prevent mosquito vectors breeding • mosquito nets to prevent bites • anti-malarial medicine

Controlling the spread of communicable disease

There are a number of ways to prevent the spread of communicable diseases from one organism to another.

Hygiene
Hand washing, disinfecting surfaces and machinery, keeping raw meat separate, covering mouth when coughing/sneezing.

Isolation
Isolation of infected individuals – people, animals, and plants can be isolated to stop the spread of disease.

Controlling Vectors
If a vector spreads a disease, destroying or controlling the population of the vector can limit the spread of disease.

Vaccination
Vaccination can protect large numbers of individuals against diseases. It cannot be used in plants as they don't have an immune system.

Vaccination involves injecting small quantities of dead or inactive form of a pathogen into the body

This stimulates lymphocytes to produce the correct antibodies for that pathogen

If the same pathogen re-enters the body, the correct antibodies can be produced quickly to prevent infection.

Herd immunity

If a large proportion of a population is vaccinated against a disease, the disease is less likely to spread even if there are some unvaccinated individuals.

Key terms

Bacterium communicable disease fungicide fungus herd immunity pathogen protist sexually transmitted disease (STD) toxin vaccination vector virus

Health and Infectious Disease Knowledge Organiser

Non-specific defences

Non-specific defences of the human body against all pathogens include:

Skin
- physical barrier to infection
- produces antimicrobial secretions
- Microorganisms that normally live on the skin prevent pathogens growing

Nose
Cilia and mucus trap particle in the air, preventing them from entering the lungs. Trachea and bronchi produce mucus, which is moved away from the lungs to the back of the throat by the cilia, where it is expelled.

Stomach
Produces strong acid (pH2) that destroys pathogens in mucus, food and drinks.

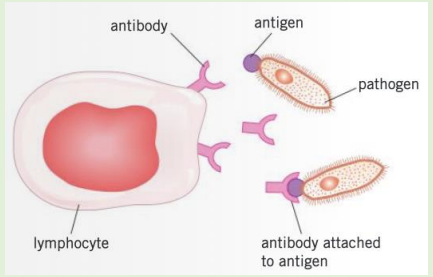
White blood cells

If a pathogen enters the body, the immune system tries to destroy the pathogen.
The function of white blood cells is to fight pathogens.
There are two main types of white blood cell - lymphocytes and phagocytes.

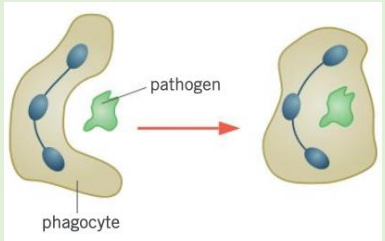
Lymphocytes fight pathogens in two ways:

Antitoxins
Lymphocytes produce **antitoxins** that bind to the toxins produced by some pathogen (usually bacteria). This *neutralises* the toxins.

Antibodies
Lymphocytes produce antibodies that target and help to destroy specific pathogens by binding to antigens (proteins) on the pathogen's surface's.



1. **Phagocytes** are attracted to areas of infection.
2. The phagocyte surrounds the pathogen and engulfs it.
3. Enzymes that digest and destroy the pathogen are released.



Treating diseases

Antibiotics
- **Antibiotics** are medicines that can kill *bacteria* in the body.
- Specific bacteria need to be treated by specific antibiotics
- Antibiotics have greatly reduced deaths from infectious bacterial diseases, but antibiotic-resistant strains of bacteria are emerging.

Treating viral diseases
- Antibiotics *do not* affect viruses.
- Drugs that kill viruses often damage the body's tissues.
- Painkillers treat the symptoms of viral diseases but do not kill pathogens.

Discovering and developing new drugs

Drugs were traditionally extracted from plants and microorganisms, for example

- The heart drug digitalis comes from foxglove plants
- The painkiller aspirin originates from willow trees
- Penicillin was discovered by Alexander Fleming from *Penicillium* mould.

Most modern are now synthesised by chemists in laboratories.

New drugs are extensively tested and trailed for

- Toxicity – is it harmful?
- Efficacy – does it work?
- Dose – what amount is safe and effective to give

Stages of clinical trials

Pre-clinical trials
Drug is tested in cells, tissues, and live animals.

Clinical trials
1. Healthy volunteers receive vary low doses to test whether the drugs is safe and effective.
2. If safe, large numbers of healthy volunteers and patients receive the drugs to find the optimum dose.

Peer review
Before being published, the results of clinical trials will be tested and checked by independent researchers. This is called **peer review**.

Double-blind trials
Some clinical trials give some of their patients a placebo drug – one that is known to have no effect.
Double-blind trials are when neither the patients nor the doctors know who has been given the real drug and who has been given the placebo. This reduces biases in the trail.

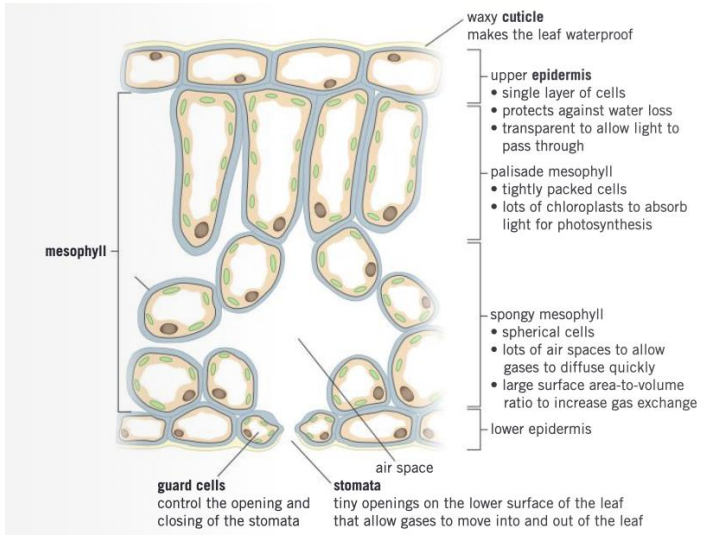
Key terms

Bacterium communicable disease fungicide fungus herd immunity pathogen protist sexually transmitted disease (STD) toxin vaccination vector virus

Plant Tissues
Knowledge Organiser – Science – year 11

Tissues in a leaf

Leaves are organs because they contain many tissues that work together to perform photosynthesis.



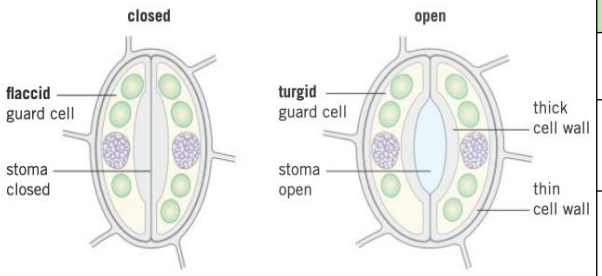
Stomata

Stomata are tiny openings in the undersides of leaves – this placement reduces water loss through evaporation.

They control gas exchange and water loss from leaves by:
- Allowing diffusions of carbon dioxide into the plant for photosynthesis
- Allowing diffusion of oxygen out of the plant

Guard cells are used to open and close the stomata.

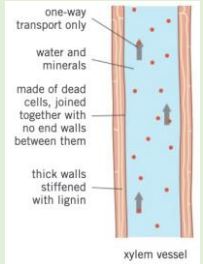
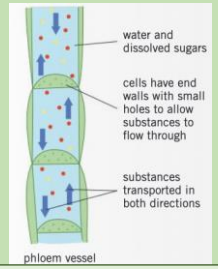
When a plant has plenty of water, the guard cells become turgid. The cell wall on the inner surface is very thick, so it cannot stretch as much as the outer surface. So as the guard cells swell up, they curve away from each other, opening the stoma.



Key terms

cuticle epidermis flaccid mesophyll stomata phloem xylem turgid translocation transpiration guard cell

Transportation in plants

	Transpiration	Translocation
Description	Water is lost through the stomata by evaporation. This pulls water up from the roots through the xylem and is called transpiration. The constant movement of water up the plant is called the transpiration stream.	The movement of dissolved sugars from the leaves to the rest of the plant through the phloem.
Importance	Provides water to cells to keep them turgid. Provides water to cells for photosynthesis Transports mineral ions to leaves.	Moves dissolved sugars made during photosynthesis to other parts of the plant. This allows for respiration, growth and glucose storage.
Specialised Tissues		

Factors affecting the rate of transpiration

Factor	Effect on transpiration	Because…
temperature	higher temperatures increase the rate of transpiration	water evaporates faster at higher temperatures
humidity	lower humidity increases the rate of transpiration	the drier the air the steeper the concentration gradient of water molecules between the air and the leaf
wind speed	more wind increases the rate of transpiration	wind removes the water vapour quickly, maintaining a steeper concentration gradient
light intensity	Higher light intensity increases the rate of transpiration	stomata open wider to let more carbo dioxide into the leaf for photosynthesis

Photosynthesis
Knowledge Organiser - Science – year 11

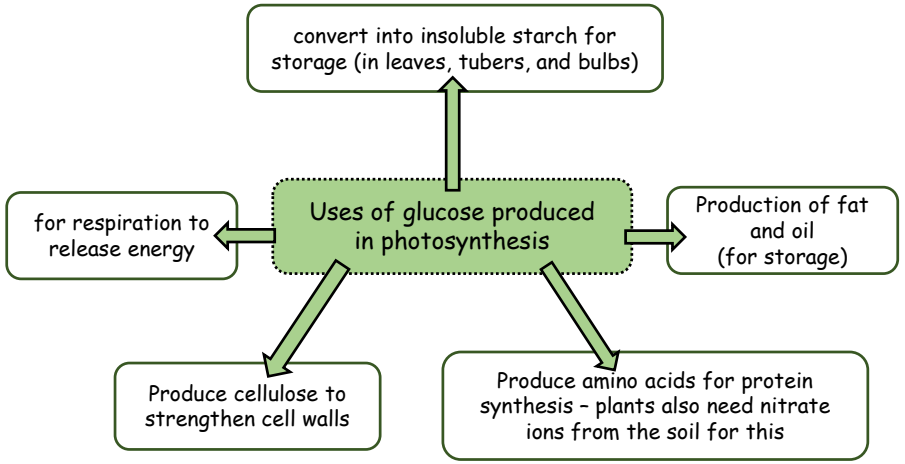
Photosynthesis reaction

Photosynthesis is a chemical reaction in which energy is transferred from the environment as light from the Sun to the leaves of a plant. This is an endothermic reaction.

Chlorophyll, the green pigment in chloroplasts in the leaves, absorbs the light energy. Leaves are well adapted to increase the rate of photosynthesis when needed.

carbon dioxide + water $\xrightarrow{\text{light}}$ **glucose** + oxygen

$6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2$



Inverse square law

As the distance of a light source from a plant increases, the light intensity decreases – this is called an inverse relationship. This relationship is not linear, as light intensity varies in inverse proportion to the square of the distance:

$$\text{light intensity} \propto \frac{1}{\text{distance}^2}$$

For example, if you double the distance between a light source and a plant, light intensity falls by three quarters.

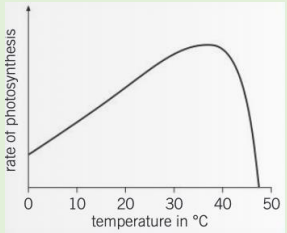
Rate of photosynthesis

A limiting factor is anything that limits the rate of a reaction when it is in short supply.

The limiting factors for photosynthesis are
- Temperature
- Carbon dioxide concentration
- Light intensity
- Amount of chlorophyll

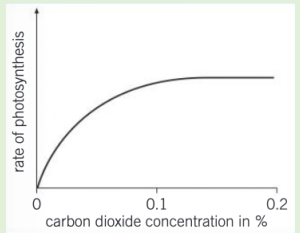
Less chlorophyll in the leaves reduces the rate of photosynthesis. More chlorophyll may be produced by plants in well-lit areas to increase the photosynthesis rate.

Limiting factors and photosynthesis rate



At low temperatures the rate of photosynthesis is low because the reactant molecules have less kinetic energy.

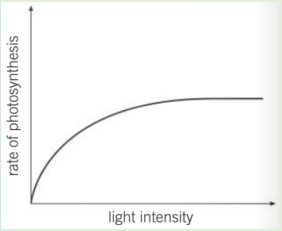
Photosynthesis is an enzyme-controlled reaction, so at high temperatures the enzymes are denatured and the rate quickly decreases.



Carbon dioxide is used up in photosynthesis, so increasing carbon dioxide concentration increases the rate of photosynthesis.

At a certain point, another factor becomes limiting.

Carbon dioxide is often the limiting factor for photosynthesis.



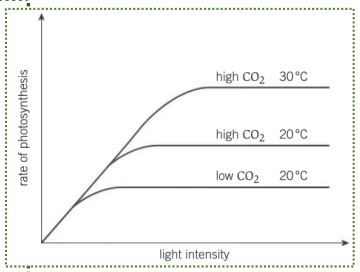
Light energy is needed for photosynthesis, so increasing light intensity increases the rate of photosynthesis.

At a certain point, another factor becomes limiting.

Photosynthesis will stop if there is little or no light.

Interaction of limiting factors

Limiting factors often interact, and any one may be limiting photosynthesis.
For example, on the graph the lowest curve has both carbon dioxide and temperature limiting photosynthesis. Temperature is limiting for the middle curve, and the highest curve shows photosynthesis rate increases when both temperature and carbon dioxide are increased until another factor becomes limiting.



Greenhouse economics

Commercial greenhouses control limiting factors to get the highest possible rates of photosynthesis so they can grow plants as quickly as possible or produce the highest yields, whilst making a profit.

Key terms

carbon dioxide | chlorophyll | chloroplast | endothermic | glucose | inverse square law | limiting factor | photosynthesis

Respiration
Knowledge Organiser - Science – year 11

Cellular respiration

Cellular respiration is an exothermic reaction that occurs continuously in the mitochondria of living cells to supply the cells with energy.

The energy released during respiration is needed for all living processes, including

- chemical reactions to build larger molecules, for example, making proteins from amino acids
- muscle contraction for movement
- keeping warm

Respiration in cells can take place aerobically (using oxygen) or anaerobically (without oxygen).

Type of respiration	Oxygen required?	Relative amount of energy transferred
aerobic	✔	Complete **oxidation** of glucose – large amount of energy is released
anaerobic	✘	Incomplete oxidation of glucose – much less energy is released per glucose molecule than in aerobic respiration

Aerobic respiration

glucose + oxygen → carbon dioxide + water

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

Anaerobic respiration in muscles

glucose → lactic acid

$C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$

Fermentation

Anaerobic respiration in plant and yeast cells is represented by the equation:

glucose → ethanol + carbon dioxide (energy transferred to the environment)

Anaerobic respiration in yeast cells is called fermentation.

The products of fermentation are important in the manufacturing of bread and alcoholic drinks.

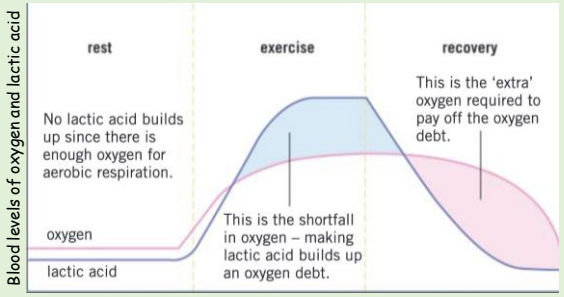
Response to exercise

During exercise the human body reacts to the increased demand for energy.

To supply the muscles with more oxygenated blood, heart rate, breathing rate, and breath volume all increase.

If insufficient oxygen is supplied, anaerobic respiration takes place instead, leading to the build up of lactic acid.

During long periods of vigorous exercise, muscles become fatigued and stop contracting efficiently.



After exercise, the lactic acid accumulated during anaerobic respiration needs to be removed. Oxygen debt is the amount of oxygen needed to react with the lactic acid to remove it from cells.

Removal of lactic acid

Lactic acid in the muscles ⇩ Transported to the liver in the blood ⇩ Lactic acid is converted back to glucose

Metabolism

Metabolism is the sum of all the reactions in the body.

The energy released by respiration in cells is used for the continual enzyme-controlled processes of metabolism that produce new molecules.

Metabolic processes include the synthesis and breakdown of:

Carbohydrates
- synthesis of larger carbohydrates from sugars (starch, glycogen and cellulose)
- breakdown of glucose in respiration to release energy

Proteins
- synthesis of amino acids from glucose and nitrate ions
- amino acids used to form proteins
- excess proteins broken down to form urea for excretion

Lipids
- synthesis of lipids from one molecule of glycerol and three molecules of fatty acid

Key terms: aerobic, anaerobic, exothermic, fermentation, lactic acid, metabolism, mitochondria, oxidation, oxygen debt, respiration

Investigating Photosynthesis

Knowledge Organiser - Science – year 11

Aim

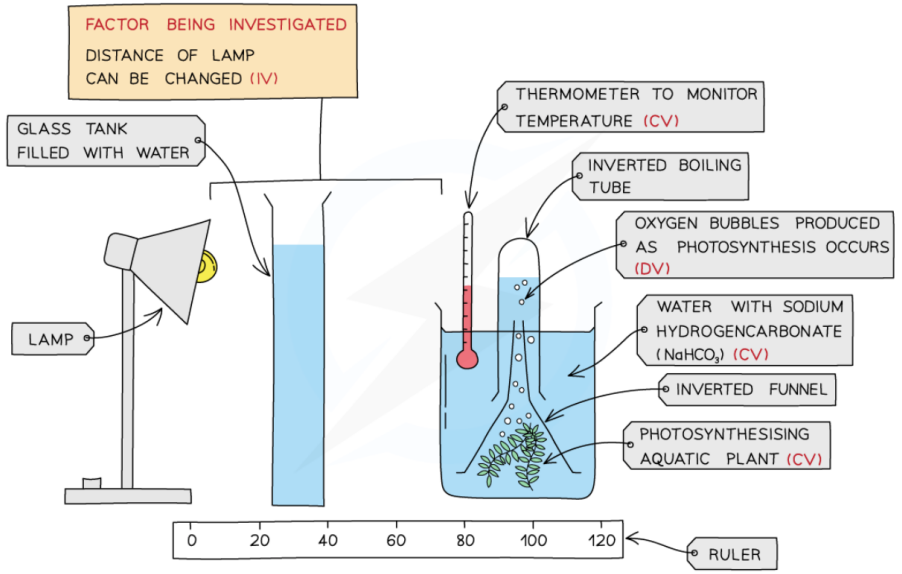
Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed

Variables

Dependent – The number of bubbles / volume of oxygen produced
Independent – Distance between light source and plant / light intensity.
Control – Temperature (can be controlled using and LED bulb or a heat shield, carbon dioxide concentration, type of plant, length of plant, mass of plant.

Method

Place a piece of pondweed (Elodea or Cabomba are often used), into a beaker of water
Use a light a set distance from the plant
Record the number of bubbles observed in three minutes
Repeat steps for different distances



Improvements

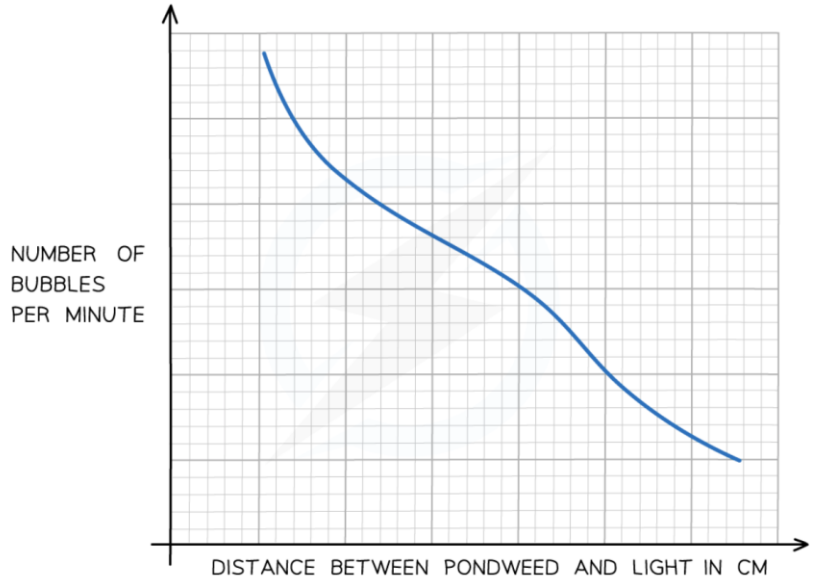
- Use a gas syringe to collect the volume of gas produced
- Repeat the experiment at least twice for each distance and calculate the mean number of bubbles
- Use of a glass tank between lamp and plant to prevent heating of the plant, or using an LED bulb that releases very little heat energy

Changing the Independent Variable

- To investigate the impact of carbon dioxide concentration the concentration of sodium hydrogen carbonate can be changed.
- Use different temperatures of sodium hydrogen carbonate solution.

Results

- As the distance between the plant and light source increases the number of bubbles decreases. This shows that the rate of photosynthesis decreases at lower light intensities.



Key terms

carbon dioxide chlorophyll chloroplast endothermic glucose inverse square law limiting factor photosynthesis

Biology

- Paper 2

Inheritance
Knowledge Organiser

Types of reproduction

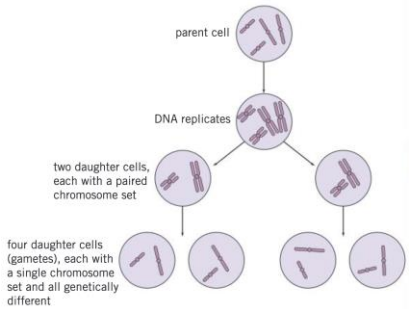
Sexual	Asexual
Two parents	One parent
Cell division thorough meiosis	Cell division by mitosis
Joining of male and female sex cells (gametes) – sperm and egg in animals, pollen and ovule in plants	No fusion of gametes
Produces non-identical offspring that are genetically different to parents	Produces offspring that are genetically identical to parent (clones)
Results in wide variation within offspring and species	No mixing of genetic information

Meiosis

Meiosis is a type of cell division that makes gametes in the reproductive organs.

Meiosis halves the number of chromosomes in gametes, and fertilisation (joining of two gametes) restores the full number of chromosomes.

The fertilised cell divides by mitosis, producing more cells. As the embryo develops, the cells differentiate.



DNA and the genome

Genetic material in the nucleus of a cell is composed of DNA.
DNA is made up of two strands forming a double helix.
DNA is contained in structures called chromosomes.
A gene is a small section of DNA on a chromosome that codes for a specific sequence of amino acids, to produce a specific protein.
The genome of an organism is the entire genetic material of that organism.
The whole human genome has been studied, and this has allowed scientists to:

- Search for genes linked to different diseases
- Understand and treat inherited disorders
- Trace human migration patterns from the past.

Inherited disorders

Some disorders are due to the inheritance of certain alleles:

- Polydactyly (extra finger or toe) is caused by a dominant allele.
- Cystic fibrosis (a disorder of cell membranes) is caused by a recessive allele.

Embryo screening and gene therapy may alleviate suffering from these disorders, but there are ethical issues surrounding their use.

Genetic inheritance

You need to be able to explain these terms about genetic inheritance:

gamete	Specialised sex cell formed by meiosis
chromosomes	Long molecule made from DNA found in the nucleus of cells
gene	Part of a chromosome that codes for a protein – some characteristics are controlled by a single gene (e.g. fur colour in mice and red-green colour blindness in humans), but most are controlled by multiple genes interacting
allele	Different forms of the same gene
dominant	Allele that only needs one copy present to be expressed
recessive	Allele that needs two copies to present to be expressed
homozygous	When an individual carries two copies of the same allele for a trait
heterozygous	When an individual carriers two alleles for a trait
genotype	Combination of alleles an individual has
phenotype	Physical expression of the genotype – the characteristic shown

Genetic crosses

A genetic cross is when you consider the offspring that might result from two known parents. Punnett squares can be used to predict the outcome of a genetic cross, for both the genotypes the offspring might have and their phenotypes.
For example, the cross bb (brown fur) x BB (black fur) in mice:

		mother	
		B	B
father	b	Bb	Bb
	b	Bb	Bb

Offspring genotype: 100% Bb
Offspring phenotype: all black fur

Sex determination

Normal human body cells contain 23 pairs of chromosomes-one of these pairs determines the sex of the offspring.
In human females the sex chromosomes are the same (XX) and in males there are different (XY).
A Punnett square can be used to determine the probability of offspring being male or female. The probability is always 50% in human as there are two XX and two XY outcomes.

		mother	
		X	X
father	X	XX	XX
	Y	XY	XY

Key terms

allele chromosomes clone DNA dominant double helix fertilisation gamete gene genetic cross genome genotype homozygous heterozygous meiosis mitosis phenotype Punnett square recessive

Inheritance
Knowledge Organiser

Variation in populations

Differences in the characteristics of individuals in a population are called variation.
Variation may be due to differences in:

- the genes they have inherited, for example eye colour (genetic causes)
- the environment in which they have developed, for example, language (environmental causes)
- a combination of genes and the environment.

Mutation

There is usually a lot of genetic variation within a population of species – this variation arises from mutations.
A mutation is a change in a DNA sequence:

- mutations occur continuously
- very rarely a mutation will lead to a new phenotype
- some mutations may change an existing phenotype and most have no effect
- if a phenotype is suited to an environmental change, it can lead to a relatively rapid change in the species – this is the theory of evolution by natural selection.

Selective Breeding

Selective breeding (artificial selection) is the process by which humans breed plants and animals for particular genetic characteristics.
Humans have been using selective breeding for thousands of years, since breeding crops from wild plants and domesticating animals.

Process of selective breeding:

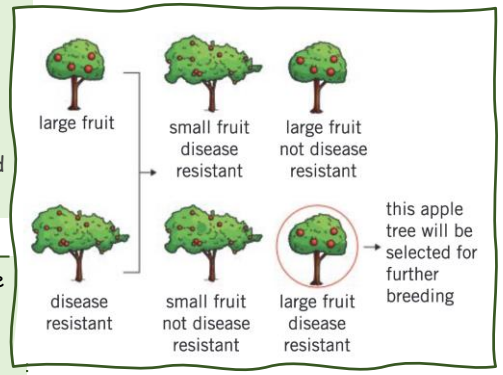
1. choose parents with the desired characteristics from a mixed population
2. breed them together
3. choose offspring with the desired characteristic and breed them together
4. continue over many generations until all offspring show the desired characteristic.

The characteristic targeted in selective breeding can be chosen for usefulness or appearance, for example

- disease resistance in food crops
- animals that produce more meat or milk
- domestic dogs with a gentle nature
- larger or unusual flowers.

Disadvantages of selective breeding:

- can lead to inbreeding, where some breeds are particularly prone to inherited defects or diseases
- reduces variation, meaning all members of a species could be susceptible to certain diseases.

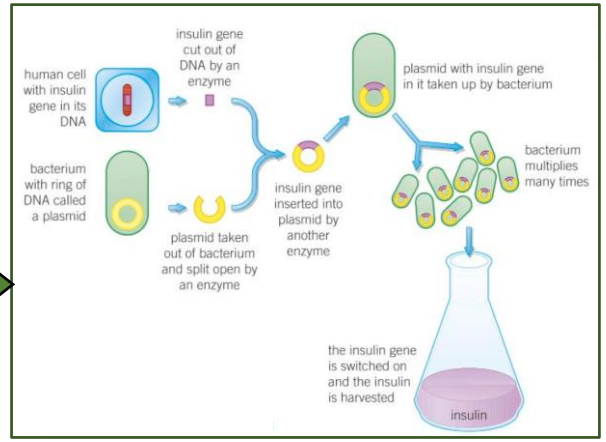


Genetic Engineering

Genetic engineering is a process that involves changing the genome of an organism by introducing a gene from another organism to produce a desired characteristic.

For example:

- Bacterial cells have been genetically engineered to produce useful substances, such as human insulin to treat diabetes.
- Plant crops have been genetically engineered to be resistant to diseases, insects, or herbicides, or to produce bigger and better fruits and higher crop yields. Crops that have undergone genetic engineering are called genetically modified (GM).



There are many benefits to genetic engineering in agriculture and medicine, but also some risks and moral objections.

Benefits	Risks
• Potential to overcome some inherited human diseases • Can lead to higher value of crops as GM crops have bigger yields than normal • Crops can be engineered to be resistant to herbicides, make their own pesticides, or be better adapted to environmental conditions.	• Genes from GM plants and animals may spread to other wildlife, which could have devastating effects on ecosystems • Potential negative impacts on populations of wild flowers and insects • Ethical concerns, for example, in the future people could manipulate the genes of foetuses to ensure certain characteristics • Some people believe the long-term effects on health of eating GM crops have not been fully explored.

Key terms genetically modified | genetic engineering | inbreeding | mutation | selective breeding | variation

Inheritance
Knowledge Organiser

Theory of evolution

Evolution is the gradual change in the inherited characteristics of a population over time.

Evolution occurs through the process of natural selection and may result in the formation of new species.

Process of natural selection

The theory of evolution by natural selection states that:

- Organisms within species show a wide variation in phenotype
- Individuals with characteristics most suited to the environment are more likely to survive and breed successfully
- These characteristics are then passed on to their offspring.

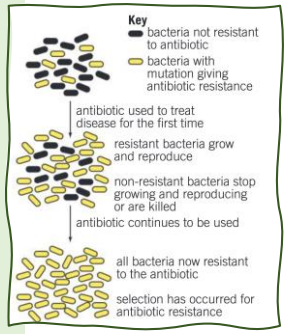
Resistant bacteria

Bacteria can evolve rapidly because the reproduce very quickly. This has lead to many strains of bacteria developing antibiotic resistance, such as MRSA. The development of antibiotic resistance is evidence for the theory of evolution by natural selection.

The development of new antibiotics is expensive and slow, so is unlikely to keep up with the emergence of new antibiotic-resistant bacteria strains.

To reduce the rise of antibiotic-resistant strains

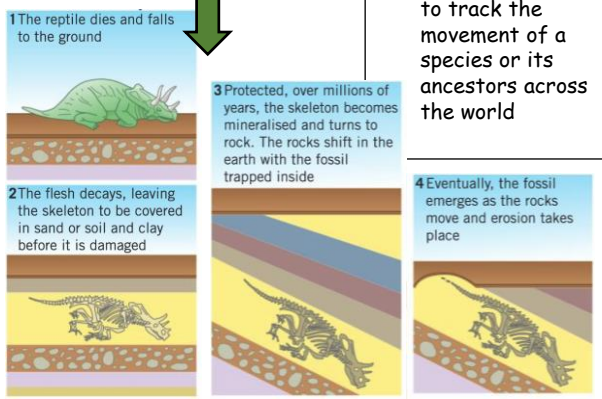
- doctors should only prescribe antibiotics for serious bacterial infections
- patients should complete their courses of antibiotics so all bacteria are killed and non survive to form resistant strains.
- the use of antibiotics in farming and agriculture should be restricted.



Fossils

Fossils are the remains of organisms from millions of years ago, which are found in rocks.
Fossils can be formed from:

- Parts of the organism that do not decay because one or more of the conditions needed for decay are absent
- Hard parts of an organism (e.g. bones) when replaced by minerals
- Preservation of the traces of organisms (e.g. burrows, footprints, and rootlet traces).



Evidence for evolution

The theory of evolution by natural selection is now widely accepted because there are lots of data to support it, such as

- It has been shown that characteristics are passed on to offspring in genes
- Evidence from the fossil record
- The evolution of antibiotic resistance in bacteria

Benefits of the fossil record	Problems with the fossil record
• Can tell scientists how individual species have changed over time • Fossils allow us to understand how life developed over the Earth's history • Fossils can be used to track the movement of a species or its ancestors across the world	• Many early organisms were soft-bodied, so most decayed before producing fossils • There are gaps in the fossil record as not all fossils have been found and others have been destroyed by geological or human activity – this means scientists cannot be certain about how life began on Earth.

Classification of living organisms

Kingdom
Phylum
Class
Order
Family
Genus
Species

Organisms are named by the binomial system of genus and species e.g. **Homo Sapiens**

Homo is our **Genus**
Sapien is our **Species**

Carl Linnaeus developed a system to classify living things into groups, based upon observable characteristics.

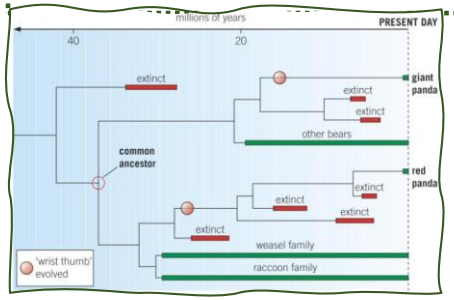
New models of classification were proposed as understanding of biochemical processes developed and improvements in microscopes led to discoveries of internal structures.

There is now a three-domain system developed by Carl Woese, dividing organisms into:

- Bacteria (true bacteria)
- Archea (primitive bacteria usually living in extreme conditions)
- Eukaryota (including protists, plants, fungi and animals).

Evolutionary Trees

Evolutionary trees use current classification data for living organisms and fossil data for extinct organisms to show how scientists believe organisms are related.



Extinction

Extinction is when there are no remaining individuals of a species still alive.
Factors that may contribute to a species' extinction include:

- new predators
- new diseases
- new competitors
- catastrophic events
- changes to the environment

Key terms: Antibiotic resistance | binomial system | evolution | evolutionary tree | extinction | fossil record | natural selection | three-domain system

Homeostasis and the nervous system
Knowledge Organiser

Homeostasis

Homeostasis is the regulation of internal conditions (of a cell or whole organism) in response to internal and external changes, to maintain optimum conditions for functioning.

This maintains optimum conditions for all cell functions and enzyme action.

In the human body, this includes control of
- blood glucose concentration
- body temperature
- water levels

The automatic control systems of homeostasis may involve nervous responses or chemical responses.

All control systems involve

- Receptor cells, which detect stimuli (changes in the environment)
- Coordination centres (such as the brain, spinal cord, or pancreas), which receive and process information from receptors
- Effectors (muscles or glands), which produce responses to restore optimum conditions.

The nervous system

Function

The nervous system enables humans to react to their surroundings and to coordinate their behaviour – this includes both voluntary and involuntary actions.

Structure

The nervous system is made up of the central nervous system (CNS) and a network of nerves.
The CNS comprises the brain and the spinal cord.

Stimulus
A change in the environment (stimulus) is detected by receptors

Receptor
Information from receptors passes along cells (neurones) to the CNS as electrical impulses

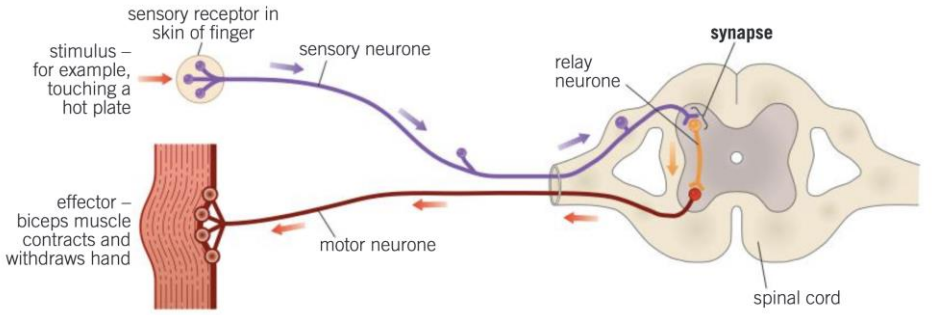
Coordinator
The CNS coordinates the body's response to the stimulus

Effector
Effectors bring about a response, such as glands secreting hormones or muscles contracting

Response
The body responds to the stimulus

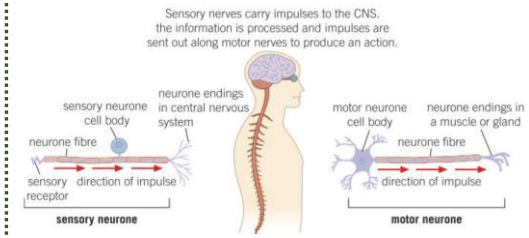
Reflex arcs

Reflex actions of the nervous system are automatic and rapid – they do not involve the conscious part of the brain.
Reflex actions are important for survival because they help prevent damage to the body.

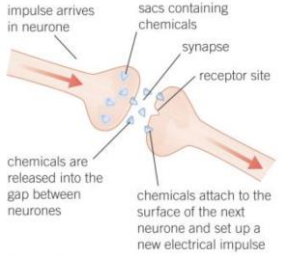


Reflex arc structures

Neurones
Carry electrical impulses around the body – relay neurones connect sensory neurones to motor neurones



Synapses
Gaps between neurones, which allow electrical impulses in the nervous system to cross between neurones.



Factors affecting reaction time

- Tiredness
- Distractions
- Caffeine
- Alcohol

Key terms

brain | central nervous system | coordination centre | effectors | homeostasis | involuntary | neurones | receptors | reflex action | spinal cord | stimulus | synapse

Hormonal Control
Knowledge Organiser

Human endocrine system

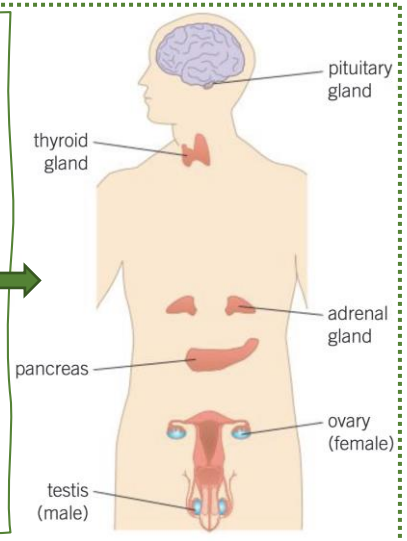
The endocrine system is composed of glands that secrete chemicals called hormones into the bloodstream.

The blood carries hormones to a target organ, where an effect is produced.

Compared to the nervous system, the effects caused by the endocrine system are slower but act for longer.

The pituitary gland, located in the brain, is known s a 'master gland', because it secretes several hormones into the blood.

These hormones then act on other glands to stimulate the release of other hormones, and bring about effects.

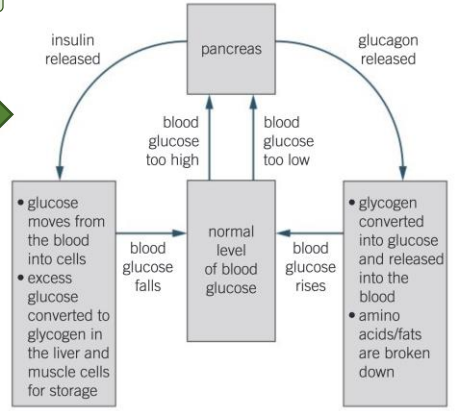


Endocrine gland	Role of the hormone
Pituitary	• Controls growth in children • Stimulates the thyroid gland to make thyroxine to control metabolic rate • In females – stimulates the ovaries to make and release eggs • In males – stimulate the testes to make sperm
Thyroid	• Controls the rate of metabolism
Pancreas	• Controls blood glucose levels
Adrenal	• Prepares the body for stress • Involved in the 'fight or flight' response
Ovaries	• Controls the development of female secondary sexual characteristics • Controls the menstrual cycle
Testes	• Controls the development of male secondary sexual characteristics • Involved in the production of sperm

Control of blood glucose levels

Blood glucose (sugar) concentration is monitored and controlled by the pancreas.

This is an example of negative feedback control, as the pancreas switches production between the hormones insulin and glucagon to control blood glucose levels.



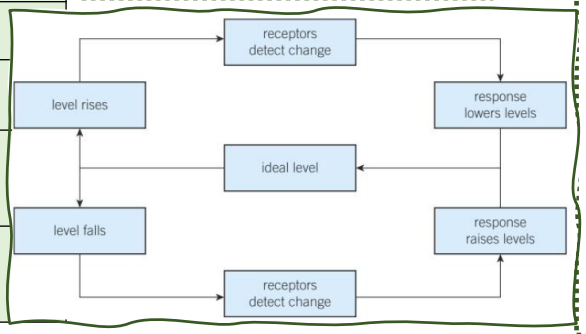
Diabetes

Diabetes is a non-communicable disease where the body either cannot produce or respond to insulin, leading to uncontrolled blood glucose concentrations.

Type 1 diabetes	Type 2 diabetes
Early onset	Usually later onset, obesity is a risk factor
Pancreas stops producing sufficient insulin	Body doesn't respond to the insulin produced
Commonly treated through insulin injections, also diet control and exercise	Commonly treated through a carbohydrate controlled diet and exercise

Negative feedback – HT Only

Negative feedback systems work to maintain a steady state. For example, blood glucose, water, and thyroxine levels are all controlled in the body by negative feedback.



Adrenaline
- produced by adrenal glands in time of fear or stress
- Increases heart rate
- Boosts delivery of oxygen and glucose to brain and muscles
- Prepares the body for 'fight or flight' response
- Does not involve negative feedback, as adrenal glands stop producing adrenaline

Thyroxine
- Produced by the thyroid gland
- Regulates how quickly your body uses energy and makes proteins (metabolic rate)
- Important for growth and development
- Levels controlled by negative feedback

Key terms: brain, central nervous system, coordination centre, effectors, homeostasis, involuntary, neurones, receptors, reflex action, spinal cord, stimulus, synapse

Hormonal Control
Knowledge Organiser

Hormones in human reproduction

During puberty, reproductive hormones cause the secondary sex characteristics to develop:

Oestrogen

- Main female reproductive hormone
- Produced in the ovary
- At puberty, eggs begin to mature and one is released every 28 days

Testosterone

- Main male reproductive hormone
- Produced by the testes
- Stimulates sperm production

Several hormones are involved in the menstrual cycle. Their functions are given in the table, and their levels vary as shown in the figures

Hormone	Released by	Function
Follicle stimulating hormone (FSH)	Pituitary gland	• Causes eggs to mature in the ovaries • Stimulates ovaries to produce oestrogen
Luteinising hormone (LH)	Pituitary gland	• Stimulates the release of mature eggs from the ovaries (ovulation)
Oestrogen	ovaries	• Causes lining of uterus wall to thicken • Inhibits release of FSH • Stimulates release of LH
Progesterone	ovaries	• Maintains thick uterus lining • Inhibits release of FSH and LH

Key terms

contraception follicle stimulating hormone infertility in vitro fertilisation oestrogen ovary luteinising hormone menstrual cycle ovulation progesterone testes uterus

Higher Tier Only: Treating infertility with hormones

Hormones are used in modern reproductive technologies to treating infertility.

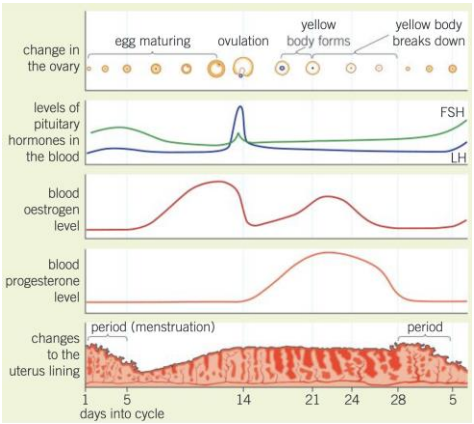
FSH and LH can be given as a drug to treat infertility, or in vitro fertilisation (IVF) treatment may be used.

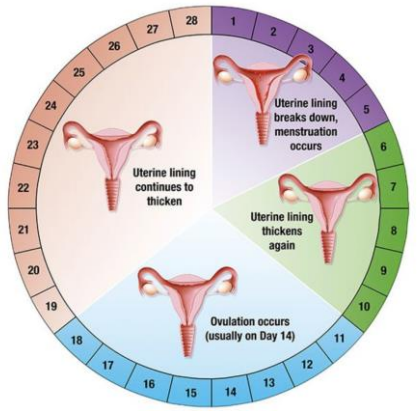
IVF treatment

1. Mother given FSH and LH to stimulate the maturation of several eggs
2. Eggs collected from the mother and fertilised by sperm from the father in a laboratory
3. Fertilised eggs develop into embryos
4. One or two embryos are inserted into the mother's uterus (womb) when the embryos are still tiny balls of cells.

Fertility treatment has some disadvantages:

- It is emotionally and physically stressful
- It has a low success rate
- It can lead to multiple births, which are a high risk to both the babies and the mother.





Contraception

Fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception.

Hormonal contraception

- Oral contraceptives – contain hormones to inhibit FSH production so no eggs mature
- Injection, implant, skin patch or intrauterine device (IUD) – slowly release progesterone to inhibit maturation and release of eggs; can last months or years

Non-hormonal contraception

- Barrier methods, for example, condoms and diaphragms – prevent sperm reaching the egg
- Copper IUD – prevents the implantation of an embryo
- Surgical methods of male and female sterilisation
- Spermicidal agents – kill or disable sperm
- Abstaining from intercourse when an egg may be in the oviduct

Relationships in an Ecosystem
Knowledge Organiser

Ecosystem organisation

Individual organisms

Population - the total number of organisms of the same species that live in one specific geographical area

Community – group of two or more populations of different species living in one specific geographical area

Ecosystem - the interaction of a community of living organisms with the non-living parts of their environment

Competition

To survive and reproduce, organisms require a supply of resources from their surroundings and from the other living organisms there.

This can create competition, where organisms within a community compete for resources.

There are two types of competition – interspecific competition is between organisms of different species and intraspecific competition is between organisms of the same species.

Animals	Plants
• Food	• Light
• Mates	• Space
• Territory	• Water and mineral ions

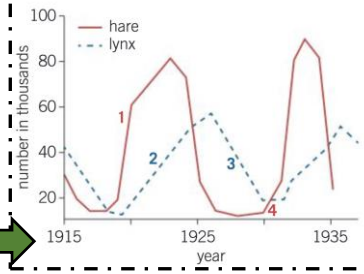
Interdependence

Within a community each species interacts with many others and may depend on other species for things like food, shelter, pollination, and seed dispersal.

If one species is removed it can affect the whole community – this is called interdependence.

A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant.

An example of this is the interaction between predator and prey populations, which rise and fall in a constant cycle so that each remains within a stable range



1 If the population of hares increases there is a larger food supply for the lynx.

2 This can therefore support more lynx, so more offspring survive.

3 The growing numbers of lynx eventually reduce the food supply. The number of predators starts to decrease.

4 The prey population starts to increase once more – the cycle then begins again.

Abiotic Factors
Abiotic factors are non-living factors in the ecosystem that can affect a community.
Too much or too little of the following abiotic factors can negatively affect the community in an ecosystem:

carbon dioxide level for plants, light intensity, moisture levels, oxygen levels for animals that live in water, soil pH and mineral content, temperature, wind intensity and direction

Biotic Factors
Biotic factors are living factors in the ecosystem that can affect a community.
For example, the following biotic factors would all negatively affect populations in a community:

decreased availability of food, new predators arriving, new pathogens, competition between species.

Adaptations of organisms

Organisms have features – adaptation – that enable them to survive in the condition in which they live. The adaptations of an organism may allow it to outcompete others, and provide it with an evolutionary advantage.

Structural
Physical features that allow an organism to successfully compete:
- sharp teeth to hunt prey
- colouring that may provide camouflage to hide from predators or to hunt prey
- a large or small body surface area-to-volume ratio.

Behavioural
The behaviour of an organism that gives it an advantage:
- making nests to shelter offspring or attract a mate
- courtship dances to attract a mate
- use of tools to obtain food
- working together in packs

Functional
Adaptations related to processes that allow an organism to survive:
- photosynthesis is plants
- production of poisons or venom to deter predators or kill prey
- changes in reproduction timings

Organism	Example adaptations
	- White fur for camouflage when hunting - Feet with large surface area to distribute weight on snow - Small ears to reduce heat loss - Thick fur for insulation
	- Feet with large surface to distribute weight on sand - Hump stores fat to provide energy when food is scarce - Tough mouth and tongue to allow camel to eat cacti - Long eyelashes to keep sand out of eyes.
	- Spines instead of leaves to reduce surface area and therefore water loss - Long roots to reach water underground - Large, fleshy stem to store water

Some organisms are extremophiles, which means they live in environments that are very extreme where most other organisms could not survive. For example, areas with very high temperatures, extreme pressures, high salt concentrations, highly acidic or alkaline conditions, low levels of oxygen or water.

Key terms

abiotic factor adaptation biotic factor community ecosystem extremophile interaction interdependence interspecific intraspecific population

Ecology
Knowledge Organiser

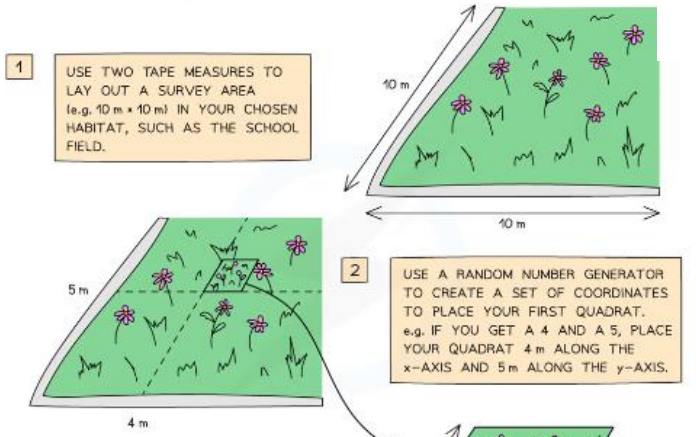
Investigating Distribution

Aim: To measure the population size of a common species in a habitat and use sampling techniques to investigate the effect of a factor on the distribution of this species

You will:
- Use a quadrat to estimate the population size of a plant species in a survey area
- Use a transect line and a quadrat to investigate the effect of a factor on the number of plants in a survey are

ESTIMATING POPULATION SIZE METHOD

1 USE TWO TAPE MEASURES TO LAY OUT A SURVEY AREA (e.g. 10 m × 10 m) IN YOUR CHOSEN HABITAT, SUCH AS THE SCHOOL FIELD.



2 USE A RANDOM NUMBER GENERATOR TO CREATE A SET OF COORDINATES TO PLACE YOUR FIRST QUADRAT. e.g. IF YOU GET A 4 AND A 5, PLACE YOUR QUADRAT 4 m ALONG THE x-AXIS AND 5 m ALONG THE y-AXIS.

3 COUNT THE NUMBER OF YOUR CHOSEN PLANT SPECIES (e.g. DANDELIONS) THAT ARE FOUND WITHIN THIS QUADRAT.

4 RECORD THIS NUMBER IN A RESULTS TABLE AND REPEAT STEPS 1–3 UNTIL YOU HAVE RECORDED THE NUMBER OF YOUR CHOSEN PLANT SPECIES IN 10 QUADRATS.

Quadrat	Number of dandelions
1	3
2	4
3	2
4	1
5	0
6	0
7	2
8	5
9	3
10	1
Total	21

5 ESTIMATE THE POPULATION OF DANDELIONS IN YOUR SURVEY AREA USING THE EQUATION:

$$\text{ESTIMATED POPULATION SIZE} = \frac{\text{TOTAL AREA}}{\text{AREA SAMPLED}} \times \text{TOTAL NUMBER OF DANDELIONS COUNTED}$$

TOTAL SURVEY AREA WAS 10 m × 10 m

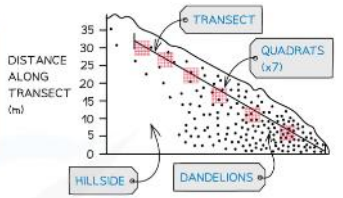
$= \frac{100}{10} \times 21$

$= 210$

EACH QUADRAT IS 1 m × 1m AND 10 QUADRATS WERE PLACED

INVESTIGATING THE EFFECT OF A FACTOR ON THE DISTRIBUTION OF A SPECIES METHOD

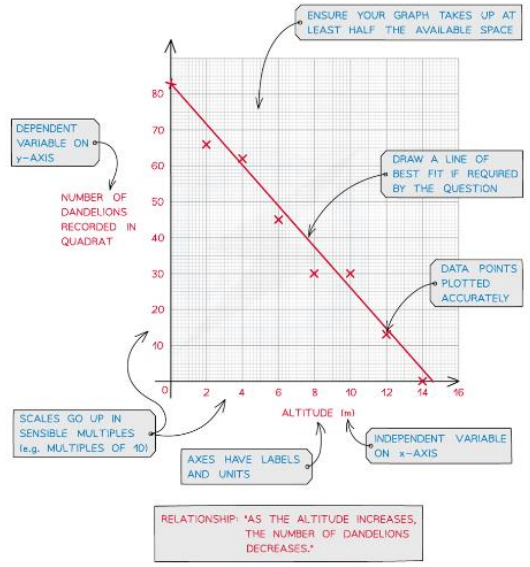
1 SET YOUR TRANSECT UP THROUGH THE AREA YOU ARE INVESTIGATING. IN THIS CASE, A 30 m TAPE MEASURE IS PLACED UP A HILLSIDE. PLACE A QUADRAT AT EQUAL INTERVALS (e.g. EVERY 5 m) ALONG THE TRANSECT.



Distance along transect (m)	Number of dandelions	Attitude (m)
0	84	2
5	66	4
10	62	6
15	45	8
20	30	10
25	30	12
30	13	14

2 RECORD THE NUMBER OF YOUR CHOSEN PLANT SPECIES INSIDE EACH QUADRAT. RECORD YOUR ABIOTIC FACTOR (e.g. ALTITUDE) AT EACH QUADRAT. RECORD YOUR RESULTS IN A TABLE.

3 PLOT YOUR DATA IN A GRAPH AND DESCRIBE ANY RELATIONSHIP THAT CAN BE OBSERVED.



Key terms

biodiversity biofuel biomass deforestation global warming peat bog pollution

Ecology
Knowledge Organiser

Biodiversity

Biodiversity is the variety of all the different species of organisms (plant, animal, and microorganism) on Earth, or within a specific ecosystem.

High biodiversity ensures the stability of an ecosystem because it reduces the dependence of one species on another for food or habitat maintenance.

The future of the human species depends on us maintaining a good level of biodiversity. Many human activities, such as deforestation, are reducing biodiversity, but only recently have measures been taken to try to prevent this.

Maintaining biodiversity

Many habitats are currently under threat due to human activities such as deforestation, climate change, and habitat destruction.

There are a number of ways in which scientists and concerned citizens are trying to maintain biodiversity and reduce the negative impact of humans on ecosystems, including

- breeding programmes in zoos for endangered species
- protection and regeneration of rare habitats (e.g., national parks)
- reintroduction of hedgerows in agricultural areas where single crop species are grown, as hedges provide habitat for many organisms
- government policies to reduce deforestation and carbon dioxide emissions
- recycling resources rather than dumping waste in landfill.

Waste Management

Rapid growth of the human population and increases in the standard of living mean that humans are using more resources and producing more waste.
Waste and chemical materials need to be properly handled in order to reduce the amount of pollution they cause. Pollution kills plants and animals, and can accumulate in food chains, reducing biodiversity.
Pollution can occur

- in water, from sewage, fertiliser run-off, or toxic chemicals (e.g., from factories)
- in air, from smoke and acidic gases
- on land, from landfill and toxic chemicals.

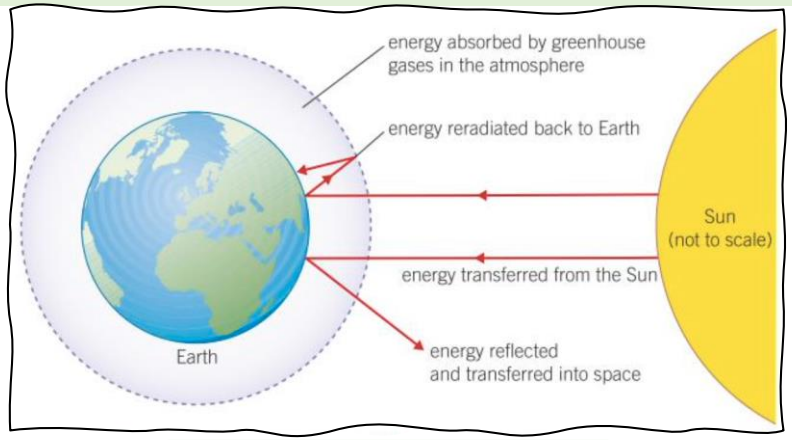
Key terms

biodiversity biofuel biomass deforestation global warming peat bog pollution

Global warming

Levels of carbon dioxide and methane in the atmosphere are increasing due to human activity, contributing to global warming and climate change.
Global warming is the gradual increase in the average temperature of the Earth. This scientific consensus is based on systematic reviews of thousands of peer-reviewed publications.
Global warming has resulted in

- large-scale habitat change and reduction, causing a decrease in biodiversity
- extreme weather and sea-level changes
- migration of species to different parts of the world, affecting ecosystems
- threats to the security and availability of food.



Land use and deforestation

Rapid population growth has led to humans using much more land for building, quarrying, farming, and dumping waste. This reduces the area in which animals can live and can further destroy habitats through pollution.
For example, the destruction of peat bogs (areas of partially decayed vegetation) to produce garden compost has decreased the amount of this important habitat, and the biodiversity it supports. The decay or burning of peat for energy also releases carbon dioxide into the atmosphere, contributing to global warming.
Large-scale deforestation in tropical areas has been carried out to provide land for cattle and rice fields, and to grow crops for biofuels.

This has resulted in

- large amounts of carbon dioxide being released into the atmosphere due to burning of trees.
- extinctions and reductions in biodiversity as habitats are destroyed
- climate change, as trees absorb carbon dioxide and release water vapour.

Knowledge Organiser - Space

SCIENCE

Keywords

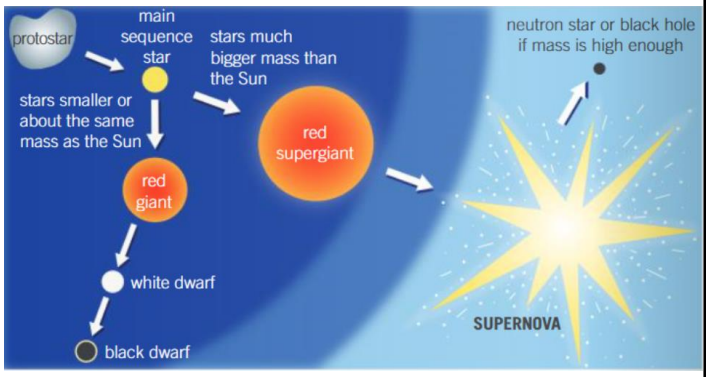
Big Bang theory- the theory that the universe was created in a massive explosion from a single point and the universe has been expanding ever since.
Centripetal force- The resultant force towards the centre of a circle acting on an object moving in a circular path.
Dark energy-Believed to cause the universe's acceleration.
Dark matter- Matter in a galaxy that cannot be seen. Its presence has been deduced because galaxies would spin much faster if their stars were their only matter.
Nebula- interstellar cloud of dust and gas.
Red shift- Increase in the wavelength of EM waves emitted by a star due to the galaxies motion away from us. The faster the speed of the galaxy the greater the red shift.
Satellite- an object that orbits around a planet in a circular motion.
Supernova- the explosion of a massive star after fusion ceases and causes the matter to collapse into its core.

Formation of stars continued

More energy from the gravitational potential energy store of the particles is transferred to the thermal energy store so the temperature of the Protostar increases.

When the temperature is high enough hydrogen nuclei fuse together to form helium nuclei. This nuclear fusion releases huge amounts of energy. The star is now at its main sequence stage. The star is stable as the forces are balanced. The inwards gravitational force and the outwards force from the fusion.
When the star runs of out hydrogen to fuse it reaches the end of main sequence. Its core collapses and the outer layers swell. The star is now a red giant/ red super giant depending on the size of the star.

- If the star is the same size as the sun or smaller when ta star has fused the heavier elements up to iron, fusion stops. The star collapses. It gets very hot and dense. It glows, this is a white dwarf. It then fades and becomes a black dwarf.
- If the star is much bigger than the sun the red super giant will fuse heavier elements up to iron and then it will collapse. The compression causes a cataclysmic explosion called a supernova. Elements heavier than iron are formed in a supernova. The most massive stars then form a black hole. Those that are a bit less massive from neutron stars.



Our solar system

Our solar system is made up of the Sun (a star) and all the objects that's orbit it. Including; eight planets, dwarf planets, asteroids, comets and moons (natural satellites that orbit planets).
The sun is located in the Milky way galaxy which contains billions of other stars.

Formation of stars

The sun (and all the other stars) was formed from a huge cloud of dust and gas (a nebula) pulled together by gravitational attraction.

Gravitational attraction between the particles f dust and gas cause them to merge together to form a Protostar.

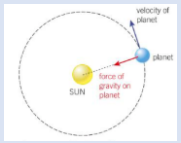
The Protostar becomes denser as gravitational forces continue to pull it together, so the particles in the Protostar collide more often.

Orbital motion and satellites

The Earth and other planets in the solar system orbit the Sun. The moon is a natural satellite that orbits the Earth. Other planets have moons orbiting them. The Earth has artificial satellites orbiting it also.

Circular orbits

Satellites orbit around the Earth in a circular orbit.
An object in a circular orbit is constantly changing direction. It is constantly changing **velocity** (not speed) as velocity is a vector quantity.
Therefore it is constantly **accelerating** and so have a **resultant force** acting on it.
The resultant force is centripetal force and is always directed towards the centre of the circular orbit. The acceleration is always directed towards the centre.



The big bang theory

Scientists used observations to propose the Big Bang theory for the start of the universe. The Big Bang theory suggests that the universe started off as an extremely hot small and dense object that exploded.
The evidence for this is **red-shift** and the existence of **electromagnetic radiation** left over from the Big Bang.
Red shift is the name given to the effect that makes the wavelengths of light longer if the light source is moving away from the observer. Light from the most distant galaxies are the most red shifted and suggests they are moving away the fastest.

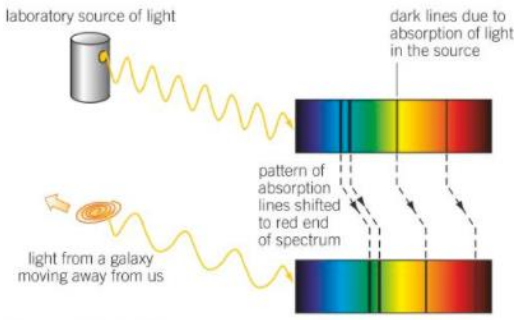


Figure 2 *Red-shift*

Scientists do not know or understand much about the origin of the universe. For example **dark energy** could be responsible for the acceleration of the universe and **dark matter** might provide gravitational force holding galaxies together.
Dark matter cannot be seen. Its presence means that the density of the universe is much larger than if it did not exist.

GCSE Spanish

Knowledge

organiser

This knowledge organiser has lot of general vocabulary and topic specific vocabulary to help you revise.

Whenever you see a QR code, scan it and it will take you straight to that set of vocabulary to practise on Quizlet!

Present Tense

There are two main present tenses in Spanish.

Present tense

Present tense: Used to talk about things that usually happen.

To form:

1. Take your infinitive.
2. Remove the –AR, -ER, -IR
3. Add the correct ending

Endings

-AR verbs		-ER verbs		-IR verbs	
I	-o	I	-o	I	-o
You	-as	You	-es	You	-es
He/she	-a	He/she	-e	He/she	-e
We	-amos	We	-emos	We	-imos
You lot	-áis	You lot	-éis	You lot	-ís
They	-an	They	-en	They	-en

Examples

Present	English	Present	English
Tengo	I have	**Estudio**	I study
Voy	I go	**Trabajo**	I work
Doy	I give	**Dejo**	I stop
Soy	I am	**Uso**	I use
Sigo	I carry on	**Escucho**	I listen
Puedo	I can	**Como**	I eat
Hago	I do	**Bebo**	I drink
Salgo	I go out	**Aprendo**	I learn
Juego	I play	**Veo**	I watch
Hablo	I talk/speak	**Vivo**	I live
Continuo	I continue	**Escribo**	I write

Present continuous tense: Used to talk about things that are happening right now .

To form:

1. Take the present tense of the verb "estar".
2. Add the present participle

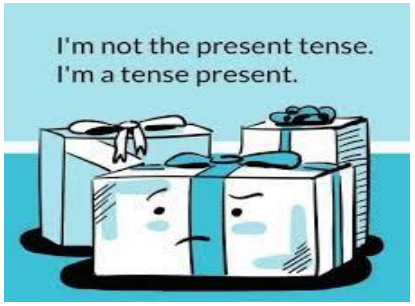
Verb "estar"

-AR verbs	
Estoy	I am
Estás	You are
Está	He/she/it is
Estamos	We are
Estáis	You lot are
Están	They are

AR Verbs	Present participle	ER/IR verbs	Present participle
hablar	**hablando** (speaking)	**comer**	**comiendo** (eating)
jugar	**jugando** (playing)	**beber**	**bebiendo** (drinking)
estudiar	**estudiando** (studying)	**aprender**	**aprendiendo** (learning)
escuchar	**escuchando** (listening)	**escribir**	**escribiendo** (writing)
llevar	**llevando** (wearing)	**vivir**	**viviendo** (living)
continuar	**continuando** (continuing)	**ver**	**viendo** (watching)
decir	**diciendo** (saying)	**ir**	**yendo** (going)

Time phrases

Normalmente – normally
Suelo + infinitive – usually/I tend to…
Generalmente – generally
Hoy – today
Por la tarde - in the evening/afternoon
Por la mañana – in the morning
Por la noche – at night
Los lunes/martes etc… - on Mondays, Tuesdays etc…
Todos los días/cada día – everyday
Siempre – always
A veces – sometimes
A menudo – often
De vez en cuando – from time to time
Frecuentemente – frequently
Tarde – late
Temprano – early
Ahora – now
De nuevo – again
Durante – during
Cada quince días – every fortnight
Casi nunca – almost never
En mi tiempo libre – in my free time
Cuando hace buen tiempo – when it's nice weather
Cuando hace mal tiempo – when it's bad weather
Cuando tengo tiempo – when I have time



Past Tense

Preterite tense Imperfect tense

There are two main past tenses in Spanish. The preterite and the imperfect.

Preterite tense: Used to talk about completed actions in the past.

To form:

1. Take your infinitive.
2. Remove the –AR, -ER, -IR
3. Add the correct ending

-AR verbs		-ER/-IR verbs	
I	-é	I	-í
You	-aste	You	-iste
He/she	-ó	He/she	-ió
We	-amos	We	-imos
You lot	-asteis	You lot	-isteis
They	-aron	They	-ieron

Endings

Examples

Preterite	English	Preterite	English
Tuve	I had	**Trabajé**	I worked
Fui	I went	**Dejé**	I stopped
Di	I gave	**Usé**	I used
Fui	I was	**Escuché**	I listened
Seguí	I carried on	**Comí**	I ate
Pude	I could	**Bebí**	I drank
Hice	I did	**Aprendí**	I learned
Jugué	I played	**Vi**	I saw/watched
Hablé	I spoke/talked	**Viví**	I lived
Continué	I continued	**Escribí**	I wrote
Estudié	I studied	**Decidí**	I decided

Imperfect tense: Used to narrate events in the past and describe what things used to be like

To form:

1. Take your infinitive.
2. Remove the –AR, -ER, -IR
3. Add the correct ending

-AR verbs		-ER/-IR verbs	
I	-aba	I	-ía
You	-abas	You	-ías
He/she	-aba	He/she	-ía
We	-ábamos	We	-íamos
You lot	-abais	You lot	-íais
They	-aban	They	-ían

Endings

Imperfect	English	Imperfect	English
Era	I used to be	**Trabajaba**	I used to work
Iba	I used to go	**Dejaba**	I used to stop
Veía	I used to watch/see	**Usaba**	I used to use
Tenía	I used to have	**Escuchaba**	I used to listen
Seguía	I used to carry on	**Comía**	I used to eat
Podía	I used to be able	**Bebía**	I used to drink
Hacía	I used to do	**Aprendía**	I used to learn
Jugaba	I used to play	**Daba**	I used to give
Hablaba	I used to speak/talk	**Vivía**	I used to live
Continuaba	I used to continue	**Escribía**	I used to write
Estudiaba	I used to study	**Decidía**	I used to decide

Time phrases

En el pasado – in the past
Ayer – yesterday
Anoche – last night
El año pasado – last year
El mes pasado – last month
La semana pasada – last week
Hace___años - ___ years ago
Cuando era más joven – when I was younger
Cuando era niño/a – when I was a child
De niño/a – As a child
La última vez – the last time
Durante el siglo XX – in the 20th century
Anteayer – the day before yesterday

Learn as many of these verbs and their meanings as you can – by memory!

Future Tense

Near future tense

Simple future tense

There are two main future tenses in Spanish. The near future and the simple future.

Near future tense: Used to talk about what's ***going*** to happen.

Simple future tense: Used say what ***will*** happen.

To form:

1. Use the present tense of the verb "ir".
2. Add your infinitive. (ends in –AR, -ER or –IR)

Verb ir

"ir" = to go	
Voy a	I'm going
Vas a	You're going
Va a	He/she/it's going
Vamos a	We're going
Vais a	You lot are going
Van a	They're going

Learn as many of these verbs and their meanings as you can – by memory!

To form:

1. Take your infinitive.
2. Add the correct ending

Endings

All verbs	
I	-é
You	-ás
He/she	-á
We	-emos
You lot	-éis
They	-án

Time phrases

En el futuro… - In the future…
Mañana – tomorrow
Esta noche – tonight
Este fin de semana – this weekend
La semana que viene/próxima – next week
El mes que viene/próximo – next month
El año que viene/próximo – next year
Pasado mañana – the day after tomorrow
Cuando sea mayor – when I'm older
Cuando termine mis estudios – when I finish my studies
Cuando tenga ____ años – When I'm… years old
Cuando vaya a la Universidad – when I go to university
Cuando gane bastante dinero – when I earn enough money

Examples

Near future	English	Near future	English
Voy a tener	I'm going to have	**Voy a trabajar**	I'm going to work
Voy a ir	I'm going to go	**Voy a dejar**	I'm going to stop
Voy a dar	I'm going to give	**Voy a usar**	I'm going to use
Voy a ser	I'm going to be	**Voy a escuchar**	I'm going to listen
Voy a seguir	I'm going to carry on	**Voy a comer**	I'm going to eat
Voy a poder	I'm going to be able to	**Voy a beber**	I'm going to drink
Voy a hacer	I'm going to do	**Voy a aprender**	I'm going to learn
Voy a jugar	I'm going to play	**Voy a ver**	I'm going to watch
Voy a hablar	I'm going to talk/speak	**Voy a vivir**	I'm going to live
Voy a continuar	I'm going to continue	**Voy a escribir**	I'm going to write
Voy a estudiar	I'm going to study	**Voy a decidir**	I'm going to decide

Examples

Simple future	English	Simple future	English
Tendré	I will have	**Trabajaré**	I will work
Iré	I will go	**Dejaré**	I will stop
Daré	I will give	**Usaré**	I will use
Seré	I will be	**Escucharé**	I will listen
Seguiré	I will carry on	**Comeré**	I will eat
Podré	I will be able to	**Beberé**	I will drink
Haré	I will do	**Aprenderé**	I will learn
Jugaré	I will play	**Veré**	I will watch
Hablaré	I will talk/speak	**Viviré**	I will live
Continuaré	I will continue	**Escribiré**	I will write
Estudiaré	I will study	**Decidiré**	I will decide

Useful Vocabulary

Connectives/Conjunctions

además/también – also/in addition/moreover
aparte de – apart from
a pesar de – in spite of/despite
así que/por eso/por consecuencia – so/therefore
aun (si) – even (if)
aunque – although
cada vez más – more and more
como – as/since/like
con - with
claro que – of course
cuando – when
donde – where
es decir – that is to say/in other words
en cambio… – instead…
incluso – including
mientras – while
o – or
para que – in order that
pero - but
por ejemplo – for example
por un lado/por otro lado – on one hand/on the other hand
por una parte/por otra parte – on one hand/on the other hand
porque/dado que/puesto que/ya que – because
sin - without
sin duda – obviously/certainly
sin embargo/no obstante/en cambio – however
si – if
tal vez – maybe, perhaps
y - and

Sequencers

primero – first
segundo – second
tercero – third
luego – then
después – after
finalmente - finally

Negatives

jamás – never
ni…ni… – neither…nor…
nada – nothing
nadie – nobody
ninguno – none, no-one
nunca – never
sino – but, except
tampoco – neither (also, but in a negative way)
ya no – no longer/not anymore

Useful Little Words

bastante – quite/enough
demasiado – too (much)
más – more
la mayoría – the majority
mismo – same
mucho – a lot
muy – very
poco – not very
un poco – a bit
aquí = here
allí – there
cerca – close
lejos – far
todavía – still
ya – already
casi - almost

Questions

Questions

¿Qué…? – What?
¿Cómo…? – How/what?
¿(A)Dónde…? – Where?
¿Cuál(es)…? Which?
¿Cuándo…? – When?
¿Cuánto…? – How much?
¿Cuántos…? – How many?
¿De dónde…? – Where from?
¿De quién…? – Whose?
¿Por dónde…? Through where?
¿Por qué…? – Why?
¿Quién…? – Who?

Idioms

¿A qué hora…? – at what time…?
¿Cuánto cuesta(n)…? – how much does it (they) cost?
¿Cuánto es? – How much is it?
¿Cuántos años tienes? – How old are you?
¿De qué color? – what colour?
¿Para/por cuánto tiempo? – For how long?
¿Qué día? – what day?
¿Qué fecha? – what date?
¿Qué hora es? – what time is it?
¿Hay…? – is/are there…?

Informal (tú)	Formal (usted)
¿Te gusta(n)…? – Do you like…?	**¿A usted le gusta(n)**…? – Do you like…?
¿Qué piensas de…? What do you think of…?	**¿Qué piensa usted de**…? – What do you think of…
¿Tienes…? – Do you have…	**¿Tiene usted**…? – do you have…?

Idioms

Es/será pan comido – it's/it will be a piece of cake
Trabajo como un burro – I work my socks off
Somos uña y carne – we're bosom buddies (very close)
Tuvo un humor de perros – he/she was in a bad mood
Fue de mal en peor – it went from bad to worse
Nos parecemos como un huevo a otro – we're like two peas in a pod
Cuesta un ojo de la cara – it costs an arm and a leg
Nos peleamos como el perro y el gato – we fight like cat and dog

Grade 9 Structures

Decidí + infinitive – I decided to… (decidí ir a Francia – I decided to go to France)
Sin + infinitive - without… (sin perder un momento – without wasting a minute)
Antes de + infinitive – before… (antes de comer… - before eating…)
Al + infinitive – on… (al llegar… - on arriving)
Después de + infinitive – after… (después de nadar… - after swimming…)
A pesar de que - in spite of… (a pesar de que no tengo dinero… - In spite of the fact that I have no money…)
Acabo de + infinitive – I have just… (acabo de ir a Grecia – I have just been to Greece)
Estoy/Estaba a punto de + infinitive – I am/was about to… (estaba a punto de quejarme… - I was about to complain…)
Siempre me ha gustado – I've always like
Siempre he soñado – I've always dreamed
Siempre he querido – I've always wanted
Ojalá pudiera – If only I could
Ojalá tuviera – if only I had
Ojalá fuera – If only I/it was
Haga lo que haga – whatever I/people might do
Si pudiera me gustaría – If I could, I would like to…
Tengo ganas de… - I'm looking forward to…

Below are some examples of how these words and phrases could be used. Where could you use them in your speaking and writing?

¿Qué piensa usted de su trabajo?	**What do you think** of your job?
Por una parte la tecnología es muy utíl sin embargo **por otra parte**, puede ser un poco peligroso.	**On one hand** technology is very useful however **on the other hand**, it can be a bit dangerous.
El año pasado **decidí ir a** Turquía. **Al llegar** al aeropuerto perdí mi móvil.	Last year **I decided to go** to Turkey. **On arriving** at the airport I lost my phone.
Me encanta estudiar el inglés **ya que**, para mí, es interesante y **es pan comido**.	I love studying English **because**, for me, it's interesting **and it's a piece of cake.**
Cuando era más joven jugaba al balconcesto cada semana pero **ya no** porque **es menos divertido que** jugar con mi consola.	**When I was younger** I used to play basketball every week but **I don't anymore** because **it's less fun than** playing on my console.
Estoy a punto de ir a la Universidad. **Tengo muchas ganas** pero en mi opinion **cuesta un ojo de la cara.**	**I'm about to go to** university. **I'm really looking forward to it** but in my opinion **it costs an arm and a leg.**
Vivo en una casa bastante pequeña. **Ojalá tuviera más dinero**, compraría una más grande.	I live in quite a small house. **If only I had more money**, I would buy a bigger one.
A pesar de que no tengo mucho dinero me encanta ir al centro para ir de compras con mis amigas.	**Despite the fact that** I don't have much money, I love going to the city centre to go shopping with my friends.

Comparisons

Igual que… – the same as
Tan…como… - as…as…
Tanto…como… - as much…as
Parecido a – similar to
Lo/la mismo – the same
Más…que – more…than
Más - more
Menos…que - less…than
Menos - less
El/la más… - the most
El/la menos… - the least
Peor que – worse than
Peor - worse
El/la peor – the worst
Mejor que – better than
Mejor – better
El/la mejor – the best
Mayor – main/major/larger/bigger/greater
Menor – smaller/less/least

Adjectives

Colours

azul – blue
amarillo – yellow
rosa – pink
violeta – purple
negro – black
gris – grey

rojo – red
verde – green
morado – purple
marrón – brown
blanco – white
naranja – orange

claro – light
vivo – vivid

oscuro – dark
pálido – pale

To describe people

optimista – optimistic
trabajador – hardworking
tacaño – mean
hablador – chatty
divertido/gracioso – funny
fiel – loyal
feliz/contento – happy
ordenado – tidy
energético/animado – lively
pensativo – thoughtful
comprensivo – understanding
simpático – nice
travieso – naughty
explosivo – explosive
creativo – creative
fuerte – strong
organizado – organised
práctico – practical
valiente – brave
listo – clever
severo – strict

pesimista – pessimistic
perezoso/vago – lazy
egoísta – selfish
callado – quiet
sensible – sensitive
infiel – disloyal
triste – sad
caótico – messy
tranquilo – calm
molesto – annoying
alegre – cheerful
antipático – mean
idealista – idealistic
ambicioso – ambitious
extrovertido – outgoing
inteligente – clever
paciente – patient
serio – serious
tolerante – tolerant
impaciente – impatient
justo – fair

alto – tall
gordo – fat
gordito – chubby
guapo – good looking
musculoso – muscly
viejo – old

bajo – short
delgado slim
atractivo – attractive
feo – ugly
joven – young

de estatura media – average height

Your house

moderno – modern
grande – big
enorme – enormous
nuevo – new
caro – expensive
hermoso – beautiful
cómodo – comfy
espacioso – spacious
limpio – clean
bien equipada – well equipped
recien renovado – recently renovated

antiguo – old fashioned
pequeño – small
feo – ugly
viejo – old
barato – cheap
bonito – pretty
acogedor – comfy/cosy
lujoso – luxurious

Your town

histórico – historic
tranquilo – calm/quiet
animado – lively
turístico – touristy
famoso – famous

moderno – modern
ruidoso – noisy
aburrido – boring
industrial – industrial
conocido por... - known for...

Transport

cómodo – comfortable
barato – cheap
rápido – fast
ruidoso – noisy
limpio – clean

caro – expensive
seguro – safe
peligroso – dangerous
atestado – crowded
sucio - dirty

Jobs + school subjects

artístico – artistic
exigente – demanding
fácil – easy
variado – varied

útil – useful
práctico – practical
relevante – relevant
exacto – precise
duro – hard

emocionante – exciting
importante – important
difícil – hard
repetitivo - repetitive

inútil – useless
creativo – creative
relajante – relaxing
lógico – logical

TV, film + technology

amplio – extensive
divertido – fun
peligroso dangerous
rápido – fast
popular – popular
gratis – free
lento – slow
interactivo – interactive

aburrido – boring
divertido – fun
tonto – silly
malo – bad/rubbish
interesante – interesting

cómodo – convenient
necesario – necessary
práctico – practical
fácil de usar – easy to use
útil – useful
ridículo – ridiculous
sencillo – simple

adictivo– addictive
entretenido – entertaining
informativo – informative
emocionante – exciting
infantil – childish

Food

delicioso – delicious
sabroso – tasty
jugoso – juicy
picante – spicy
dulce – sweet
soso – tasteless
fresco – fresh

rico – tasty/rich
grasiento – greasy
seco – dry
salado – salty
armargo – bitter
malsano – unhealthy

Random

apropriado – appropriate
afortunado – lucky
decepcionante – disappointing
distinto – different
encantador – charming
hermoso – beautiful
impresionante – impressive
precioso – beautiful
sorprendido – surprising
único – unique/only
ancho – wide
estrecho – narrow
grueso – thick
vacío – empty
lleno – full
abierto – open
cerrado - closed

Adjective agreements

Adjectives in Spanish MUST agree (match) in number (singular/plural) and gender (masculine/feminine) the thing they are describing.

ADJECTIVES ENING IN "O"

Singular		Plural	
Masculine	Feminine	Masculine	Feminine
rojo	roja	rojos	rojas
divertido	divertida	divertidos	divertidas
alto	alta	altos	altas

ADJECTIVES ENING IN "E"

Singular		Plural	
Masculine	Feminine	Masculine	Feminine
verde	verde	verdes	verdes
dulce	dulce	dulces	dulces
grande	grande	grandes	grandes

ADJECTIVES ENING IN A "CONSONANT"

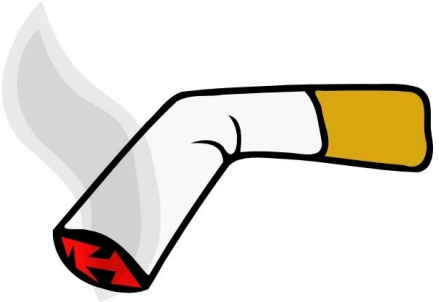
Singular		Plural	
Masculine	Feminine	Masculine	Feminine
azul	azul	azules	azules
fácil	fácil	fáciles	fáciles
útil	útil	útiles	útiles

Theme 2

Local, national,

International and Global

areas of interest



Topics:

- Home, town, neighbourhood and region
- Charity and voluntary work
- Healthy living
- The environment
- Poverty and homelessness
- Travel and tourism

Mi casa

Types of houses | Rooms | Furniture | Descriptions | Prepositions

My house

Vivo en – I live in
Vive en – he/she lives in
Vivimos en – we live in
Viven en – they live in

una casa – a house
una casa individual – a detached house
una casa adosada – a semi-detached house
un chalet/chalé – a bungalow/chalet/villa
un piso/un apartamento – a flat/apartment
un bloque de pisos – a block of flats
una residencia de ancianos – an old people's home
una finca/una granja – a farm

que – which

está en… – it's in…

el campo – the countryside
la costa – the coast
las montañas/la sierra – the mountains
las afueras – the suburbs/outskirts
un barrio de la ciudad – a district/suburb of the city
el primer/segundo/tercer/cuarto piso de un edificio antiguo – it's on the first/second/third/fourth floor of an old building.
el norte – the north
el este – the east
el oueste – the west
el sur – the south

En la casa (no)hay… - in the house there is(n't)
Tiene… - it has…
Arriba hay – upstairs there is
Abajo hay – downstairs there is
Afuera hay - outside there is

cinco habitaciones/salas – five rooms
tres dormitorios – three bedrooms
dos cuartos de baño – two bathrooms
una cocina – a kitchen
un comedor – a dining room
un estudio/un despacho/una oficina – an office
un comedor – a dining room
un sótano – a basement

un salón – a living room
un aseo – a toilet (room)
una entrada – an entrance
una terraza – a terrace/patio
un garaje – a garage
jardín – a garden
el césped – the lawn

Mi casa/piso es… - My house/flat is…

moderno/a – modern
antiguo/a – old fashioned
pequeño/a – small
enorme – enormous
nuevo/a – new
viejo/a – old

caro/a – expensive
barato/a – cheap
hermoso/a – beautiful
bonito/a – pretty
feo/a – ugly
cómodo/a – comfy

acogedor/a – comfy/cosy
espacioso/a – spacious
lujoso/a – luxurious
limpio - clean
bien equipada – well equipped
recien renovado – recently renovated

Furniture

una mesa – a table
un ascensor – a lift
unas sillas – some chairs
una butaca/un sillón – an armchair
una alfombra – a rug
una cama – a bed
un armario – a wardrobe
una luz - a light
calefacción – heating

una librería – a bookcase
una ducha – a shower
un espejo – a mirror
las cortinas – the curtains
una moqueta – a carpet
las paredes – the walls
la escalera – the stairs
un fregadero – a sink
un lavabo – a wash basin

una lavadora – a washing machine
un lavaplatos – a dishwasher
un microondas – a microwave
un horno – an oven
muebles – furniture
la puerta – the door
la ventana – the window
una nevera/un frigorífico – a fridge
el congelador – a freezer

Prepositions

delante de – in front of
detrás de – behind
al lado de – next to
cerca de – near
lejos de – far from
debajo de – under
encima de – above/on top of
en – in/on
a la derecha de – to the right of
a la izquierda de – to the left of

Prepositions

Tengo mi propio dormitorio – I have my own room
(No) tengo que compartir mi dormitorio – I (don't) have to share my room
La habitación que más me gusta es… - the room I like the most is…
El aseo necesita una reforma – the toilet needs remodelling/redecorating
Mi dormitorio puede ser muy desordenado – my room can be very messy
A mi hermano no le gusta nuestra casa porque… - my brother doesn't like our house because…

Vivo en **una casa adosada** que	I live in a **semi-detached house** which
está en **las afueras** de Liverpool	is in **the outskirts** of Liverpool
en el noroeste de Inglaterra.	in the Northwest of England.
En la casa hay **ocho** habitaciones.	In the house there are **8** rooms.
Abajo hay **una cocina**, **un comedor** y **un salón enorme**	Downstairs there is **a kitchen**, **a dining room** and **an enormous living room**
y arriba hay **cuatro dormitorios** y **un cuarto de baño**.	and upstairs there are **four bedrooms** and a **bathroom**.
Me encanta mi casa ya que es **hermosa** y **espaciosa**	**I love** my house because it's **pretty** and **spacious**
aunque es un poco **viejo**.	**although it's** a bit **old**.
Lo que más me gusta es que tengo mi propio dormitorio	**The thing I like the most is that** I have my own room
sin embargo mi dormitorio **puede ser** muy **desordenado**	however my room **can be** very **messy**
y necesita **una reforma**	and it needs **redecorating**
aunque **cuando era niño** vivía en **un piso pequeño**	although **when I was a child** I used to live in **a small flat**
y **tenía que** compartir mi dormitorio con mi hermano menor.	and **I had to** share a room with my younger brother.
¡Fue un desastre!	It was a disaster!
Discutíamos todos los días.	We used to argue every day.
Cuando sea mayor me gustaría vivir	**When I'm older** I would like to live
en **una casa más grande en la costa**	in **a bigger house on the coast**.

A model text on my house

Mi ciudad

Places in town | Town descriptions | Activities | Shops

My city

En mi ciudad/pueblo hay… - In my city/town there is…

Mi ciudad/pueblo tiene… - My city/town has…

un ayuntamiento – a town hall
un bar/muchos bares – a bar/lots of bars
un castillo (en ruinas) – a (ruined) castle
un cine – a cinema
un mercado – a market
una piscina – a swimming pool
un supermercado – a supermarket
una playa – a beach
un museo – a museum
una plaza mayor – a town square
un parque – a park
una plaza de toros – a bull ring
un polideportivo – a sports centre
una pista de hielo – an ice rink
un puerto – a port/harbour
una oficina de correos – a post office
un restaurante – a restaurant
una bolera – a bowling alley
un teatro – a theatre
una iglesia – a church
una biblioteca – a library
una comisería – a police station
una estación de trenes/autobuses – a train/bus station
un gran almacén – a department store
un centro comercial – a shopping centre
muchos lugares de interés – lots of sights

Es una ciudad/un pueblo_____ - It's a ____ city/town

histórico/a – historic
tranquilo/a – calm/quiet
animado/a – lively
turístico – touristy
famoso/a – famous
moderno/a – modern
ruidoso/a – noisy
aburrido/a – boring
industrial – industrial
conocido/a por… - known for…

Está situado – it's situated…

al lado del río – next to the river
está rodeado de… - it's surrounded by

Tiene unos impresionantes paisajes naturales – it has some amazing natural landscapes
Tiene varios influencias culturales – it has various cultural influences
Tiene el bullicio de la ciudad – it has the hustle and bustle of the city
Es mi ciudad natal – it's my home town
Hay mucho que hacer/hay mucha marcha – there's lots to do
No hay nada que hacer – there's nothing to do
Hay una zona peatonal – there's a pedestrian zone

Activities

Se puede… - you can

estar mucho tiempo al aire libre – spend a lot of time in the open air
subir la torre – go up the tower
hacer un recorrido en autobús – do a bus tour
disfrutar de las vistas – enjoy the views
apreciar la arquitectura variada – appreciate the variety of the architecture
aprovechar del buen tiempo – make the most of the good weather
probar platos típicos – try local dishes
practicar deportes acuáticos – do water sports
practicar senderismo – go hiking/trekking
ir de compras – go shopping

Shops

Un estanco – a tobacconist's
Un banco – a bank
Una cafeteria – a café
Una carnicería – a butcher's
Una farmacia – a pharmacy/chemist's
Una frutería – a greengrocer's
Una joyería – a jeweller's
Una librería – a bookshop
Una panadería – a bakery
Una papelería – a stationery shop
Una pastelería – a cake shop
Una peluquería – a hairdresser's
Una pescadería – a fishmonger's
Una tienda de ropa – a clothes shop
Una zapatería – a shoe shop
Una juguetería – a toy shop
Una tienda de comestibles – a grocery store/supermarket

Vivo en **Liverpool**, una ciudad **grande**	I live in **Liverpool**, a big **city**
que **está situado** en el **noroeste de Inglaterra**,	which **is situated** in the **Northwest of England**
al lado del río **Mersey**.	next to the river **Mersey**.
Vivo en **las afueras** y	I live in **the outskirts** and
me chifla mi barrio porque hay mucho para los habitantes.	**I love** my neighbourhood because there is lots for the residents.
Por ejemplo, se puede **visitar los museos**, **hacer un recorrido en autobús** o **ir de compras**	For example, you can **visit the museums**, **go on a bus tour** or **go shopping**
ya que hay un centro commercial enorme.	**because** there is an enormous shopping centre.
También hay un lago donde se puede hacer esquí acuático.	Also, there is a lake where you can go water skiing.
Desafortunadamente no hay **piscina**.	**Unfortunately** there is no **swimming pool**.
¡Qué pena! Me flipa hacer natación.	**What a shame!** I'm crazy about swimming.
En mi opinión Liverpool es muy **turística** **dado que**	In my opinion Liverpool is very **touristy** **because**
hay muchos **museos**, dos **catedrales**	there are lots of **museums**, two **cathedrals**
y **es conocido por** **los Beatles**	and **it's known for** **the Beatles**
y **el fútbol**. ¡Hay dos **estadios de fútbol**!	and **football**. There are **two football stadiums**!
Tiene **el bullicio de la ciudad** y	It has **the hustle and bustle of a city** and
varios influencias culturales.	various cultural influences.
Es mi ciudad natal	It's my home town
y me encanta.	and I love it.

A model text on my city

Mi ciudad

Advantages and disadvantages | Changes | In the past

Advantages and disadvantages

Lo mejor de vivir en la ciudad es que… - the best thing about living in the city is that…	**es tan fácil desplazarse** – it's so easy to get around **hay una red de transporte público** – there's a public transport network **hay tantas diversiones** – there's so much to do **hay muchas posibilidades de trabajo** – there are lots of job opportunities **la vida es más interesante** – life is more interesting
Lo peor que que… - the worst thing is that…	**el centro es tan ruidoso** – the centre is so noisy **hay tanto tráfico** – there's so much traffic **se lleva una vida tan frenética** – life is so hectic **la gente no se conoce** – people don't know each other **hay demasiado contaminación** – there's too much pollution
En el campo… - in the countryside	**el transporte público no es fiable** – the public transport isn't reliable **hay bastante desempleo** – there's quite a lot of unemployment **yo conozco a todos mis vecinos** – I know all of my neighbours **se puede aprovechar del aire libre** – you can enjoy the fresh air **la vida es más tranquila** – life is calmer **la vida es más aburrida** – life is more boring

Changes

Si fuera posible – if it were possible	**introduciría transporte público gratis** – I would introduce free public transport **renovaría los edificios viejos** – I would renovate the old buildings **mejoraría el sistema de transporte público** – I would improve the public transport system **crearía más trabajos** – I would create more jobs **crearía más espacios verdes** – I would create more green spaces **invertiría en la educación** – I would invest in education **plantaría más árboles** – I would plant more trees **constuiría más tiendas en el centro** – I would build more shops in the centre **reduciría la contaminación** – I would reduce pollution **prohibiría los coches** – I would ban cars

My city in the past

En el pasado – in the past **Hace (10) años** – 10 years ago **En los años sesenta** – in the 60s **Mis padres/mis abuelos dicen que** – my parents/grandparents say that…	**la ciudad era** – the city was **había** – there was **tenía** – it had	**más/menos que hacer** – more/less to do **mucho despempleo** – there was a lot of unemployment **más/menos pobreza** – more/less poverty **más/menos industrial** – more/less industrial **un puerto importante** – an important port
	los Beatles se volvían famosos – the Beatles became famous **Liverpool era la capital de cultura durante el año dos mil ocho (2008)** – Liverpool was the Capital of Culture in 2008 **la ciudad ha cambiado a lo largo de los siglos** – the city has changed throughout the centuries	

Lo mejor de vivir en la ciudad es que	**The best thing** about living in the city is that
es **tan fácil desplazarse** ya que	it's **so easy to get around**
hay **una red de transporte público muy fiable**.	because there is **a really reliable public transport network**.
Además, **merece la pena madrugar** porque	Moreover, **it's worth getting up early** because
hay mucho que hacer.	There's a lot to do.
Hay **cines**, **tiendas** y **boleras** y	There are **cinemas**, **shops** and **bowling alleys** and
mucha gente dice que la vida es más interesante.	**lots of people say that life is more interesting**.
En mi opinión, se lleva una vida tan frenética en la ciudad	In my opinion life is so hectic in the city
y por eso, **preferiría vivir** en el campo.	therefore **I would prefer to live** in the countryside.
Me parece que hay **bastante desempleo**	**It seems that** there is **a lot of unemployment**
sin embargo la vida es **más tranquila** y	however life **is calmer** and
se puede aprovechar del aire libre.	you can enjoy the fresh air.
Si fuera posible cambiaría muchas cosas de mi ciudad.	**If it were possible** I would change a lot of things in my city.
Por ejemplo **reduciría la contaminación** y	For example I would **reduce pollution** and
plantaría más árboles ya que	**plant more trees** because
en el pasado era muy **industrial**.	in the past it was very **industrial**.

A model text on advantages and disadvantages of the city

La salud

Aches and pains | Symptoms | Healthy eating

Aches and pains

Me duele(n)… - …hurts **Tengo dolor de**… - …hurts	**La cabeza** – head **Los ojos** – eyes **La(s) pierna(s)** – leg(s) **La espalda** – back **El(los) hombro(s)** – shoulder **la garganta** – throat **la nariz** – nose **los pies** – feet **la(s) rodilla(s)** – knee(s) **las muelas/los dientes** – teeth **las orejas/los oídos** – ears **la(s) mano(s)** – hand(s) **el(los) brazo(s)** – arm(s) **el(los) tobillo(s)** – ankle(s)
Tengo	**frío** – I'm cold **sueño** – I'm tired **catarro/un resfriado** – I have a cold **una picadura** – I have a bite **calor** – I'm hot **tos** – I have a cough **fiebre** – I have a fever **vómitos** – I'm being sick **una insolación** – sunstroke **gripe** – I have the flu
Estoy	**cansado** – I'm tired **mareado** – I feel sick/dizzy **enfermo** – I'm ill

Me ha roto la pierna – I've broken my leg
Me ha torcido el tobillo – I've twisted my ankle
Me ha cortado la mano – I've cut my hand
Me ha quemado el hombro – I've burnt my shoulder
Un ataque cardiáco – a heart attack
El cerebro – the brain
El hidago – the liver
Los pulmones – the lungs
El corazón – the heart

Siempre me canso – I always get tired
No tengo energía – I don't have any energy

Healthy eating

Suelo comer/beber… I tend to eat/drink…	**…porque contiene(n)** – because it (they) contain	**lácteos** – milk products **grasas** – fats **dulces** – sugars/sweet things **legumbres** – pulses **frutos secos** – dried fruits **los nutrientes** – nutrients **proteínas** – proteins **minerales** – minerals **sal** – salt **vitaminas** – vitamins **gluten** – gluten **la fibra** – fibre **azúcar** - sugar **protege contra el cáncer** – protects against cancer **combate la obesidad** – combats obesity **reduce el riesgo de enfermedades** – reduce the risk of illness

Para llevar una dieta equilibrada – to have a balanced diet
No tengo tiempo para cocinar – I don't have time to cook
Es mejor preparar comida con ingredientes frescos – it's better to prepare food with fresh ingredients
Saltarse - to skip (a meal)
Engordar – to put on weight
Evitar – to avoid
Soy bastante activo/a – I'm quite active
Entreno dos veces a la semana – I train twice a week
Estoy en forma – I'm fit
Me acuesto/me levanto temprano – I go to bed/get up early
Mantenerse en forma – to keep fit

En mi opinión llevo una vida bastante **sana**	In my opinion I lead quite a healthy **lifestyle**
ya que **suelo comer frutas** y **verduras**	because **I tend to eat fruit** and **veg**
dado que contienen **minerales** y **vitaminas**	**as** they contain **minerals** and **vitamins**
y **protegen contra el cancer**.	and **they protect against cancer**.
A mi parecer es mejor preparar comida con ingredientes frescos.	**In my opinion** it's best to prepare food with fresh ingredients.
Además, siempre desayuno **huevos** porque	Moreover, I always have **eggs** for breakfast because
contienen muchos **nutrientes**.	they contain los of **nutrients**.
Es esencial que no te saltes el desayuno.	**It's essential that you don't skip breakfast**.
Es la comida la más importante del día.	It's the most important meal of the day.
Lo peor es que **no puedo resistirme** al **chocolate**.	The worst thing is that **I can't resist chocolate**.
Lo como cada día y contiene	**I eat it** every day and it contains
demasiado **azúcar**.	too much **sugar**.
El azúcar **causa la obesidad** y	**Sugar causes obesity** and
no quiero engordar.	I don't want to put on weight.
por eso, voy a evitar el **chocolate**	therefore I'm going to avoid **chocolate**
para combatir la obesidad y	to combat obesity and
reducir el riesgo de enfermades graves.	reduce the risk or serious illness.

A model text on healthy living

El medio ambiente

Problems | Natural disasters | Solutions | Commands

Environmental problems

Me preocupa(n) mucho – I'm really worried about

Lo que más me preocupa es (que) – the thing I'm most worried about is (that)

El problema más grave es (que) – the most serious problem is (that)

la deforestación – deforestation
la lluvia ácida – acid rain
las mareas negras – oil spills
la sobrepoblación – overpopulation
el calentamiento global – global warming
la contaminación – pollution
la sequía – drought
los problemas del medio ambiente – environmental problems
las especies amenazadas/en peligro de extinción – threatened/endangered species
la polución de los mares y los ríos – sea and river pollution
la destrucción de los bosques – destruction of woods/forests
los combustibles fósiles se acaban – fossil fuels are running out
hay demasiada basura en las calles – there's too much litter/rubbish in the streets
hay demasiado tráfico – there's too much traffic
el tráfico causa mucho ruido – the noise causes a lot of noise
mucha gente usa el coche todos los días – lots of people use their cars everyday
hay demasiadas fábricas – there are too many factories
no hay espacios verdes – there are no green spaces
la gente no recicla – people don't recycle

causa – it causes
amenezar – to threaten
echar la culpa - to blame
es nocivo – it's harmful
agotar – to use up
una multa – a fine
el vertadero – the tip
provocar – to provoke/cause
contribuir – to contribute
un atasco – a traffic jam
el combustible - fuel
una fábrica – a factory

un terremoto – an earthquake
una tormenta de nieve – a snow storm
un incendio forestal – a forest fire
un huracán – a hurricane
un temblor – a tremor
un tornado – a tornado
las inundaciones - floods

Solutions

Para proteger el medio ambiente/ el planeta – to protect the environment/ the planet

(no) se debe – you must(n't)

(no) se debería – you should(n't)

apagar la luz – turn off the light
ducharse en vez de bañarse – shower instead of having a bath
separar la basura – separate the rubbish
reciclar el plástico y el vidrio – recycle plastic and glass
desenchufar los aparatos eléctricos – unplug electrical appliances
ahorrar energía – save energy
cerrar el grifo – turn off the tap
hacer todo lo posible – do everything possible
malgastar agua – waste water
usar bolsas de plástico – use plastic bags

Es esencial que – it's essential that
Es importante que – it's important that

cuidemos el planeta – we look after the planet
hagamos proyectos de conservación – we do conservation projects
compremos/usamos productos verdes - we buy use eco-friendly products
productos de comercio justo – we fair trade products
ahorremos agua – we save water
cambiemos la ley – we change the law
consumamos menos – we consume less

No corte tantos árboles – Don't cut down so many trees
No tire basura al suelo – don't throw rubbish on the floor
No malgaste energía – Don't waste energy
Plante más bosques y selvas – plant more forests and trees
Use energías renovables – use renewable energy
No construya tantas casas grandes – don't build so many big houses
No vaya en coche si es possible ir a pie – Don't go by car if it's possible to walk
No eche tantos desechos químicos – Don't release so much chemical waste
Reduzca las emisiones de los vehículos – reduce vehicle emissions

En mi opinión hay tantos problemas medioambientales	In my opinion there are so many environmental problems
como la sobrepoblación y la deforestación	like overpopulation and deforestation
pero pienso que el problema más grave es	but I think that the most serious problem is
la contaminación del aire ya que	air pollution because
es nociva y causa el calentamiento global.	it's harmful and causes global warming.
Las fábricas y los atascos contribuyen a la contaminación del aire	Factories and traffic jams contribute to air pollution
y por eso es esencial que usemos el transporte público	and therefore it's essential that we use public transport
y que compremos productos verdes.	and that we buy eco-friendly products.
En el pasado me preocupaba más la deforestación	In the past I was most worried about deforestation
y la destrucción de los bosques	and the destruction of forests
dado que causa las especies amenazadas y	because it causes endangered animals and
organicé un evento para recaudar dinero.	I organised an event to raise money.
Para proteger el planeta	To protect the planet
no corte tantos árboles y plante más bosques y selvas.	don't cut down so many trees and plant more woods and forests,
Yo, voy a intentar usar menos energía.	I'm going to try to use less energy.
Apagaré la luz y desenchufaré los aparatos eléctricos.	I will turn off the light and I will unplug electrical items.
Voy a hacer todo lo possible.	I'm going to do everything possible.

A model text on the environment

Problemas sociales

Problems Solutions Vices

Social issues

Me preocupa(n) mucho – I'm really worried about

Lo que más me preocupa es (que) – the thing I'm most worried about is (that)

El problema más grave es (que) – the most serious problem is (that)

el paro/el desempleo – unemployment
el hambre/la pobreza – hunger/poverty
la obesidad – obesity
la drogadicción – drug addiction
la diferencia entre ricos y pobres – the rich/poor divide
la crisis económica – the economic crisis
los sin hogar/los sin techo – the homeless
el estrés – stress
la soledad – loneliness
el prejuicio – prejudice
el racism – racism
la igualdad – equality
el crimen - crime

To help

Es necesario que – it's necessary that

recaudamos dinero/fondos – we raise money/funds
hagamos campañas publicitarias – we carry out publicity campaigns
construyamos más casas – we build more houses
creemos oportunidades de trabajo – we create job opportunities
compremos productos de comercio justo – we buy fair trade products
apoyemos proyectos de ayuda – we support help projects

Random

organización benéfica – a charity
el sida – aids
una residencia de ancianos – old people's home
una tienda solidaria/con fines benéficos – charity shop
el trabajo voluntario – voluntary work
una campana – a campaign
el desarollo – development

borracho - drunk
el humo – the smoke
el olor – the smell
muerto - dead
un fumador – a smoker
un ladrón – a thief

Vices

Beber alcohol – drinking
Fumar cigarillos – smoking cigarettes
Fumar porros – smoking joints
Tomar drogas duras/blandas – taking hard/soft drugs
El fumo pasivo – passive smoking
Emborracharse – getting drunk
El tabaquismo – tobacco addiciton

es - is

ilegal – illegal
peligroso – dangerous
un malgasto de dinero – a waste of money
una tontería – stupid
un problema serio – a serious problem
un vicio muy caro – a very expensive habit
tan malo como… – as bad as…
muy perjudicial para la salud – very damaging to your health

provoca mal aliento – causes bad breath
daña los pulmones – damages your lungs
mancha los dientes de amarillo – makes your teeth yellow
causa el fracaso escolar – causes failure at school
causa la depresión – causes depression
produce una fuerte dependencia física – causes a stong, physical dependence
tiene muchos riesgos – has many risks
afecta a tu capacidad para tomar decisiones – affects your ability to make decisions
te relaja – relaxes you
te quita el estrés – relieves stress
te quita el sueño/el control – robs you of sleep/control
te hace sentir bueno – makes you feel good
te hace sentir más adulto – it makes you feel more grown-up

No es justo que haya tanto desigualdad social en el mundo.	It's not fair that there's so much social inequality in the world.
Me preocupa más la pobreza y por eso	I'm most worried about poverty and therefore
Recaudo dinero para una obra benéfica que ayuda a los sin techo	I raise money for a charity which helps the homeless
y he organizado un evento para recaudar fondos	and I have organised an event to raise funds.
En mi opinión, es necesario que construyamos más casas	In my opinion, it's necessary that we build more houses
y creemos oportunidades de trabajo.	And create job opportunities.
Además, es terrible que haya tanta gente obesa y tantos drogadictos en mi ciudad.	In addition, it's terrible that there are so many obese people and so many drug addicts in my town.
Nunca bebo alcohol porque es un malgasto de dinero	I never drink alcohol because it's a waste of money
pero mis amigos lo beben cada fin de semana.	but my friends drink it every weekend.
Dicen que te quita el estrés	They say that it relieves stress
y te hace sentir más adulto.	and makes you feel like an adult.
No estoy de acuerdo.	I disagree.
Lo peor es que fumo cigarillos y	The worst thing is that I smoke cigarettes and
es muy perjudical para la salud.	it's very damaging to your health.
Daña los pulmones	It harms your lungs
y produce una fuerte dependencia física	and causes a strong, physical dependence
pero no puede parar.	but I can't stop

A model text on social issues

Shopping

Shopping | Clothes | Souvenirs | Complaints

Shopping

Nunca me ha gustado – I've never liked **Siempre me ha gustado** – I've always liked	**comprar** – to shop in	**en cadenas** –chain stores **en las grandes almacenes** – department stores **en tiendas de diseño** – designer shops **en tiendas de segundo mano** – second hand shops **por internet/la red** – online	**ya que** – because

es más económico/práctico/cómodo – it's cheaper/more practical/more convenient
es un buen sitio para pasar la tarde – it's a good place to spend the afternoon
hay más variedad – there's more variety
hay demasiado gente – there are too many people
los precios son más bajos – the prices are lower
hay más ofertas – there are more offers
hay ropa alternativa/ de moda – alternative clothing/fashionable clothing
hay gangas – bargains
hay artículos de marca – branded items

Clothes/accessories

una camisa – a shirt
un bolso – a handbag
una camiseta – a t-shirt
un chandal – a tracksuit
una blusa – a blouse
una corbata – a tie
unos pantalones – trousers
una bufanda – a scarf
unos pantalones cortos – shorts
un paraguas – an umbrella

un abrigo – a coat
un sombrero – a hat
un traje – a suit
una gorra – a cap
un vestido – a dress
una falda – a skirt
unos zapatos – shoes
unas zapatillas de deporte – trainers
una botas – boots
las sandalias - sandals

un cinturón – a belt
unos guantes – gloves
una chaqueta – a blazer/jacket
unos calcetines – socks
unas medias – tights
unos vaqueros – jeans
un monedero – a purse
un jersey – a jumper
un reloj – a watch
una sudadera – a hoody

Demonstrative adjectives	Singular		Plural	
	Masculine	Feminine	Masculine	Feminine
This, these	Este bolso (this bag)	Esta corbata (this tie)	Estos bolsos (Those bags)	Estas corbatas (these ties)
That, those	Ese bolso (that bag)	Esa corbata (that tie)	Esos bolsos (those bags)	Esas corbatas (those ties)
That/ those… over there	Aquel bolso (that bag over there)	Aquella corbata (that tie over there)	Aquellos bolsos (those bags over there)	Aquellas corbatas (those ties over there)

Souvenirs

un abanico – a fan
una taza – a mug
unos pendientes – some earrings
los zapatos – shoes

una gorra – a cap
un oso de peluche – a teddy bear
las pegatinas – stickers
juguetes – toys

un chorizo – a chorizo (sausage)
unas golosinas - sweets
la ropa – clothes
sellos – stamps

In the shop

¿Me puede ayudar? – can you help me?
¿Qué me recomienda? – What do you recommend?
Tiene uno/a/os/as más barato/a/os/as – Do you have a cheaper one?
¿Qué tal…/qué te parece(n)…? – What about…/What do you think of…?
Quiero comprar – I want to buy
Me lo/la/los/las llevo – I'll take it/them
Tengo cambio – I have change
Un billete de___euros – a ___ Euro note

Complaints

Quiero devolver… – I want to return
Está roto/a – it's broken
Es demasiado estrecho/a – it's too tight
Tiene un agujero/una mancha – it has a hole/a stain
Falta un botón – it's missing a button
Necesito una talla más grande/pequeña – I need a bigger/smaller size
En rebajas – on sale

¿Puede reembolsarme? – can you reimburse me?
Quiero un reembolso – I want a refund
Podemos hacer un cambio – we can exchange it
Un recibo – a receipt

Dependienta: ¿En qué puedo ayudarle?

Cliente: *Quiero devolver este bolso porque tiene un agujero. ¿Puede reembolsarme?*

Dependienta: No, pero Podemos hacer un cambio.

Cliente: *Muy bien. Quisiero un bolso grande y de cuero.*

Dependienta: Vale. Tenemos este bolso rojo o este bolso negro.

Cliente: *Prefiero el bolso negro. Me lo llevo.*

Dependienta: Muy bien. ¿Algo más?

Cliente: *Si, busco una falda para ir a una boda.*

Dependienta: ¿Qué le parece esta falda rojo?

Cliente: *No me gusta. ¿Tiene una azul?*

Dependienta. Lo siento pero no. ¿Qué tal esta falda negra?

Cliente. *Me la llevo. ¿Cuanto cuestan?*

Dependienta: En total son ochenta euros.

Cliente: *Tengo un billete de cien euros.*

Dependienta: Gracias.

El Corte Inglés

El Corte Inglés is a department store found in towns and cities all over Spain. Think John Lewis or Debenhams

← Role play
← example on
← shopping

Tickets and directions

Directions

At the tourist office

Directions	**¿Dónde está…?** – where is…? **¿_____ está cerca/lejos?** – is _____ near/far?	**Sigue todo recto** – go straight ahead **Gira a la derecha/a la izquierda** – turn right/left **Tome la primera/segunda/tercera calle**… - take the 1st/2nd/3rd street… **Pasa el puente** – go over the bridge **Pasa los semáforos** – go across the traffic lights **Cruza la plaza/la calle** – cross the square/street **Coge el autobús número 37** – take the number 37 bus	
		Está… - it is	**en la esquina** – on the corner **al final de la calle – at the end of the street** **al lado del museo** – next to the museum

Buying tickets/at the tourist office	**¿Me puede dar**…? – Can you give me…?	**Un plano de la ciudad** – a map of the city **Más información sobre**… - more information about… **Un billete** - a ticket **Para**… - for
	¿Cuanto cuesta una entrada? – how much does a ticket cost? **¿Hay un descuento para estudiantes?** – is there a student discount? **¿Dónde se pueden sacar las entradas?** – where can you buy tickets?	**Para adultos/niños** – for adults/children
	¿A qué hora…? – What time	**Sale al autobús/el tren** – does the bus/train leave? **Abre**… - does_____ open?
	¿Me puede recomendar…? – can you recommend…?	**Un restaurante típico** – a typical restaurant **Un hotel/una excursión** – a hotel/a trip
	¿Hay visitas guiadas? – Are there guided tours?	

Persona 1: Hola. Estoy perdido. ¿Me puede ayudar?

Persona 2: *Claro. ¿Qué quiere?*

Persona 1: ¿La Sagrada Familia está cerca?

Persona 2: *Sí, está bastante cerca. Sigue todo recto y luego gira a la derecha. Pasa el puente y cruza la calle. Tome la tercera calle a la izquierda y está al final de la calle.*

Persona 1: Muchas gracias.

Persona 2: *De nada*

The Sagrada Familia is a cathedral in Barcelona, designed by architect Antonio Gaudi. He started it's construction in 1883 and it's still not finished! It is due to be completed in 2026.

Role play example directions

Dependiente: Buenos días. ¿En qué puedo ayudarle?

Cliente: *Hola. Quiero comprar tres entradas para la Sagrada Familia.*

Dependiente: ¿Para cuándo?

Cliente: *Para el viernes a las diez. ¿Cuánto son?*

Dependiente: Cuestan quince euros para adultos y diez euros para niños.

Cliente: *¿Hay un descuento para estudiantes?*

Dependiente: Sí, una entrada para estudiante cuesta doce euros.

Cliente: *Muy bien. Quiero una entrada para adultos, y dos para estudiantes.*

Dependiente: Son treinta y nueve euros.

Cliente: *¿Hay visitas guiadas?*

Dependiente: Sí. Empezan a las once en el fondo de la catedral.

Cliente: *Muchas gracias. Adiós.*

Dependiente: Adiós

Role play example in the tourist office