



ORMISTON  
**SWB**  
ACADEMY

# Knowledge Organisers Spring Term – Year 11

Name: \_\_\_\_\_

Please remember:

- It is to be kept inside your knowledge organiser book
  - It is to be brought into school every day

Regular retrieval throughout a scheme of learning (daily, weekly and monthly) has been proven to **reduce the rate of forgetting**, supporting you to **retain more** in long term memory- making assessments/ exams way easier! The challenge for you as a student is to make sure you use your knowledge organiser for each subject properly to help you to know more and remember more over time. We've created this walk through to support you in using your knowledge organiser- for more support speak to your subject teachers.



# Using your Knowledge Organiser

1	2	3	4	5
Look	Cover	Write	Check	Repeat
Start with a <b>small section of knowledge</b> that you want to remember e.g <i>Henry VIII's wives in History</i> . Read through this section of the knowledge organiser (a couple of times if it helps)	Now <b>cover up this section</b> of your knowledge organiser with a post it note or scrap paper.	<b>Self quiz- what can you remember</b> and rewrite? Make sure you do this without looking back at your knowledge organiser.	<b>Remove the post it and check for accuracy-</b> did you get the key terminology? Was it spelt correctly? Was the order correct? If you drew a diagram, how much of this did you get correct?  Most importantly- what did you miss out?	After a short break away from your knowledge organiser repeat the look, cover, write, check <b>until you can recall all of the facts correctly without prompts.</b>  This process can be used for any new knowledge that you want to acquire. It is good idea to do this on a regular basis, once a week.

**Strategy 1- Look, cover, write, check** – A really simple but effective way to use your knowledge organiser. Focus on a specific area of your knowledge organiser.

1	2	3	4	5
Focus	Big ideas	Explain it	Link it	Record it
<b>Make it manageable</b> by selecting an area of your KO <u>where your learning is not secure</u> . Don't waste time going off something you can already do!	Pick out the main points or the <b>big ideas</b> in this section.	<b>Explain what you know</b> about the main points (this could be written or shared verbally – a friend, a family member.	Now, see <b>how it links to other areas</b> within the subject. E.g <i>Eating meat – causes global warming. Cows produce methane which is a greenhouse gas.</i>	<b>Write down as many 'think it, link it' ideas</b> as you can in your book. See if you can beat others in you class!

**Strategy 2- Think it, link it** – Great for connecting the big ideas in your subject. How does 'x' relate to 'y'. What are the key factors which make an equation/ experiment/ process work? Challenge yourself to see how many links you can make!

1	2	3	4	5
Select topic	Prepare quiz	Answer it	Self check	Repeat
Decide <b>which area you want to be quizzed</b> on (this might build up over time)	Get someone else to <b>prepare 10 random questions</b> on that topic to challenge you.	<b>Set a time limit</b> (depending on the number of questions) and answer the questions without looking at your KO.	Now look at your KO to <b>self check-</b> make a note of your score. Celebrate your successes and make a note of anything you missed or got incorrect.	<b>Return to this section</b> in 2/3 weeks- see if you can improve your score! Re-do those questions that you missed or got incorrect.

**Strategy 3- Knowledge quiz** – You might try this after a few weeks of using your knowledge organiser. Get someone to set you 10 questions using your knowledge organiser. These could be spellings, key words, processes, equations etc to see how much you can remember! Record your score and see if you can beat your personal best each half term!

# Contents Page

<b>Pages</b>	<b>Subject</b>
4 – 18	English
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## Your Task:

Prepare a spoken presentation on a specific topic.  
The duration of the whole assessment should be around **8 minutes**.



## Top Tips



- ✓ Ensure you use **Standard English**(a),
- ✓ Look at your audience,
- ✓ Don't just read from your notes,
- ✓ Don't have too many words on your power point (if you are using one) and
- ✓ Present your ideas on something you are **passionate about**.



**Practise** until you believe that you can deliver your speech with confidence.



- ✓ Key Criteria
- ✓ • Presentations must be **formal (b)**.
- ✓ • Presentations must be **planned** and organised.
- ✓ • You must listen to and respond appropriately to **questions and feedback**.



## Assessment Objectives:

- **AO7:** Demonstrate presentation skills in a formal setting.
- **AO8:** Listen and respond appropriately to spoken language, including to questions and feedback on presentations.
- **AO9:** Use spoken Standard English effectively in speeches and presentations.

	Key terms	Definition
A	<b>Standard English</b>	English that is clear and most easily understood by a wide audience. It is the 'correct' form of English.
B	<b>Formal</b>	Language that doesn't use any slang or abbreviations.
C	<b>Sophisticated</b>	Complicated or showing higher level knowledge.

## STEP 1: Choosing your Topic

Your topic should be of interest to you. Think carefully about whether you will be able to speak in a sophisticated (c) and formal way about it though! You must talk for 4 minutes so ensure that it's something you are knowledgeable about.

**Topics that have been successful in previous years:**

- Does rap music glorify gang culture?
- Gaming: is it good for young people?
- Technology and its impact on our generation.
- Social Media: Benefits and Flaws
- Should animals be used for testing/ human entertainment?

**OR Choose a topic you're interested in. Previous successful topics:**

- Is basketball a fair sport given it picks based on height and speed?
- Do we still need to travel abroad when we can see it all on the internet?

## Step 2: Getting Started

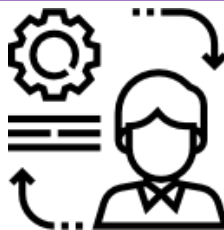
To get started, answer the following questions:

- **What** is important about this topic?
- **Who** are you presenting to?
- **Why** have you chosen this topic and **why** should your audience listen?



## Step 4: Practise

Read through your presentation to parents, guardians and friends.



## Step 3: Planning your Presentation

**You must make sure you plan and practise your presentation. Your organisation and preparation will improve your confidence and this will result in a higher grade.**

### 1. Break your topic down into smaller sections:

- Introduction,
- Statistics,
- Facts,
- Specific cases/ case studies/ anecdotes or
- Personal opinion.

### 2. Do your research:

- You could look online for appropriate articles, documentaries etc.
- You could read some books/ magazines/ newspapers/ blogs.
- You should discuss your topic with friends and family to gain their ideas and inspiration.

### 3. Engagement Strategies: methods you could use to enhance your presentation:

- True/False with the audience,
- Audience interaction,
- Some students have even played instruments and worn costumes!
- Emotive language, rhetorical questions, shocking facts/ statistics and
- When presenting, adapt your tone of voice, use hand gestures and eye contact!

**Plan the questions for the questions you may be asked and how you will respond to them.**



# KS4 – English – A Christmas Carol Plot and Key Quotations


- The **narrator** informs the reader that Jacob Marley (former business partner) died 7 years ago.
- Scrooge is described as mean and **miserly (d)**.
- The weather is harsh and Bob Cratchit, Scrooge's worker, is treated harshly..
- Scrooge is mean towards Fred, his nephew.
- He refuses to donate money to the portly gentleman.
- He sees the face of Jacob Marley in his door knocker.
- He is visited by Jacob Marley (**bound in chains**) who informs him that he will be visited by three spirits.

- The Ghost of Christmas Past** visits Scrooge.
- Scrooge is taken back to his childhood and sees his former self alone at school.
- We are introduced to his sister – Fan and the poor relationship with his father.
- Scrooge is then taken to **Fezziwig** where we see him enjoying himself at a party. He interacts with people.
- Scrooge is then shown his former fiancée **Belle** and how they split. He becomes upset when he sees **Belle** and her family in another vision.
- He demands to be taken home.

- The Ghost of Christmas Present** visits Scrooge.
- He takes him to see Bob Cratchit and his family. Scrooge is surprised at how little the family have.
- He is then taken to his nephew, Fred's house. Fred and his guests mock Scrooge and his **miserly (d)** ways.
- He is then taken to a poor part of the city and introduced to **Ignorance (f)** and **Want**.
- The spirit becomes frustrated and leaves him there.

- The Ghost of Yet To Come is shrouded in darkness:** silent and scary.
- He is taken to the city and instructed to listen to a group of businessmen who are discussing the recent death of a man who was not very well-liked.
- He is taken to **Old Joe's shop** where a dead man's belongings are being pawned.
- He is then taken to a bedroom where he sees a corpse (h).
- Scrooge demands to see **fenderness** surrounding the death. He is then taken to the Cratchit's and learns the death of **Tiny Tim**.
- Scrooge wants to identify the dead man and he is taken to his grave.

- Scrooge awakes **disorientated** and worries he has missed Christmas.
- He is **joyful** when he learns he hasn't.
- He orders and pays for the biggest turkey to be delivered to the Cratchit family.
- He apologises and **donates** a healthy sum of money to the portly gentleman, to give to the poor.
- He visits Fred and his wife and asks to join them for dinner.
- He is **joyful the** next day, playing a trick on a terrified Bob, who arrives late to work.
- He gives Bob a pay rise and pays for treatment for Tiny Tim.
- Scrooge is **reformed** and is a complete contrast to Stave One!

'His **sole executor (b)**, his **sole** administrator...his **sole** friend and **sole** mourner.'

...'solitary (c) as an **oyster**.'

'...**wound** about him like a **tail**.'



'**Hard and sharp as flint**.'

'Another **idol** has **displaced** me...a **golden one**.'

'A **solitary child**, **neglected** by his friends, is left there.'

'The happiness he gives is as great as if it cost a fortune.'



'A **vacant** seat...and a crutch without an owner.'

'The boy is **ignorance (f)**. The girl is **Want**.'

'As good as gold.'



'I hope to live to be another man from what I was.'

'**Shrouded (g)** in a deep **black** garment.'

'...legs trembled beneath him.'

'Scrooge regarded **everyone with a delighted smile**.'

'I am as **light as a feather**, I am as **happy as an angel**, I am as **merry as a school boy**.'

'A merry Christmas to everybody.'

## Christmas

Decline of Christmas

At the beginning of the Victorian period, the celebration of Christmas was in decline. The **Industrial Revolution, (o)** in full swing in Dickens' time, allowed workers little time for the celebration of Christmas.

**Dickens** describes the holidays as "a good time: a kind, **forgiving, charitable,** pleasant time: the only time I know of in the long calendar of the year, when men and women seem by one consent to open their shut-up **hearts freely,** and to think of other people below them as if they really were fellow-passengers to the grave, and not another race of creatures bound on other journeys."

Christian Values

## Family

The role of the Family

The **Victorian** family was considered to be a very valuable part of the everyday life throughout the era. By today's standards, families were often considered to be very large. In 1870, you would find that the average household family contained five or six children.

Scenes of **family harmony** and cosy **firesides** in many of Charles Dickens' stories seem in stark contrast to his own family life. Later Dickens' own family was marked by strife as his relationship with his wife deteriorated and his sons seemed to have inherited their paternal grandfather's trouble handling finances.

Reflection of Dickens' life

## Responsibility

1834 Poor Law

Victorian society ignored the **poverty (e)** of its poorest. On the one hand were the rich who enjoyed comfort and feasting at Christmas, and on the other were children forced to live in dreadful conditions in **workhouses.**

Dickens uses the novel to present his feelings that the **rich** must help the **poor** in order for the world to be **improved,** and that it is the **rich's responsibility** to help the **poorest** in society. He exposes the unfair treatment of the poor, and shows that the **stereotypes** that the poor are lazy are untrue, which he does by using the Cratchit's six children. The **1834 Poor Law** meant that unfortunate people were sent to prison-like conditions just because they were poor rather than getting financial help.

Stereotyping poorer citizens (r)

## Redemption (i)

Role of religion

The Victorians were **religious**. Many believe that the novella (a) should be seen as an allegory (n) of the Christian concept of redemption (i). **Redemption** is the idea of being saved from sin or evil.

Because Dickens **experienced** life living in **poverty (e)** and **wealth** he wanted the **moral** message of the **novella (a)** to be that all human beings have the **opportunity** to behave in **kinder** ways towards each other. He wanted people to see the joy **redemption (i)** brings.

Performing kind deeds

	Key Terms	Definition
A	Novella	A <b>novella</b> or short <b>novel</b> is a work of narrative prose fiction, longer than a short story but shorter than a <b>novel</b> .
B	Executor	Someone responsible for following through on a task or duty.
C	Solitary	Existing alone.
D	Miserly	Reluctant to spend.
E	Poverty	Not having enough material possessions or income for a person's needs.
F	Ignorance	Lack of knowledge or information.
G	Shrouded	Cover or envelop so as to conceal from view.
H	Corpse	A dead body.
I	Redemption	The action of saving or being saved from sin, error, or evil.
J	Citizens	A person of that country.
K	Misanthrope	Someone who hates other humans.
L	Clerk	Someone who keeps records.
N	Allegory	A story which is about one thing but has a hidden meaning.
O	Industrial Revolution	The time in history when machines were used in factories rather than simply people.

## Characters

**Jacob Marley**  
Scrooge's old business partner who comes back as a ghost to warn him. He is **wrapped in a chain.**

**Ghost of Christmas Past**  
A shapeshifting ghost with a **candle on top** of its head. It shows Scrooge the past.

### Fezziwig

Scrooge's former boss who was nice and hosted parties for his workers.

**Shows a vision of (S.2):**

**Ghost of Christmas Present**  
A jolly ghost who looks **like Santa Claus**, only dressed in green. **He shows Scrooge the present and introduces him to two starving children, ignorance (f) and Want.**

**Ghost of Christmas Yet to Come**  
A ghost dressed in black who **looks like the Grim Reaper**. This ghost does not speak and shows Scrooge what could happen in the future if he does not change.



**Employs (S.2)**

**Scrooge**  
A rich Victorian misanthrope (k).

**Employs**

**Bob Cratchit**  
Scrooge's clerk.

**Belle**  
Scrooge's old girlfriend who he rejected in favour of money. He sees a vision of her future with a family.

**Fan**  
Scrooge's younger sister.

**Fred**  
Scrooge's nephew who invites him to Christmas dinner.

**Martha Cratchit**  
The eldest Cratchit child.

**Belinda Cratchit**  
The second eldest Cratchit child.

**Peter Cratchit**  
The third eldest Cratchit child.

**Emily Cratchit**  
Bob's wife who hates Scrooge.



**Tiny Tim**  
Bob's disabled son.

**The twins**  
The youngest Cratchit children.

**Start of the exam**

- ✓ Use the **context box to infer (e)** information about what the text is about **and make predictions.**

**Top Tips**

- ✓ Use the **What/How/Why** paragraph structure,
- ✓ On questions 2 and 4, **zoom in** on words from text,
- ✓ Refer to the **steer of the question throughout** and
- ✓ Keep quotes to 5-10 words long.

## 1: The '4 things' Question

– List **four things** from a **specific** (a) part of the source.

You should: Select appropriate (b) **evidence from text** in response to the **statement.**



**4 marks**

## 2: The 'Language' Question

How does the writer **use language** to...? based on a specific part of the source e.g. lines 8-18.

You should: Explain or analyse the **effect of language.**



**8 marks**

## 3 The 'Structure' Question

How has the writer **structured the text to...?** Based on the whole text.

You should: Explain or analyse **the effect or how structure** interests the reader.



**8 marks**

## 4: The 'Agree' Question 20 marks

To what extent do you **agree with the statement** provided? Based on a specific part of the source.

You should:

- Judge the effect(s)** on the reader,
- Understand the **writer's methods(d),**
- Use a range of textual references and quotes and**
- Keep a relevant **focus on the question throughout.**



**Active Verbs (similar to "shows")**

- Connotes
- Depicts
- Demonstrates
- Illustrates
- Portrays
- Reflects
- Conveys
- Exhibits
- Emphasises
- Implies
- Presents
- Suggests

*The writer (active verb) the...*



Question	Marks	% of paper	% of GCSE
1	4	5	2.5
2	8	10	5
3	8	10	5
4	20	25	12.5

Key terms	Definition
A Specific	Clearly identified or marked out
B Appropriate	Suitable for the focus of the question
C Structure	The way a text is put together, whether through paragraphs, subheading or flashbacks (f) etc.
D Methods	The way something has been achieved.
E Infer	To work out from the information available in the text.





## Start of the exam

- ✓ 5 minute plan with question in mind.

### Top Tips

- ✓ Keep **your tone consistent (g)** throughout: do not use words which suggest a light and playful atmosphere (b) after you have just spent 15 minutes making the scene sound scary.
- ✓ Use a variety of **structural (e) features**: flashbacks (f),
- ✓ Keep to **one or two characters and**
- ✓ 5 minutes' of checking SPaG, including paragraphing.

### Punctuation to use

Question Mark	?	Exclamation Mark	!
Comma	,	Full stop	.
Semi-Colon	;	Speech Marks	“ ”
Colon	:	Apostrophe	'

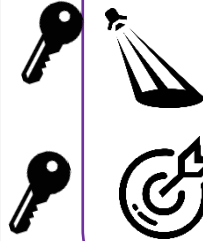
## 5: The 'Writing for a purpose' question.

### Question 5: Writing a narrative or description AO5/AO6

You will produce a story or description based on a **picture or a sentence** detailing your task.

Your local newspaper is running a creative writing competition and the best entries will be published.

**Either** write a story about time travel as suggested by this picture or write a story entitled 'Stranded'.



### Key skills:

**AO5:** You should:

Ensure the story or description is **clear**.

**AO6:** You should:

Use **varied and accurate** sentence structures.



AO	Marks	% of paper	% of GCSE
5	24	30	15
6	16	20	10

### Key language devices to use:

#### Simile

Where you compare two things by saying they're **like something else**:

"He was as timid as an urban fox."

#### Metaphor

Where you compare two things by saying something **is something else** when it clearly is not.

"She was a night owl."

#### Pathetic fallacy

Where you use the **weather to set the atmosphere (b)**.

"The sky became cloudy and darkness fell."

#### Sensory Language

Where you use **vocabulary to describe** the character's five senses.

"I could taste blood streaming from my lip."

### Overview of each paragraph

P1: Always **begin with the weather and describe the scene or setting** – decide if it's positive or negative.

P2: Character focus – introduce character – show but not tell then **lead in to a flashback. Use a symbol**, item or even to trigger the shift in time.

P3: Come back **to present moment, developing the character** in more detail. Keep something withheld!

P4: Describe the setting – **zoom out** to change focus. Include a motif (d).

P5: Cyclical (a) development – back to weather/scene/setting – **change from positive to negative or vice versa (c)**.

### Great sentence openers

<b>Connective</b>	Unless, although.
<b>Adverb</b>	Regretfully, sadly.
<b>Simile</b>	Like a mouse...
<b>Metaphor</b>	Brave lions, they...
<b>Feeling</b>	Jealous, she tore up his clothes.
<b>Verb 'ing' clause</b>	Giggling and laughing, they ran to school.

### Key terms

### Definition

A	Cyclical	Returning back to a previous point like a cycle.
B	Atmosphere	The tone or mood.
C	Vice versa	The two items can be switched around or reversed.
D	Motif	An object which is repeated and has importance to the events. E.g. a raven for death.
E	Structural	The way a text is put together, whether through paragraphs, subheading or flashbacks (f) etc.
F	Flashback	When the text goes back in time.
G	Consistent	Keeping something the same.



## Start of the exam

- ✓ 5 minute plan with question in mind.

### Top Tips

- ✓ Keep **your tone consistent (g)** throughout: do not use words which suggest a light and playful atmosphere (b) after you have just spent 15 minutes making the scene sound scary.
- ✓ Use a variety of **structural (e) features**: flashbacks (f),
- ✓ Keep to **one or two characters and**
- ✓ 5 minutes' of checking SPaG, including paragraphing.

### Punctuation to use

Question Mark	?	Exclamation Mark	!
Comma	,	Full stop	.
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## 5: The 'Writing for a purpose' question.

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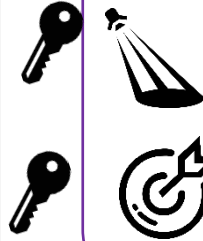
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P3: Come back **to present moment, developing the character** in more detail. Keep something withheld!

P4: Describe the setting – **zoom out** to change focus. Include a motif (d).

P5: Cyclical (a) development – back to weather/scene/setting – **change from positive to negative or vice versa (c)**.



### Key skills:

**AO5:** You should:

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G	Consistent	Keeping something the same.

**Start of the exam**

✓ Use the context box to infer (e) information about what the text is about and make predictions.

**Top Tips**

- ✓ Use the **What/How/Why** paragraph structure.
- ✓ On questions 3 and 4, **zoom in** on words from text.
- ✓ Refer to the steer (f) of the question throughout.
- ✓ Use a range of **comparison connectives**.
- ✓ Keep quotes to 5-10 words long.

**1: The 'True or False' Question**

✓

-Choose **four** statements which are true.

**Draw a box** around the lines to find the information.

Ensure to **shade** the boxes, not tick or cross.

**4 marks**

**2: The 'Summary' Question**

🍏

-Use details from both sources to write a summary of ...

Have 4 small quotes with **clear differences or similarities**.

Write 4 small paragraphs **inferring** (e) how they are different or similar.

**Do not explain** language devices, c).

**8 marks**

**4: The 'Comparison' Question**

🍏

Find **4-5** differences for the **question focus**.

Find a **quote** from each source for each of the differences.

Find **language or structure devices** in those quotes. Use **connectives** to link paragraphs and connect ideas.

Write 4-5 paragraphs, using **methods** (d) and focusing on the question.

**16 marks**

**3 The 'Language' Question**

✍️

-How does the writer **use language** to...? based on a specific (a) part of the source e.g. lines 8-18.

Explain or analyse the **effect of language**.

**12 marks**

**Active Verbs (similar to "shows")**

- Connotes
- Depicts
- Demonstrates
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3	12	10	5
4	16	20	10

Key terms	Definition
A Specific	Clearly identified or marked out.
B Appropriate	Suitable for the focus of the question.
C Devices	A thing made for a specific purpose.
D Methods	The ways a writer achieves their aim.
E Infer	Work out from the information.
F Steer	What the examiner has asked you to focus on when answering.



## Start of the exam

- ✓ 5 minute plan with question in mind.
- ✓ Underline the **audience (a), purpose (b) and form (c)** the task/question
- ✓ 35 minute response
- ✓ 5 minute checking SPaG, including paragraphing.

## Top Tips

- ✓ Consider the following first: what do you **already know** about the topic?
- ✓ What is your **opinion** on the topic?
- ✓ Do you have any **personal experiences** that could support your ideas?
- ✓ What would others' opinion be?
- ✓ What is the **effect on others or society**?

## 5: The 'Writing for a purpose' question.

### Question 5: Writing to argue AO5/AO6

You will produce a written text for a specified **audience (a), purpose (b) and form (c)**. You will give your own perspective on the theme introduced in Part A. **Example question:** "Cars are dangerous."

Write a letter to the Minister for Transport arguing your point of view on this statement.

#### Letter

Dear Sir/Madam or name •  
Addresses • Date •  
Paragraphs • Yours sincerely/faithfully.

#### Speech

- Clear address to audience
- Use rhetorical devices throughout
- A clear sign off, e.g. 'Thank you for listening'.

## Overview of each paragraph

P1: Outline your **main opinion** (big idea) and list your **three reasons** (supportive ideas). You could use a **circular structure (e) (hook)**: either open with a **descriptive hook (i)** 'Imagine a world where..' or a **questioning hook** 'Have you ever thought..' or an **anecdotal hook** 'Meet Dave...' – a made up character that is affected or not affected by the statement.

P2: **First reason** acknowledges **audience (a), purpose (b) and form (c)** and support main idea - back up with anecdotal evidence or a scenario (h).

P3: **Second reason** supports main idea - back up with anecdotal (f) evidence or a scenario.

P4: Use a **counter argument with third reason or how** might this issue impact on society?

P5: **Conclusion** – refer back to the circular structure (e). Comment on how this problem or statement might impact on others or society. **Return to 'hook' (i) from the beginning.** Imagine a world now that.. Answer question from the beginning or return to 'Dave'.

## Key skills:

### AO5: You should:

Ensure the story or description is **clear**.

### AO6: You should:

Use **varied and accurate** sentence structures.



#### Article

- Clear/apt/original title
- Introductory paragraph
- Use persuasive techniques to convince reader of your viewpoint.

#### Leaflet

- Clear/apt/original title
- Organisational devices such as inventive subheadings or boxes
- Bullet points.



## Section B: Question 5

AO	Marks	% of paper	% of GCSE
5	24	30	15
6	16	20	10

#### Key terms

#### Definition

A	Audience	This is who you are aiming your writing towards.
B	Purpose	This is why you are writing. Is it to inform, persuade, advise etc?
C	Form	This is what your writing will be in the form of i.e. a letter, speech, article, leaflet, blog etc.
D	Hook	A technique that " <b>hooks</b> " the reader's attention so that he or she will keep on reading.
E	Circular structure	You start and end using the same idea or message.
F	Anecdote	A short personal story adding meaning or significance to your message.
G	Counter	The opposite point of view.
H	Scenario	An imaginary situation.
I	Hook	Something which catches the reader's attention.

# KS4 – Macbeth – Plot and Key Quotations

- The **witches** meet on the heath.
- Macbeth and Banquo** have fought and **won a battle**. They are praised for their bravery by the Captain.
- The witches meet Macbeth and Banquo and they make **three predictions**. They predict that Macbeth will become Thane of Cawdor and eventually king. Banquo is told that he will not become king but that his children will be. Shortly after, Macbeth is told he is the new Thane of Cawdor!
- Macbeth plans for **Duncan to stay at his castle**.
- Lady Macbeth convinces Macbeth to kill King Duncan**.
- Duncan arrives at Macbeth's castle.
- Macbeth tells Lady Macbeth he will not murder Duncan. However, **she convinces him to go ahead with the murder**.

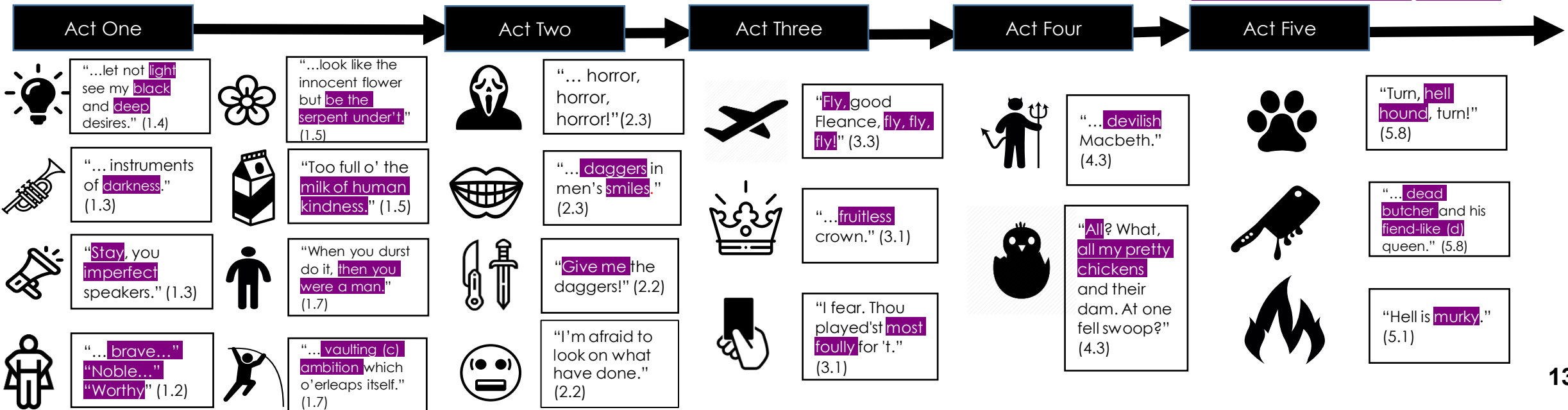
- Macbeth sees a dagger** in front of him on his way to go and kill King Duncan.
- Macbeth murders King Duncan. Macbeth's guilt** is apparent as he appears covered in blood. Lady Macbeth feels no guilt and places the daggers on Duncan's guards.
- The dead body is discovered by Macduff. Duncan's sons, **Malcolm and Donalbain, run away**: one to England and one to Ireland.
- Macbeth and his wife **become king and queen of Scotland**.

1. Macbeth questions Banquo. He is suspicious of Banquo. As a result, he plans his murder with the help of murderers.

- Banquo is murdered** by the hired murderers but his son, Fleance, manages to escape.
- At the coronation (a) banquet, **Macbeth sees the ghost of Banquo** at the table. Lady Macbeth persuades everyone that Macbeth is ill and they must leave and is furious at Macbeth.
- Hecate, the witches's leader, is angry that the witches meddled with Macbeth without her permission.
- Lennox shares his suspicions about Macbeth.

- The witches share **three more prophecies (b)**:
- Macbeth is told that: he must fear Macduff; that he will **not be harmed by anyone born of a woman** and that he will never be defeated until **Birnam Wood moves to 'High Dunsinane Hill'**. They also share a vision of Banquo.
- Macbeth has **Macduff's wife and children murdered**.
- In England, Malcolm tests Macduff's loyalty and checks they are on the same side, wanting the same things.

- Lady Macbeth sleepwalks**: she is overcome with guilt and loneliness.
- The rebels discuss the impending battle.
- Macbeth declares he has nothing to fear from the battle. He appears **confident**.
- The doctor reports on Lady Macbeth's condition. Macbeth orders him to cure her.
- Malcolm and Macduff's forces march to Dunsinane castle, **disguising themselves with branches** from the trees of Birnam Wood.
- Lady Macbeth dies off stage**.
- Macbeth realises that he is not going to win but decides to at least die fighting.
- Malcolm prepares for battle.
- Macbeth kills young Siward.
- Both **Macduff and Macbeth fight and Macbeth is killed**. His head displayed on a spike, as he was a **traitor**, Macduff is able to kill him as he reveals he was born by **caesarean (k) section**.
- Malcolm is crowned the new king of Scotland**.



# KS4 – Macbeth – Context, Themes and Characters

## Kingship

The Great Chain of Being

People believed that God set out an order for everything in the universe. This was known as **the Great Chain of Being**. On Earth, God created a social order for everybody and chose where you belonged. In other words, the king or queen was in charge because God put them there and they were only answerable to God (the **Divine Right of Kings**). This meant that **disobeying (n) the King was a sin**.

The Divine Right of Kings

King James I

## Supernatural

One of the most active centres of **witch hunting** was Scotland, where up to 4,000 people were burnt. This was due to royal witch-hunter King James I. **King James I wrote a book called 'Daemonologie'** in which he supported and encouraged the trials of witches. He believed the witches were controlled by the devil and he **described witchcraft as "high treason (e) against God"**.

Witchcraft

## Gender

**Men** assumed a **dominant** position in the society; making it **patriarchal (f)**. The main responsibility of married women was to take care of the household matters and raise children. Before marriage, a girl was under the control of her father, after marriage her husband and after the death of her husband, her son. **Women** were made to depend on their male relatives throughout their lives and had **no power**.

Gender stereotypes

The Role of Women

King James I

## Gunpowder Plot

King James did not tolerate **Catholics** and this led a group of them to plot to kill him and everyone sitting in the Houses of Parliament on **November 5th, 1605**. This was **known as the Gunpowder Plot** which had failed. Shakespeare's Macbeth was likely written in 1606 in the aftermath of the Gunpowder **Treason**. Along with its responsive nature, it is known that Shakespeare wrote the play with the intent of honouring and displaying loyalty to King James I as a **cautionary (g) tale**.

Treachery and Regicide

Religion  
Ambition

Appearance vs. Reality  
Fate vs. Freewill

Masculinity  
Ambition

Religion  
Revenge

## Characters

**Hecate**  
The leader of the witches' coven (l).

**Three Witches**  
They meet Macbeth on the heath after his first battle and give Macbeth and Banquo prophecies (b) about their lives.

**Banquo**  
The loyal friend of Macbeth who witnesses the Witches' original prophecies (b) with him. His suspicions about Duncan's death lead Macbeth to act.

**Fleance**  
Banquo's son or "seed".

**Macbeth**  
Originally the Thane of Glamis...

**Duncan**  
The original King of Scotland.

**Malcolm**  
Duncan's first son who is eventually crowned King of Scotland. He flees to England when his father is murdered.

**Donalbain**  
Donalbain is Duncan's second son who flees to Ireland once his father is murdered.

**Lady Macbeth**  
The manipulative wife of Macbeth. We never know her name...  
**She eventually succumbs (m) to madness and kills herself.**

**Macduff**  
The Thane of Fife who did not attend Macbeth's coronation (a). He forms an alliance with Malcolm when the truth comes out and eventually kills Macbeth.

**Lady Macduff**  
She is murdered along with her children when Macbeth cannot find Macduff.

**Macduff's Children**  
Macbeth orders their murder when he cannot find Macduff.

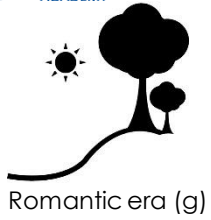
## Minor Characters

**Lennox**  
A young Thane of the Scottish kingdom.

**Ross**  
Macbeth's cousin who is initially loyal to the Thane of Glamis.

## Key terms

Key terms	Definition
A <b>Coronation</b>	Where the king or queen is officially crowned.
B <b>Prophecies</b>	A prediction of what will happen.
C <b>Vaulting</b>	High and leaping over something.
D <b>Fiend</b>	An evil spirit or demon.
E <b>Treason</b>	Betraying your country.
F <b>Patriarchy/al</b>	Men being dominant in society.
G <b>Cautionary</b>	Something to make you take notice and perhaps stop.
H <b>Tyrannical</b>	Being cruel with power.
I <b>Regicide</b>	The act of killing the king.
J <b>Righteous</b>	Behaving in the 'right' way or being morally good.
K <b>Caesarean</b>	Being cut from the womb rather than a natural birth.
L <b>Coven</b>	A group of witches.
M <b>Succumbs</b>	Being unable to stop something negative happening.
N <b>Disobey</b>	To go against orders.



**Poems:**

1. London
2. Extracts from the Prelude
3. Ozymandias

**Key ideas:**

- Poems are not about love. **Poems are about personal growth** and
- appreciating nature during the Industrial Revolution (f).
- Poets sometimes fought back against what they **thought were tyrannical (a) rulers who oppressed (c) normal people.**
- This made them considered radical (b).

**Poems:**

4. My Last Duchess
5. Charge of the Light Brigade

**Key ideas:**

- 1 in 5 people in the world called Queen Victoria of Great Britain their governor (j).
- People were very poor.
- People lacked rights.
- The social **hierarchy (h)** still defined who had **power.**

**Poems:**

6. Exposure
7. Bayonet Charge

**Key ideas:**

- In the First World War:
- 20 million people died.
- It was **fought from trenches** (holes in the ground) in Europe.

**Poems:**

11. Kamikaze

**Key ideas:**

- In the Second World War:
- 75 million people died.
- It was fought across the globe.
- Pearl Harbour in the USA was attacked in December 1941. **Japanese pilots were trained to bomb ships by flying into them. This meant they killed themselves for their country.**
- Following this, America came into the war on Britain's side, changing which side had the upper hand in the war.

**Poems:**

8. Storm on the Island
9. War Photographer
10. The Emigree
12. Tissue
- 13 Checkin' Out Me History
14. Remains
15. Poppies

**Key ideas**

- **Wars were often fought against smaller countries to stop tyrants (a) or terrorists (i).**
- Locals thought Western countries invaded for oil and other resources.
- Many locals were still loyal to the tyrants (a).

	Keyword	Definition
A	Tyrannical	Being cruel with power.
B	Radical	A person who wants to change society.
C	Oppressed	Being treated harshly, often by rulers.
D	Imperialism	Pushing your country's ideas on others.
E	Displace	Taking over the place or role.
F	Industrial Revolution	The use of machines in factories.
G	Romantic era	Poems about nature and its impact in a changing industrial (f) world.
H	Hierarchy	A system where people or items are ranked by status or power.
I	Terrorists	A person or group who uses violence to achieve their goals to change world.
J	Governor	The person in charge.

War and conflict

Power of nature

Power of the state

7 1957

"He lugged a rifle numb as a smashed arm."

The simile (k) of the rifle being like a broken limb, slowing him down, shows how the army weighs heavily.

9 1985

"A hundred agonies in black and white."

The juxtaposition (n) of agony as a fairly plain image shows the contrast between the victims and speaker.

8 1966

"We are bombarded by the empty air."

The air is personified (l) as being like a bomber plane.

2 1799

"A huge peak, black and huge... upreared its head."

The peak personified (l) as rising its 'huge' head shows how powerful nature appears, scaring the speaker.

13 2005

"Dem tell me wha dem want to tell me."

The repetition (p) of 'dem tell me' shows the control the state has to control what the speaker knows.

5 1854

"...into the jaws of death/ into the mouth of hell."

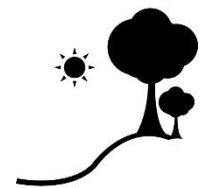
The personification (l) of death having 'jaws' shows it can kill like wild animals.



6 1917

"Tonight this frost will fasten on this mud and us."

The metaphor (j) 'fasten' shows how the weather has power to hold them down.

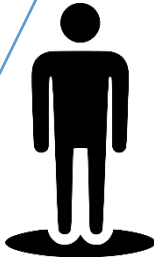
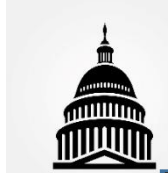


Power of the individual/ authority

10 1993

"There once was a country... I left it as a child."

The war between tyrants (a) has forced the Emigré (a) to leave, making their country in the past tense.



Power of humans

14 2008

"...his blood shadow stays on the street."

The imagery (o) of the blood being a shadow could imply it's following him, like his memories.

15 2009

"I traced the inscriptions on the war memorial."

The grieving speaker is visualising how her child could have joined the war-dead with the verb 'traced'.

11 2000s

"A shaven head full of powerful incantations."

The word 'incantations' implies the kamikaze pilot is under a spell and being controlled against their will.

4 1842

"I choose never to stoop."

The personal pronoun (m) 'I' shows how the Duke feels he is always central and most important.



3 1817

"My name is Ozymandias, king of kings."

The metaphor (j) 'king of kings' implies the tyrant (a) feels he is more powerful than all other rulers.

12 2000s

"Fine slips from grocery shops... might fly our lives like paper kites."

The simile (k) of 'paper kites' shows how fragile our lives truly are being controlled by outside forces.

Number on context page.

When written

Quote

"blood shadow stays on the street"

Analysis of quote

The metaphor (j) 'king of kings' implies the tyrant feels he is above all of rulers.

Keyword	Definition
J	Comparing two unlike things by saying something is something else.
K	Comparing two things by saying something is like something else.
L	Giving non-human things human qualities.
M	Words which replace names: I, you, he, she, it, we, they, me, him, her, us, and them.
N	Where two things are placed together solely to compare them.
O	Descriptive language which helps to create an image for the reader.
P	Where a word or idea is reused often for a particular meaning.
Q	A person who has left their country for another. Often, they have been forced out.



## Step-by-step approach for Q1

**Step 1:** Read the question: what is the **steer** (a)?



**Step 2:** Where can you find the steer (a) in the poem?

- Start with the **title**
- Beginning/middle/end
- **ONLY** things that **link to the steer** (a) or focus.



**Step 3:** Link your methods or ideas

- 1 overarching **thesis** (d) statement that **addresses the steer** (a).
- 3 supporting ideas or methods.
- language and structure



**Step 4:** **Explode the effects** of these three methods OR ideas in the poem.



**Step 5:** Structure this in three paragraphs.

- Idea, meaning, method (language and /or structure), connotations (words), effect (on a reader), **alternative** (b) **interpretations** (c) and secondary reference.



In 'Give', how does the poet present the speaker's attitude to **generosity**? (24 marks)

**Thesis:**  
The speaker wants people to be kinder to those less fortunate; this kindness is not necessarily monetary.



Give

Of all the public places, dear to make a scene, I've chosen here.

Of all the doorways in the world to choose to sleep, I've chosen yours. I'm on the street, under the stars.

For coppers I can dance or sing.  
For silver-swallow swords, eat fire.  
For gold-escape from locks and chains.

It's not as if I'm holding out for frankincense or myrrh, just change.

You give me tea. That's big of you. I'm on my knees. I beg of you.

Simon Armitage

Step 1:



The direct address (f) used by the speaker makes the reader feel slightly uncomfortable at their own lack of action; the speaker is holding them accountable (g) and reminding them that they also have a social responsibility.



By listing these metals in order of their value and what they would do for each of them, the speaker conveys their desperation for kindness from people. We can conclude that the speaker feels dehumanised (l) from the unkindness they have faced as they are willing to act as a performer rather than a fellow human being.



The ambiguous (h) use of the word 'change' could be a literal (i) interpretation: the speaker seeks something as insignificant (j) as spare change. Or, this could be metaphorical (k): the speaker is hoping for a change in society's attitudes to those less fortunate.



## Sentence Starters:

The poet alludes to/implies/conveys/signifies/expresses/illustrates...  
The poet conjures up an image of...  
The reader can infer...  
At the start/end of the poem, the poet...  
The word '\_\_\_\_\_' accentuates/evokes...  
The poet's attitude becomes apparent...  
The theme of \_\_\_\_\_ is explored...  
The writer has employed the use of...

	Key terms	Definition
A	<b>Steer</b>	Direction/focus of the question.
B	<b>Alternative</b>	Another option or possibility.
C	<b>Interpretations</b>	Explaining the meaning of something.
D	<b>Thesis</b>	Statement or theory as an argument to be proved.
E	<b>Speaker</b>	The voice or narrator of the poem.
F	<b>Direct Address</b>	The writer communicates a message directly to an individual or group of individuals.
G	<b>Accountable</b>	Required to explain their actions; be responsible for something.
H	<b>Ambiguous</b>	Not having a clear meaning.
I	<b>Literal</b>	Something in its most basic sense; not metaphorical (k).
J	<b>Insignificant</b>	Not important.
K	<b>Metaphorical</b>	When something symbolizes something else (d).
L	<b>Dehumanised</b>	Take away human qualities.
M	<b>Structure</b>	The way something is put together. E.g. Stanzas, chapters, a novel, a play etc.

## Step-by-step approach for Q2

**Step 1:** Read the question: what is the **steer** (a)?



**Step 2:** Where can you find the steer (a) in this poem and the other poem?

- Start with the **title**
- Beginning/middle/end
- **ONLY** things that **link to the steer** (a) or focus.



**Step 3:** **Compare the methods.**

- Find examples of how the poets have used language in each poem- are they the same or different?
- Find examples of how the poets have structured the poem – are they the same or different?



**Step 4:** **Explode the effects** of these methods in both poems.



**Step 5:** Structure this in one or two paragraphs.

- Poem A – method and effect
- Similar or different?
- Poem B – method and effect



In both 'Give' and 'People Need People' the speakers describe their attitudes **towards how people treat each other.**

What are the similarities/differences between the ways the poets present these attitudes? (8 marks)



Step 1:



This links to the 'steer' of the question because it's about how people treat each other.

Step 2:



The poet has repeated this phrase throughout the poem.

Step 4:



This has been done to emphasise how much and how often we need other people.

Step 3:



On the other hand, the speaker in 'Give' uses direct address: "I'm on my knees. I beg of you"

Step 4:



This also emphasises how much people need others as the speaker has to 'beg' for human affection

People need people,  
To walk to  
To talk to  
To cry and rely on,  
People will always need people.  
To love and to miss  
To hug and to kiss,  
It's useful to have other people.  
To whom to moan  
If you're all alone,  
It's so hard to share  
When no one is there.  
There's not much to do  
When there's no one but you.  
People will always need people.  
To please  
To tease  
To put you at ease,  
People will always need people.  
To make life appealing  
And give life some meaning,  
It's useful to have other people.  
If you need a change  
To whom will you turn.  
If you need a lesson  
From whom will you learn.  
If you need to play  
You'll know why I say  
People will always need people.

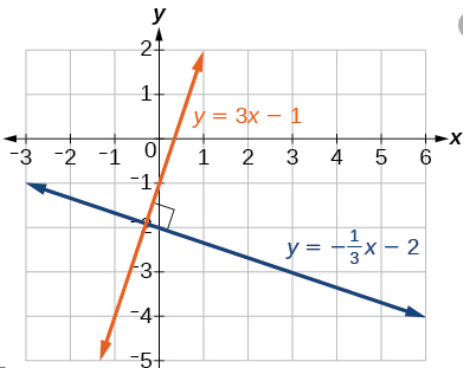
Comparison Connectives	
Similarly	Contrastingly
In the same way	On the other hand
Also	However
In addition	Whereas
Tentative Phrases	
Could	Maybe
Might	Possibly
May	Perhaps
Appears	Seems to

### Things to consider when comparing:

- Ideas
- Themes
- Effect on reader
- Writer's intentions
- Tone
- Mood and atmosphere
- Imagery
- Narrative voice
- Language techniques
- Structural (m) techniques
- Shift of focus
- Beginning
- End

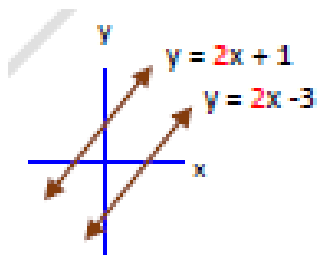
## Perpendicular Lines

Lines that meet at 90 degrees. Their gradients will be **NEGATIVE RECIPROCAL**s of each other.



## Parallel Lines

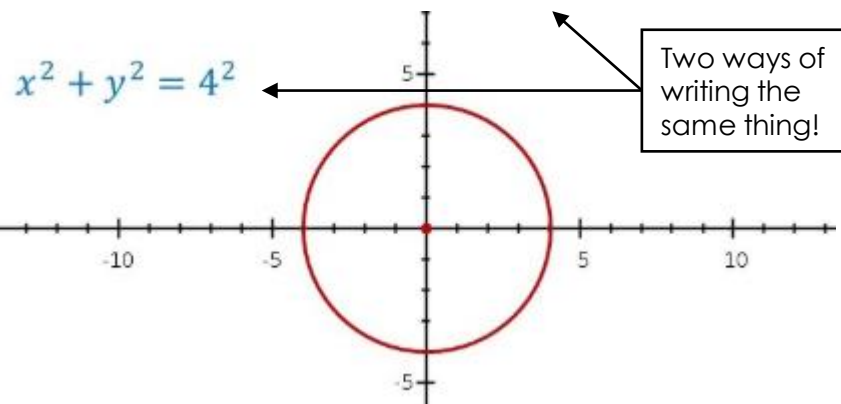
Lines that never meet. They will have the **SAME** gradient.



## Circles

The equation of a circle is in the form  $x^2 + y^2 = r^2$ , where  $r$  is the radius, and the centre of the circle is at  $(0,0)$ .

So a circle with equation  $x^2 + y^2 = 16$  looks like this:



## Graphs you need to be familiar with:

Quadratic:

When  $a$  is positive

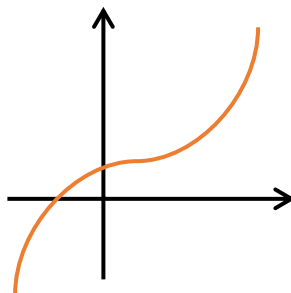


When  $a$  is negative

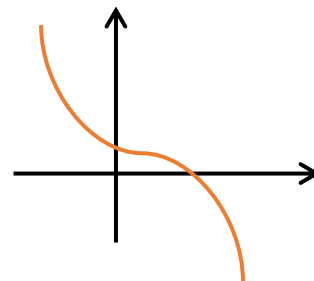


Cubic:  $ax^3 + bx^2 + cx + d$

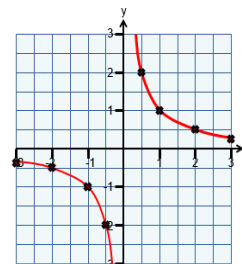
When  $a$  is positive



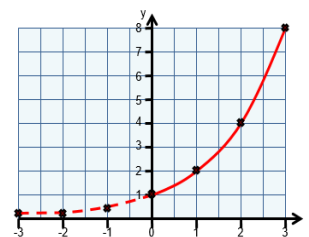
When  $a$  is negative



Reciprocal:  $y = \frac{1}{x}$



Exponential:  $y = 2^x$



Keyword/Skill	Definition/Tips
Coordinate	Shown as a pair $(2,4)$ to show a position on a set of axes.
Quadratic	An equation that has an $x^2$ as the highest power.
Cubic	An equation that has an $x^3$ as the highest power.
Reciprocal	1 divided by the number. E.g. the reciprocal of 2 is $\frac{1}{2}$ The reciprocal of 10 is $\frac{1}{10}$ The reciprocal of $x$ is $\frac{1}{x}$
Circle	A 2D shape made from drawing a curve that is always the same distance from a center.
Perpendicular	When two lines meet at a right angle.
Parallel	When two lines are always the same distance apart and never meet.

Before starting this unit of work it may help to look back at the **Crossover Unit 31 – Coordinate Geometry** knowledge organiser.

### Other Topics/Units this could appear in:

- A-Level – Core:
  - Graphs & Transformations
  - Straight Line Graphs
  - Circles
  - Functions & Graphs

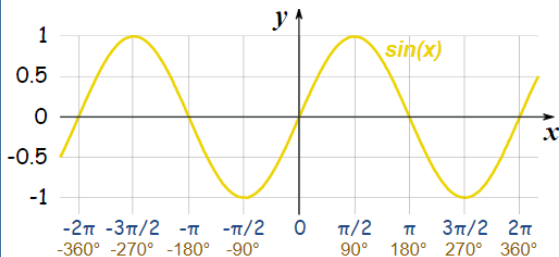
# Working Above Unit 11a & 11b – Graphs of Trigonometric Functions & Further Trigonometry

Before starting work with graphs of trigonometric functions & further trigonometry, you may find it useful to look back at the **Crossover Unit 34 – Pythagoras & Trigonometry** knowledge organiser.

**Exam Tip** – Make sure if you're asked to draw graphs you use a pencil. Your graphs need to be a smooth curve, no straight lines!

**Sine (Sin) Function Graph**

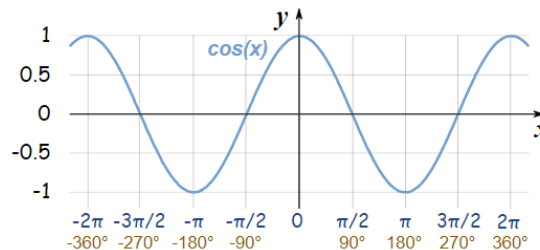
$$y = \sin(x)$$



The sine graph repeats every  $360^\circ$  in both directions of the graph.  
The graph goes through the origin and has a maximum y-value of 1 and a minimum y-value of -1.

**Cosine (Cos) Function Graph**

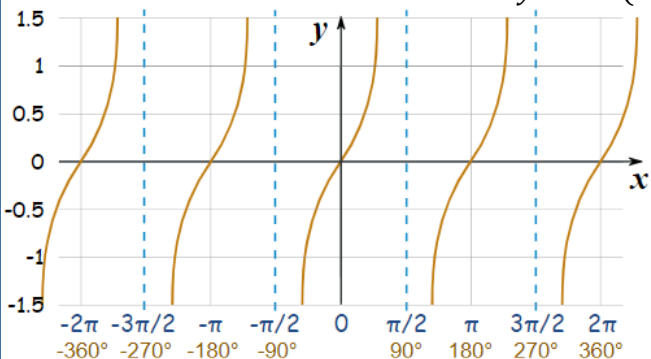
$$y = \cos(x)$$



The cosine graph repeats every  $360^\circ$  in both directions of the graph.  
The graph cuts the y axis at 1.  
It has a maximum y-value of 1 and a minimum y-value of -1.

**Tangent (Tan) Function Graph**

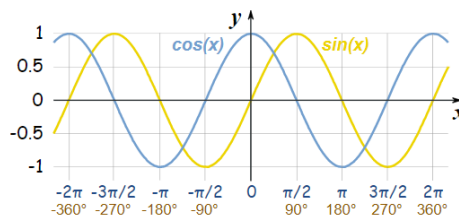
$$y = \tan(x)$$



The tan graph goes between positive and negative infinity, crossing the x-axis at 0 every  $180^\circ$ .

The graph goes through the origin.  
Every  $90^\circ$  ( $\frac{\pi}{2}$  radians) and  $270^\circ$  ( $\frac{3\pi}{2}$  radians) the function is 'undefined'.

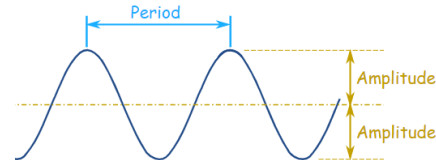
**Sin & Cos Graph**



The sin and cos graph are the exact same shape and are exactly  $90^\circ$  ( $\frac{\pi}{2}$  radians) apart.

**Exact Trig Values**

	$0^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$90^\circ$
$\sin\theta$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
$\cos\theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
$\tan\theta$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	Undefined

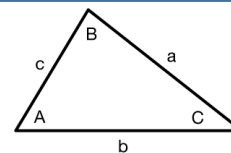
Keyword/Skill	Definition/Tips
Trigonometry	Trigonometry is the study of triangles: their angles, lengths and more.
Hypotenuse	The longest side of a right-angled triangle. It is always opposite the right angle.
Adjacent & Opposite	Adjacent side – Next to the marked angle Opposite side – Opposite the marked angle
Inverse Trig Functions	You use these when calculating angles: $\sin^{-1}(x)$ $\cos^{-1}(x)$ $\tan^{-1}(x)$
Sin/Sine	The ratio of the length of the <b>opposite</b> side to the length of the <b>hypotenuse</b>
Cos/Cosine	The ratio of the length of the <b>adjacent</b> side to the length of the <b>hypotenuse</b>
Tan/Tangent	The ratio of the length of the <b>opposite</b> side to the length of the <b>adjacent</b> side
Radians	A unit of measure for angles. The angle made by taking the radius and wrapping it round the circle. Radians are measured using $\pi$ . Degrees $\rightarrow 180^\circ = \pi$ <- Radians
Transformations	A change in position or size
Plane	A flat Surface
Periodic Function	A function (like <b>Sine</b> or <b>Cosine</b> ) that repeats forever
Amplitude	The height of the centre line (x-axis) to the top (or bottom) of a graph 

Other Topics/Units this could appear in:

- A-Level Topics – Core Trigonometry

# Working Above Unit 11a & 11b – Graphs of Trigonometric Functions & Further Trigonometry

The following rules are all used with non-right angled triangles. You label these triangles with 3 letters for the sides and angles. A side needs to match up with the angle opposite it. Example ->



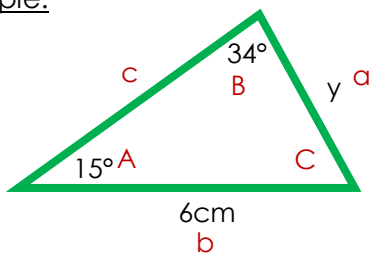
## Sine Rule

You use the sine rule when:

- You are looking for a side and have 2 angles and a side.
- You are looking for an angle and have an angle and 2 sides.

$$\text{Sine Rule: } \frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$$

Example:



Always label your triangle first

$$\frac{y}{\sin(15^\circ)} = \frac{6}{\sin(34^\circ)}$$

$$y = \frac{6}{\sin(34^\circ)} \times \sin(15^\circ)$$

$$y = 2.7770626 = 2.8\text{cm (1d.p.)}$$

## Cosine Rule

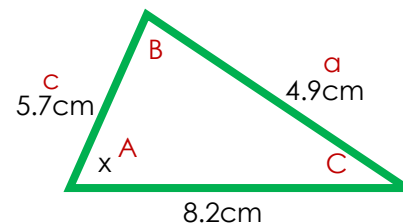
You use the cosine rule when:

- You are looking for an angle and have 3 sides.
- You are looking for a side and have an angle and 2 sides.

$$\text{Cosine Rule: } a^2 = b^2 + c^2 - 2bc\cos(A)$$

(You will sometimes need to rearrange this formula. If you need help with rearranging equations you can look back at **Working Above Unit 2b – Rearranging Equations**)

Example:



8.2cm

Substitute values into the formula

$$4.9^2 = 8.2^2 + 5.7^2 - (2 \times 8.2 \times 5.7 \times \cos(A))$$

$$24.01 = 99.73 - 93.48 \times \cos(A) \quad \text{Then make } \cos(A) \text{ the subject of the equation}$$

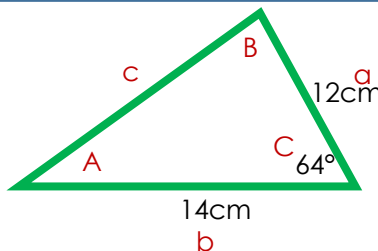
$$\cos(A) = \frac{99.73 - 24.01}{93.48} = 0.81 \text{ (2d.p.)}$$

$$\cos^{-1}(0.81) = 35.9^\circ \quad x = 35.9^\circ$$

## Area of a Triangle

$$\text{Area of a triangle: } \frac{1}{2}ab\sin(C)$$

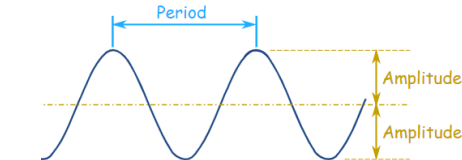
This is used for finding the area of non-right angled triangles.



$$\text{Area} = \frac{1}{2}ab\sin(C)$$

$$\text{Area} = \frac{1}{2} \times 12 \times 14 \times \sin(64^\circ)$$

$$\text{Area} = 76.13\text{cm}^2$$

Keyword/Skill	Definition/Tips
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Transformations	A change in position or size
Plane	A flat Surface
Periodic Function	A function (like <b>Sine</b> or <b>Cosine</b> ) that repeats forever
Amplitude	The height of the centre line (x-axis) to the top (or bottom) of a graph 

Other Topics/Units this could appear in:

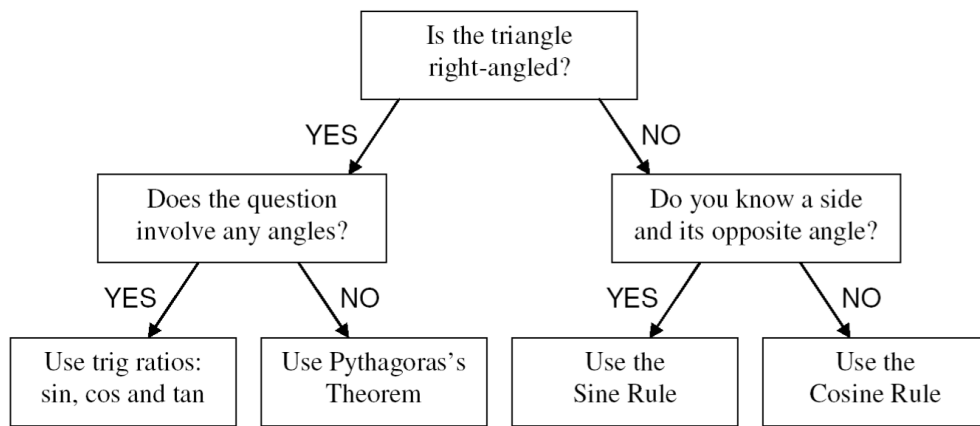
- A-Level Topics – Core Trigonometry

## Calculator Help

Here are the **trig functions** on your calculator. You use these ones when you are finding a length.

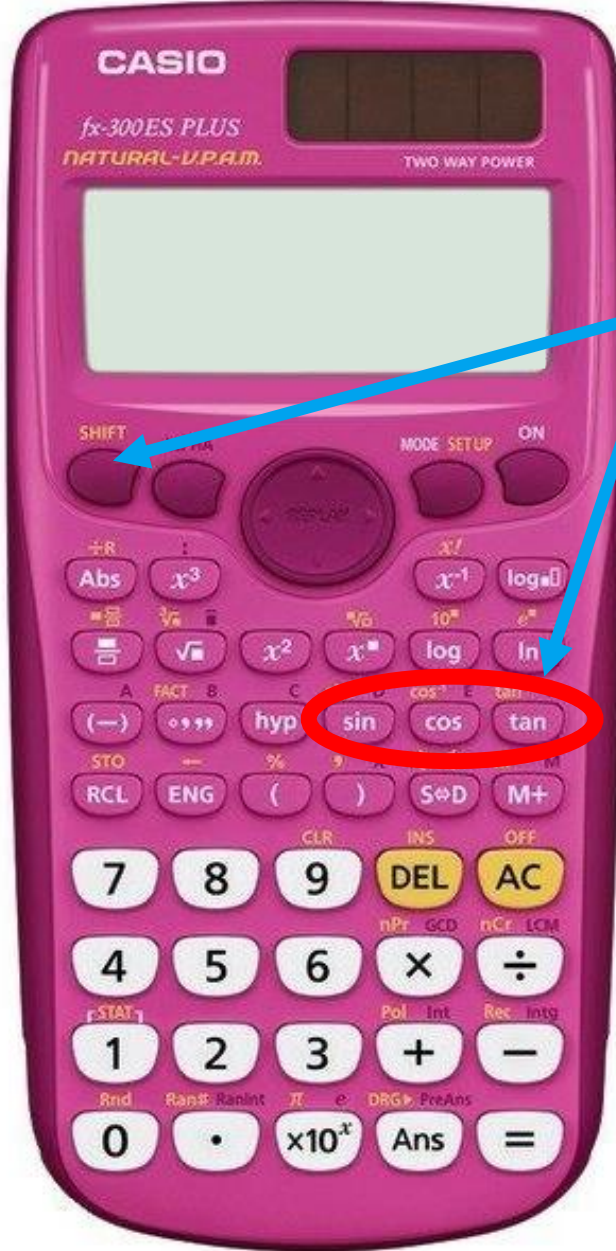
To get the **inverse trig functions** you need to press the SHIFT button first before you press the function you need. You use these ones when you are finding an angle.

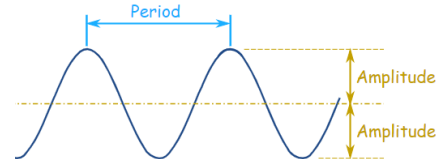
## Which Rule to use



## Exam Tip:

The sin, cos & area of a triangle formulas will sometimes need to be rearranged. You need to be able to decide which rule to use and when you will need to rearrange it. You also need to learn these rules as you will not get them in the exam!



Keyword/Skill	Definition/Tips
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Hypotenuse	The longest side of a right-angled triangle. It is always opposite the right angle.
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Amplitude	The height of the centre line (x-axis) to the top (or bottom) of a graph 

Other Topics/Units this could appear in:

- A-Level Topics – Core Trigonometry

## Types of Sampling

### Random Sampling

Random Sampling is when every person in the group you are interested in has an equal chance of being chosen.

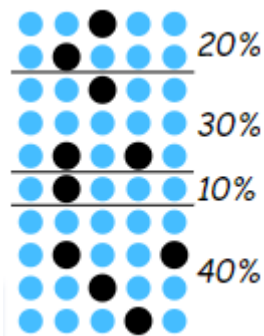
Names might be placed in a hat and then picked out or names could be chosen randomly by a computer.



### Stratified Sampling

Where the group of people, (population) is divided into smaller groups so that the same PROPORTION can be taken.

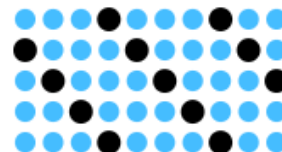
E.G. if 50 out of 1000 pupils were asked a favourite pop group,,



Before starting work with sampling, you may find it useful to look back at the **Crossover Unit 38 Sampling** knowledge organiser.

### Systematic Sampling

This follows a system. E.G every fourth person is chosen.



### Capture/Recapture

You might recognise this from biology! The method is:

- 1) Take a sample of the population
- 2) Mark each item
- 3) Put the items back into the population and ensure **they are thoroughly mixed**
- 4) Take a second sample and count how many of your sample are marked
- 5) The proportion of marked items in your new sample should be the same as the proportion of marked items from the population in your first sample

**Example:** 10 fish are caught in a lake, marked and released back into the lake. A week later, 20 fish are caught and 4 are found to be marked. Estimate the number of fish in the lake.

$$\frac{10}{n} = \frac{4}{20}$$

$$n = \frac{10 \times 20}{4}$$

$$n = 50$$

There are approximately 50 fish in the lake



Year Group	No. of Pupils	How to work out pupils in each group.	No of Pupils in Sample
7	180	$\frac{180}{1000} \times 50 = 9$	9
8	200	$\frac{200}{1000} \times 50 = 10$	10
9	240	$\frac{240}{1000} \times 50 = 12$	12
10	220	$\frac{220}{1000} \times 50 = 11$	11
11	160	$\frac{160}{1000} \times 50 = 8$	8

Check your answers add up to 50  
(9+10+12+11+8 = 50).

Keyword/Skill	Definition/Tips
Data	Facts that are collected.
Population	The whole group from where the sample is taken, i.e. a whole year group.
Primary Data	Data you collect yourself.
Secondary Data	Data which other people have collected.
Hypothesis	An idea or an assumption that you can test to see if it is true.
Quantitative Data	Data that is given in numbers.
Qualitative Data	Data that is given in words.
Discrete Data	Data that only takes a certain value. E.G. number of people in class. (Only whole numbers)
Continuous Data	Data that has a number of possibilities between two fixed points. E.G. The weight of a new born baby (Can include decimal numbers)
Bias	A built in error that makes the results wrong or "unfair", i.e. a weighted dice so when rolled it lands on 6 more than the rest.

Other Topics/Units this could appear in:

- A Level Statistics - Data Collection

# Working Above Unit 12b – Cumulative Frequency & Box Plots

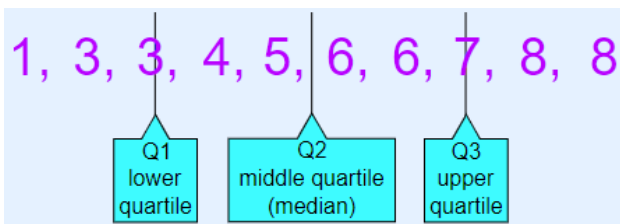
## Quartiles

Quartiles are the values that divide a list of numbers into quarters:

- Put the list of numbers **in order**
- Then cut the list into **four equal parts**
- The Quartiles are at the "cuts"

Example: 1, 3, 3, 4, 5, 6, 6, 7, 8, 8

The numbers are already in order, cut the list into quarters:



In this case Quartile 2 is half way between 5 and 6:

$$Q2 = (5+6)/2 = 5.5$$

And the result is:

- Quartile 1 (Q1) = **3 (Lower Quartile)**
- Quartile 2 (Q2) = **5.5 (Median)**
- Quartile 3 (Q3) = **7 (Upper Quartile)**

Before starting work with quartiles, you may find it useful to look back at the **Crossover Unit 23 Averages and Unit 24 Averages from a Table** knowledge organisers.

## IQR

The IQR "Interquartile Range" is the spread of the middle 50% of data.

As it is only the middle 50% the IQR is **less likely to be affected by outliers**. Whereas the range (which is the spread of all the data) would be affected by outliers.

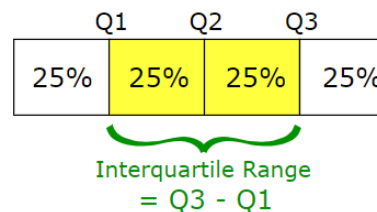
To calculate it just **subtract Quartile 1 from Quartile 3**.

Using the example from the quartiles:

$$Q3 = 7$$

$$Q1 = 3$$

So the interquartile range is 4

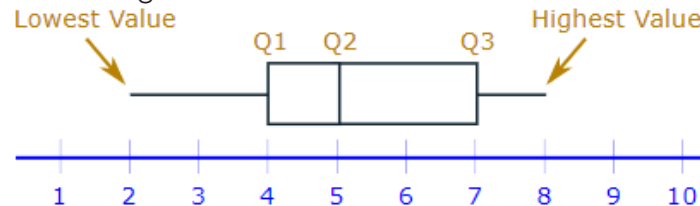


## Box Plot

A **box plot** shows a visual representation of the **median** and **quartiles** of a set of **data**.

To draw a box plot, the following information is needed:

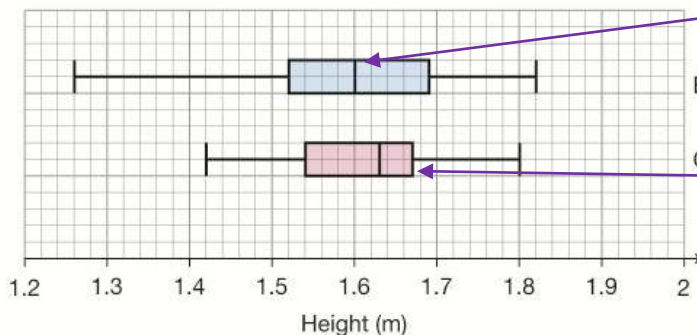
- minimum value
- **lower quartile**
- median
- **upper quartile**
- maximum value



## Making Comparisons

The box plot summarise the heights of samples of 14 and 14 year old boys and girls

Heights of boys and girls



The median is labelled as Q2, use a ruler to read the value

Median height of girls = 1.63m  
Median height of boys 1.60m

**On average**, the girls are taller than boys.

The IQR is the UQ subtract the LQ, read Q3 & Q1 then do  $Q3 - Q1$

IQR for girls =  $1.67 - 1.54 = 0.13m$   
IQR for boys =  $1.69 - 1.52 = 0.17m$

The IQR for the boys is greater than the girls, the girls heights are more **consistent** than the boys

Keyword/Skill	Definition/Tips
Sample	A group from the population that we are testing.
Population	The whole group from where the sample is taken, i.e. a whole year group.
Discrete	Discrete data can only have a finite or limited number of possible values. (Whole numbers)
Continuous	Continuous data can have an infinite number of possible values within a selected range. (Can include decimal numbers).
Quantitative	Quantitative data that can be counted (discrete), quantitative data that can be measured (continuous)
Mode	The number which appears most often in a set of numbers
Median	Place the numbers in value order and then find the middle number. When there are two numbers in the middle, we find the average them.
Range	The difference between the highest and lowest values.
Outlier	A point that "lies outside" (is much smaller or larger than) most of the other values in the dataset.
IQR (interquartile range)	The spread of the middle 50% of data. A smaller IQR shows that the data is <b>consistent</b> .

Other Topics/Units this could appear in:

- A Level Statistics- Data Collection

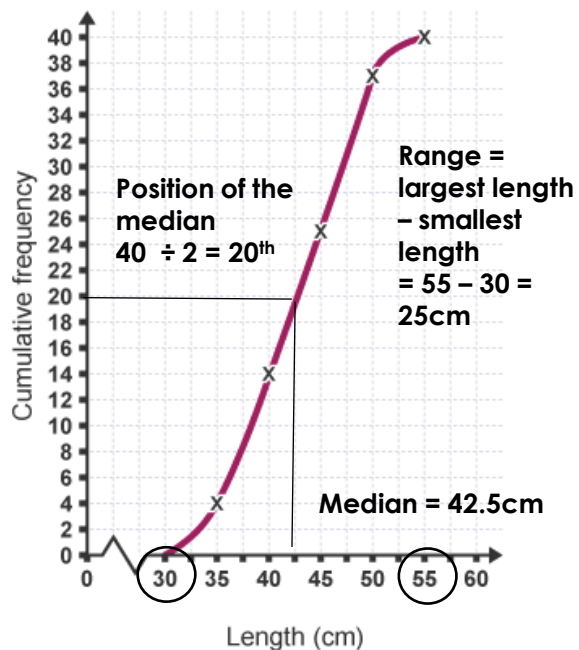


# Working Above Unit 12b – Cumulative Frequency & Box Plots

## Cumulative Frequency Graphs

A **cumulative frequency diagram** creates a running total of the amounts within a table.

A cumulative frequency diagram is drawn by plotting the **upper class boundary** with the cumulative frequency.



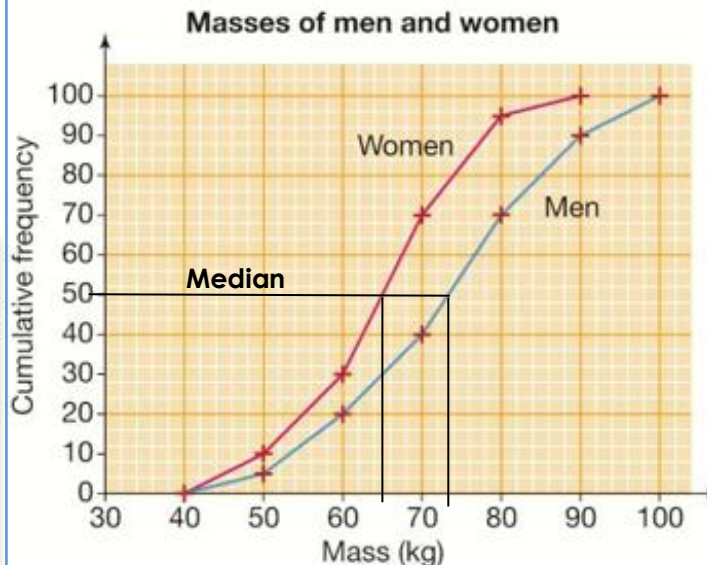
The upper class boundaries for this table are 35, 40, 45, 50 and 55.

Length (cm)	Frequency	Cumulative frequency
$30 \leq l < 35$	4	4
$35 \leq l < 40$	10	14 (4 + 10 = 14)
$40 \leq l < 45$	11	25 (4 + 11 = 25)
$45 \leq l < 50$	12	37 (25 + 12 = 37)
$50 \leq l < 55$	3	40 (37 + 3 = 40)

Before starting work with quartiles, you may find it useful to look back at the **Crossover Unit 23 Averages and Unit 24 Averages From a Table** knowledge organisers.

## Making Comparisons

When making comparisons use an **average or spread to back up your statement!**



2) Range of women's masses =  $90 - 40 = 50\text{kg}$   
 Range of men's masses =  $100 - 40 = 60\text{kg}$

The men's masses **vary** more than the women's masses

These cumulative frequency graphs summarise the masses of samples of 100 men and 100 women.

**Finding the median** mass for 100 women. Position of the median is  $100 \div 2 = 50$  so find the mass of the 50<sup>th</sup> person. Read from 50 on the cumulative frequency to the value on the mass axis.

1) Median mass of women = 65kg  
 Median mass of men = 73kg

On **average**, the women are lighter than men

**Range of masses** = largest mass (read from the final point) subtract the mass from where the line starts

## Exam Tips!

- Be sure to label the axis "cumulative frequency" not just "frequency"
- Note how the graphs don't have to start at origin
- Smooth curve going to through all the points – use a pencil!
- When making a comparison, write a statement and back it up with evidence from the graph (comparing the medians or IQR in context of the question!)

Keyword /Skill	Definition/Tips
Sample	A group from the population that we are testing .
Population	The whole group from where the sample is taken, i.e. a whole year group.
Discrete	Discrete data can only have a finite or limited number of possible values. (Whole numbers)
Continuous	Continuous data can have an infinite number of possible values within a selected range. (Can include decimal numbers).
Quantitative	Quantitative data that can be counted (discrete), quantitative data that can be measured (continuous)
Mode	The number which appears most often in a set of numbers
Median	Place the numbers in value order and then find the middle number. When there are two numbers in the middle, we find the average them.
Range	The difference between the highest and lowest values.
Outlier	A point that "lies outside" (is much smaller or larger than) most of the other values in the dataset.
IQR (interquartile range)	The spread of the middle 50% of data. A smaller IQR shows that the data is <b>consistent</b> .

Other Topics/Units this could appear in:

- A Level Statistics- Data Collection

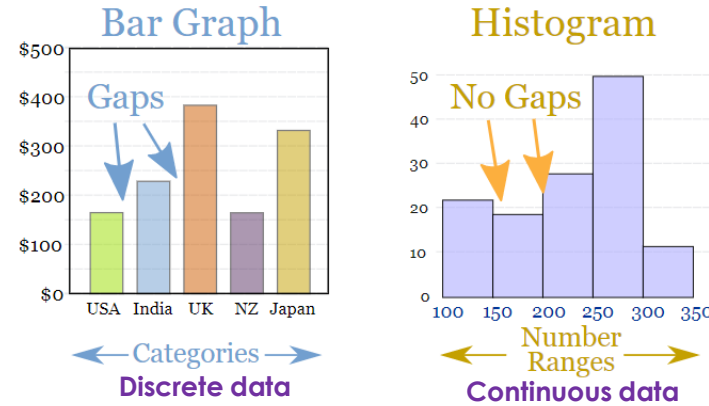
Before starting work with quartiles, you may find it useful to look back at the **Crossover Unit 23 Averages and Unit 24 Averages from a group table** knowledge organiser.

### Histograms

$$\text{Frequency density} = \frac{\text{Frequency}}{\text{Class width}}$$

#### Key Facts

- The bars in a histogram can have different widths
- The area of each bar represent the frequency
- The height of the bar represents the frequency density



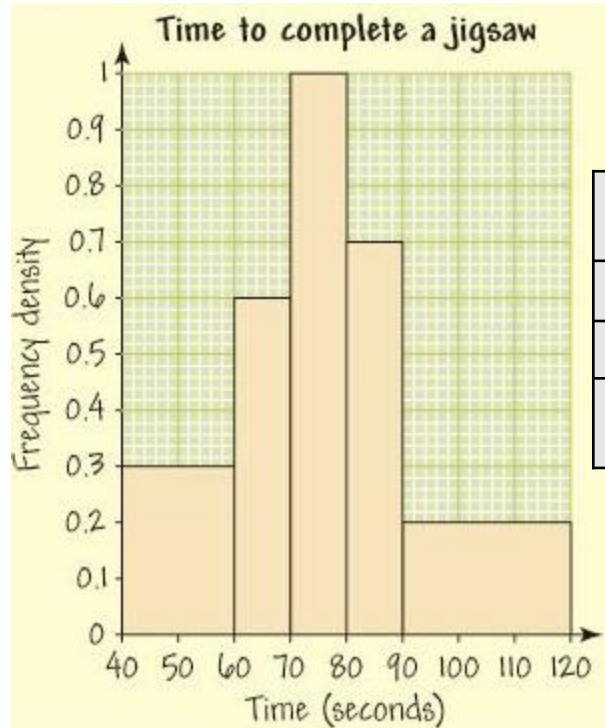
### Drawing a Histogram

How to draw a histogram

- Find the class width of each interval
- Calculate the frequency density
- Draw a histograms. **There are no gaps between the bars.**

#### Histogram axis labels

- Y axis is frequency density (you need to calculate this)
- X axis is in context of the question (time)



The table shows the time taken to complete a simple jigsaw

Time, t seconds	$40 \leq t < 60$	$60 \leq t < 70$	$70 \leq t < 80$	$80 \leq t < 90$	$90 \leq t < 120$
Class Width	20	10	10	10	70
Frequency	6	6	10	7	6
Frequency density	0.3	0.6	1	0.7	0.2

#### Class Width

Find the size of each class  
i.e.  $60 - 40 = 20$   
(Note the class widths do not need to be same)

#### Frequency Density

The frequency will be given to you and use your calculated class width

$$\frac{\text{Frequency}}{\text{Class width}} \text{ i.e. } \frac{7}{10} = 0.7$$

Keyword/Skill	Definition/Tips
Sample	A group from the population that we are testing
Population	The whole group from where the sample is taken, i.e. a whole year group
Discrete data	Can only take exact values (usually collected by counting), for example the number of students in a class. <b>Bar graphs represent discrete data.</b>
Continuous data	Can take any value (collected by measuring), for example the heights of the students in a class - use continuous data. <b>Histograms represent continuous data.</b>
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IQR (interquartile range)	The spread of the middle 50% of data. A smaller IQR shows that the data is <b>consistent</b> .
Frequency density	$\frac{\text{Frequency}}{\text{Class width}}$ It is labelled as the y axis on a histogram.

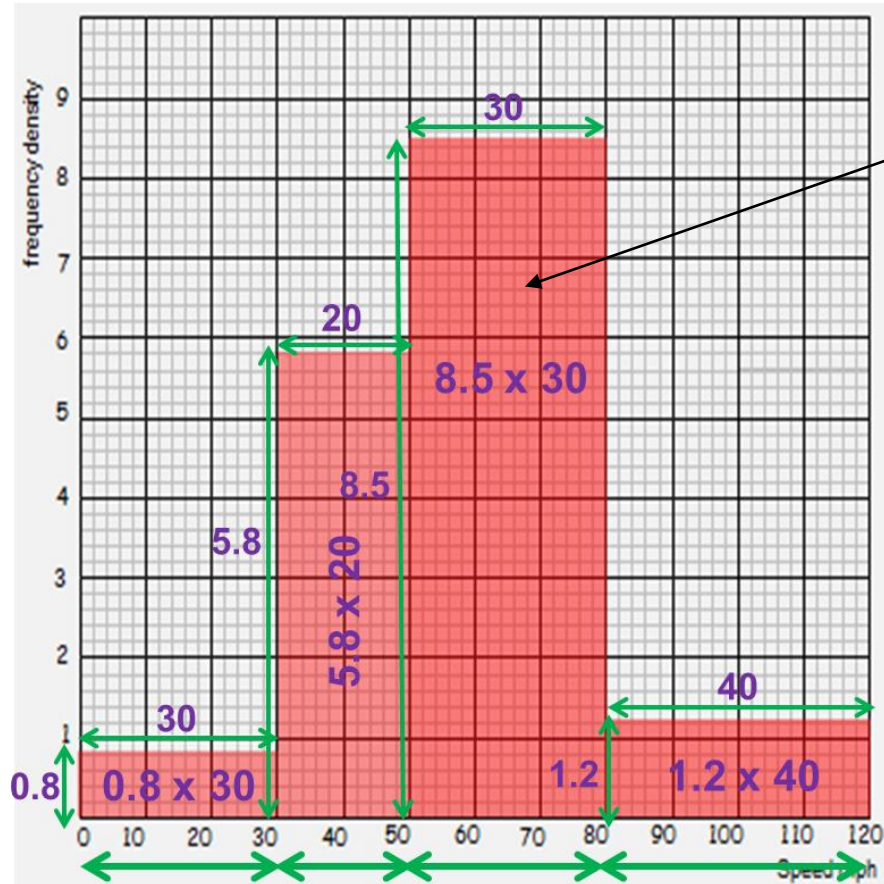
Other Topics/Units this could appear in:

- A-Level Statistics - Data Collection **26**

Before starting work with quartiles, you may find it useful to look back at the **Crossover Unit 23 Averages from a table and U24 Averages from a group table** knowledge organiser.

### Interpreting Histograms – Finding the median

Sometimes you are given the histogram and you need to interpret it. The histogram below gives information on the speed (mph) of cars on a motorway. Find the median class.



### Frequency = Frequency Density x Width

The area of each bar is the frequency, height (frequency density) multiplied by the width (class interval)

Speed (mph)	Frequency	CF
$0 \leq x < 30$	24	24
$30 \leq x < 50$	116	140
$50 \leq x < 80$	255	395
$80 \leq x < 120$	48	443

$$\text{Position of the median} = \frac{\text{total frequency} + 1}{2}$$

$$\text{Position of the median} = \frac{443 + 1}{2}$$

$$\text{Position of the median} = 222^{\text{nd}} \text{ value}$$

(Find this value by looking at the cumulative frequency column)

**Median class =  $50 \leq x < 80$**

### Interpreting Histograms – Estimating the mean

Speed (mph)	Frequency	Mid point	fx
$0 \leq x < 30$	24	15	$24 \times 15 = 360$
$30 \leq x < 50$	116	40	$116 \times 40 = 4640$
$50 \leq x < 80$	255	65	$255 \times 65 = 16575$
$80 \leq x < 120$	48	100	$48 \times 100 = 4800$
Totals	443		26375

Estimating the mean from a histogram is the same as estimating the mean from a grouped frequency table.

$$\text{Estimated mean} = \frac{\text{Total fx}}{\text{Total f}} = \frac{26375}{443} = 59.5 \text{ mph (1 d.p.)}$$

Find the mid points and calculate a new fx column

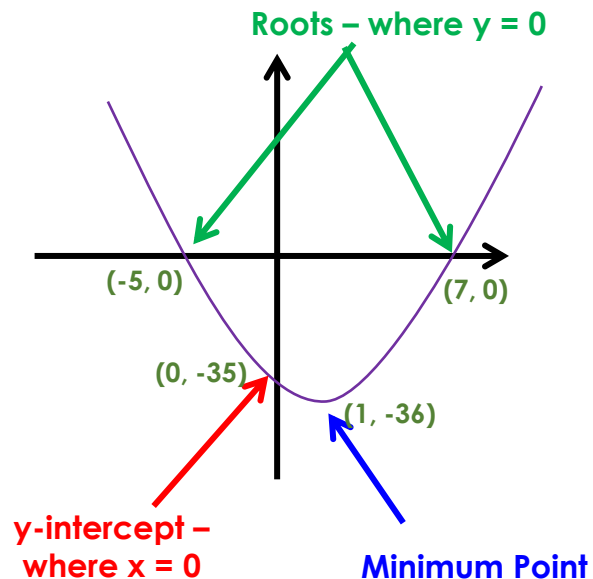
Keyword/Skill	Definition/Tips
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Outlier	A point that “lies outside” (is much smaller or larger than) most of the other values in the dataset.
IQR (interquartile range)	The spread of the middle 50% of data. A smaller IQR shows that the data is <b>consistent</b> .
Frequency density	$\frac{\text{Frequency}}{\text{Class width}}$ It is labelled as the y axis on a histogram.

Other Topics/Units this could appear in:

- A-Level Statistics- Data Collection

Before progressing through this section of work, you may find it useful to refer to **Crossover Unit 30 - Quadratic and Cubic Graphs** & **Working Above Unit 6 - Quadratics**

## Sketching Quadratic Curves



E.g. Sketch the graph of  $y = x^2 - 2x - 35$  clearly stating the roots, the y Intercept and the minimum point of the curve.

Step 1: Find the roots by factorising and solve the Quadratic Equation  $x^2 - 2x - 35 = 0$

$$(x - 7)(x + 5) = 0$$

$x = 7$  and  $x = -5$  are the two roots

Step 2: Find the y coordinate of the y intercept by putting  $x = 0$  into  $x^2 - 2x - 35$  which gives a y intercept of  $(0, -35)$

Step 3: We can find the minimum coordinate of the curve by 'completing the square'

$$x^2 - 2x - 35$$

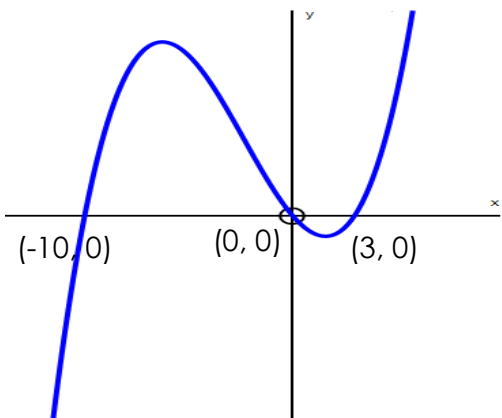
$$(x - 1)^2 - 35 - 1$$

$$(x - 1)^2 - 36$$

Minimum point at  $(1, -36)$

**Exam Tip:** These questions can be worth up to 5/6 marks  
Make sure you are familiar with the different techniques and hey presto, 5/6 marks in the bag.

## Sketching Cubic Curves - For GCSE, only the roots (x intercepts) and the y intercept are required for cubic graphs.



Eg. Sketch the graph of  $y = x^3 + 7x^2 - 30x$

Step 1: Factorise and solve the equation  $x^3 + 7x^2 - 30x = 0$

$$x(x^2 + 7x - 30) = 0 \quad \text{so immediately we know one root is } 0$$

Now solve the equation  $x^2 + 7x - 30 = 0$  for the other(s)

$$(x + 10)(x - 3) = 0$$

$$x = -10 \text{ and } x = 3$$

There are 3 roots which are -10, 0 and 3

Step 2: Find the y coordinate of the y intercept by putting

$$x = 0 \text{ into } x^3 + 7x^2 - 30x \text{ which gives a y intercept of } (0, 0)$$

Note: In this example, the y intercept is also a root. This will not always be the case.

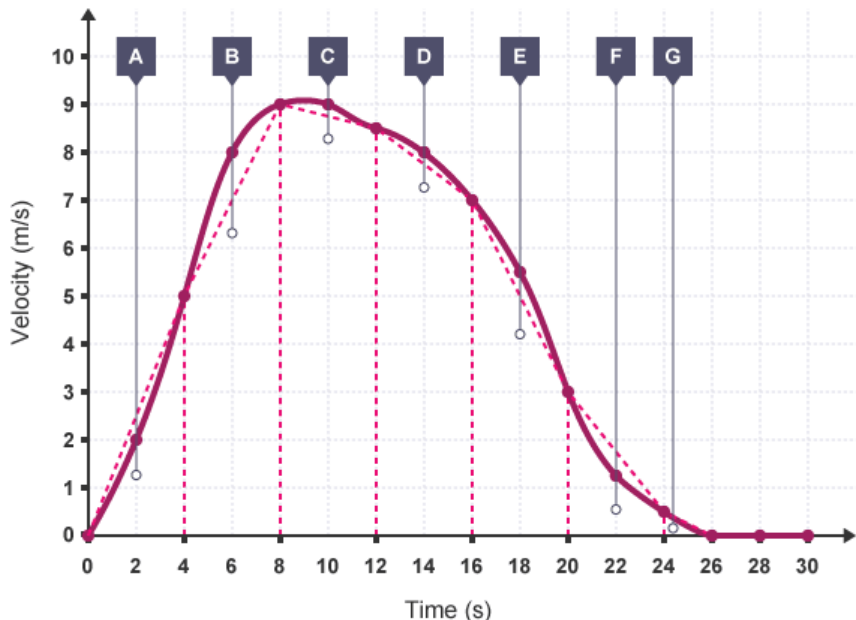
Keyword/Skill	Definition/tip
Quadratic	Where the highest power of the variable (usually x) is squared . e.g, $x^2$ , $x^2 + 5x$ , $x^2 - 2x - 8$ etc.
Cubic	Where the highest power of the variable (usually x) is cubed. e.g, $x^3$ , $x^3 + 5x$ , $x^3 + 2x^2 - 5x + 2$ etc.
Factorise	Write an expression as a product of its factors.
Root	Where a function equals zero.
Y Intercept	The point where a line or a curve crosses the y-axis of a graph.
Function	A mathematical relationship between two variables.

### Other topics/Units this could appear in:

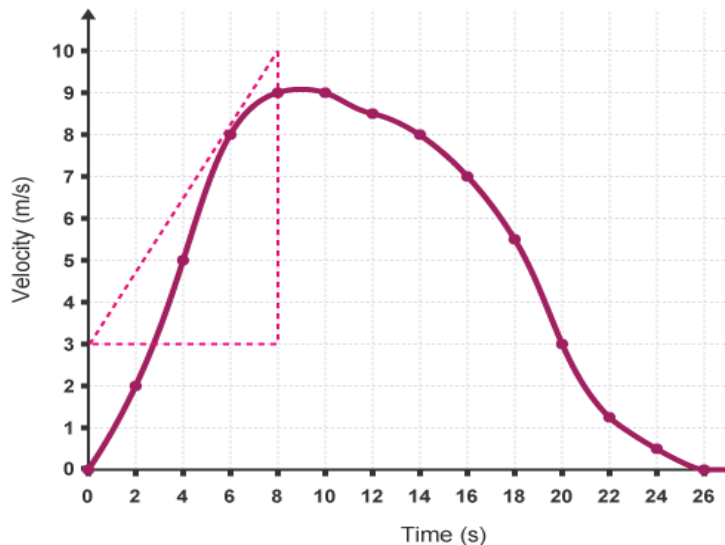
- Quadratic and Cubic Graphs
- 'A' Level:
- Core - Differentiation  
- Integration
- Mechanics - Kinematics

**Area under a Graph** - In a Velocity/Time (Speed/Time) graph, the area under a curve is the **distance** travelled.

E.g. The velocity of a sledge as it slides down a hill is shown in the graph. Estimate the distance travelled by the sledge. Use as many 4 second intervals as possible in your estimate.



Find the acceleration of the sledge when  $t = 6s$ .



As we are **estimating** the distance travelled,

Area of Triangle  $A \frac{4 \times 5}{2} = 10$

Area of Trapezium  $B \frac{4 \times (5 + 9)}{2} = 28$

Area of Trapezium  $C \frac{4 \times (9 + 8.5)}{2} = 35$

Area of Trapezium  $D \frac{4 \times (8.5 + 7)}{2} = 31$

Area of Trapezium  $E \frac{4 \times (7 + 3)}{2} = 20$

Area of Trapezium  $F \frac{4 \times (3 + 0.5)}{2} = 7$

Area of Triangle  $G \frac{(0.5 \times 2)}{2} = 0.5$

The estimated area under the graph is  $10 + 28 + 35 + 31 + 20 + 7 + 0.5 = 131.5$

**The sledge travelled is 131.5 metres.**

To work out the acceleration or deceleration at a particular point draw a tangent at that point. For instance, the acceleration of the sledge 6 seconds into its journey is:

$$\frac{\text{change in } y}{\text{change in } x} = \frac{7m/s}{8s} = 0.875m/s^2.$$

Keyword/Skill	Definition/Tip
Velocity	Speed (how fast something is moving) in a particular direction.
Acceleration	How fast velocity changes.
Estimate	To find a value that is close enough to the right answer usually involving a calculation.
Trapezium	A flat shape with 4 straight sides that has one pair of parallel sides. Area is given by $\frac{a+b}{2} \times h$ where a and b are the parallel sides and h is the distance between them.
Tangent	A line that just touches a curve at one point.

Other topics/Units this could appear in:

- Coordinate Geometry
- Real-Life Graphs

**Exam Tip:** If the question **does not** specify how many sections to split the graph into, try not to use more than 4 sections of Triangles, Trapeziums and/or Rectangles. When calculating acceleration after drawing the tangent make a right angled triangle as shown to help with the calculation.

Before starting work with circle geometry, you may find it useful to look back at the **Crossover Unit 29 – Straight-Line Graphs & Working Above Unit 3 – Coordinate Geometry** knowledge organisers.

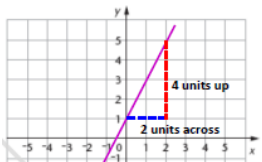
## Equation of a Straight-Line

$$y = mx + c$$

↓      ↓  
**Gradient**   **y-intercept**

How to find the gradient:

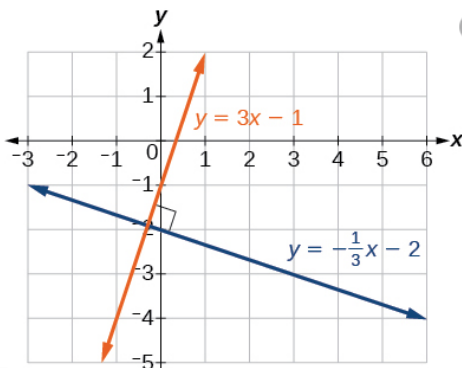
$$\text{gradient} = \frac{\text{change in } y}{\text{change in } x} = \frac{4}{2} = 2$$



The y-intercept is where the line crosses the y-axis.

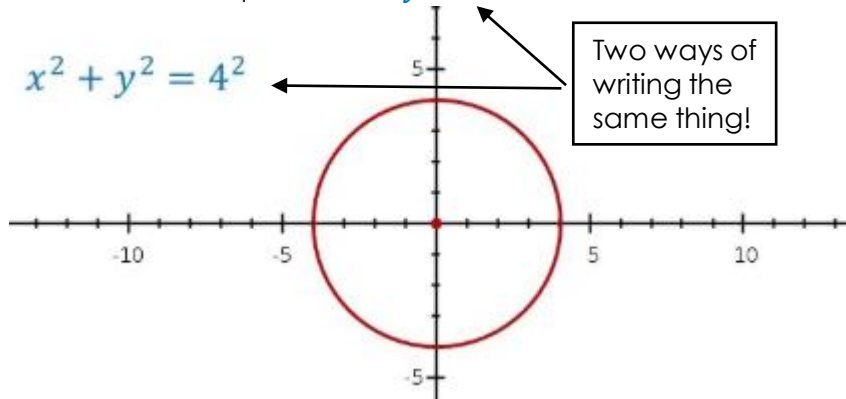
## Perpendicular Gradients

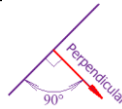
Lines that meet at 90°. Their gradients will be **negative reciprocals** of each other.



## Equation of a Circle

The equation of a circle is in the form  $x^2 + y^2 = r^2$ , where r is the radius, and the centre of the circle is at (0,0). So a circle with equation  $x^2 + y^2 = 16$  looks like this:



Keyword/Skill	Definition/Tips
Radius	A straight line from the centre of the circle to the <b>circumference</b> of a circle.
Diameter	A straight-line passing side to side through the centre of a circle.
Circumference	The perimeter of a circle.
Tangent	A line that hits the circle at only one point.
Perpendicular	When two lines meet at right angles (90°). 
Arc	A part of a curve, or a part of the <b>circumference</b> of a circle.
Coordinate	Shown as a pair (2,4) to show a position on a set of axes.
Reciprocal	1 divided by the number. E.g. the reciprocal of 2 is 1/2. The reciprocal of 10 is 1/10. The reciprocal of x is 1/x.
Gradient	How steep a line is.
Y-Intercept	The point where the line crosses the y-axis.
Origin	Where the x-axis and y-axis meet. Coordinate – (0,0)

## Equation of the Tangent

This is a typical exam question on finding the equation of a tangent line. You need to be confident with finding the equation of a line to answer this question:

Here is a circle, centre O, and the tangent to the circle at the point (2, -4). Find the equation of the tangent at the point P.

The first step you need to do is figure out the gradient of the line OP (This is the line that goes through the tangent point and the radius.)

Two points on the radius line are the centre of the circle: (0,0) and the tangent point: (2,-4)

$$\text{Gradient} = \frac{\text{change in } y}{\text{change in } x} = \frac{-4-0}{2-0} = -\frac{4}{2} = -2$$

As the gradient of OP is -2. The gradient of the tangent line is 1/2 (the negative reciprocal).

Equation of the tangent so far:  $y = \frac{1}{2}x + c$  Now we need to figure out the y-intercept.

To find out the y-intercept you need to substitute the point you have into the equation so far:

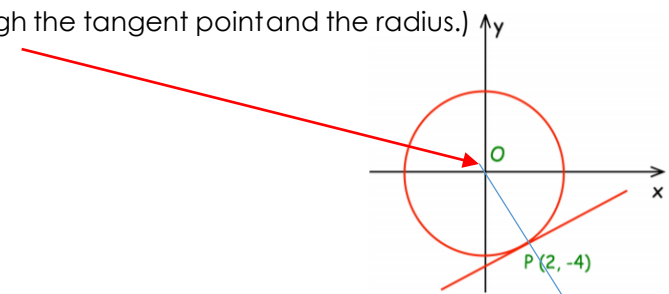
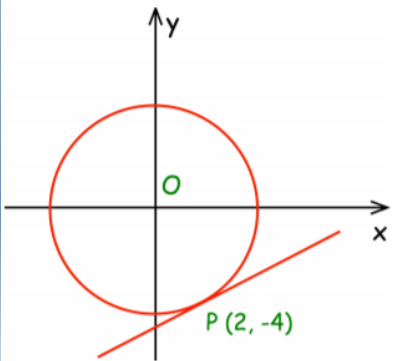
Substitute the point (2, -4) into  $y = \frac{1}{2}x + c$

$$-4 = \frac{1}{2} \times 2 + c$$

$$-4 = 1 + c$$

$$c = -5$$

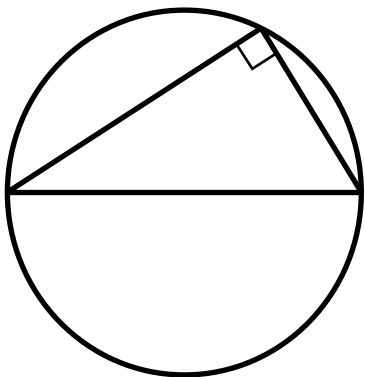
Therefore the equation of the tangent is:  $y = \frac{1}{2}x - 5$



Other Topics/Units this could appear in:

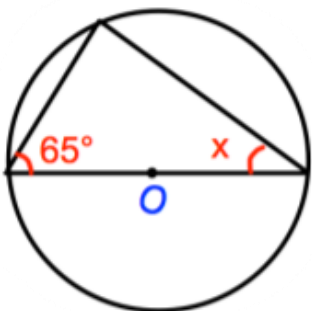
- Core – Trigonometry
- Core – Coordinate Geometry

## Angles in a Semi-Circle



The angle at the circumference standing on a diameter is equal to  $90^\circ$

Example:

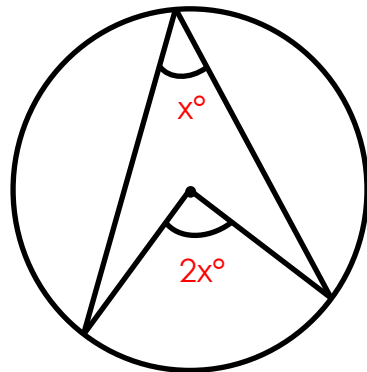


As angles in a semi-circle equal  $90^\circ$ , the angle at the circumference is  $90^\circ$ .

Angles in a triangle sum to  $180^\circ$ ,  
So therefore:  $180^\circ - (90^\circ + 65^\circ) = 25^\circ$

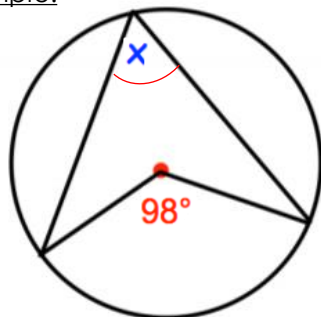
$$x = 25^\circ$$

## Angles at the Centre



The angle at the centre is double the angle at the circumference

Example:

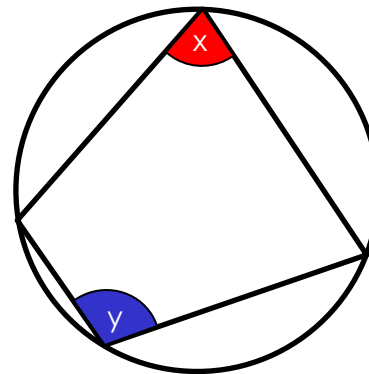


Here we have the angle at the centre. The angle at the centre is double the angle at the circumference.

$$\text{Therefore: } x = 98^\circ \div 2$$

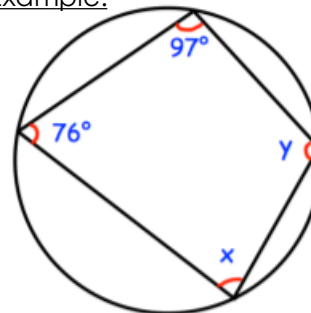
$$x = 49^\circ$$

## Opposite Angles in a Cyclic Quadrilateral



Opposite angles in a cyclic quadrilateral add up to  $180^\circ$

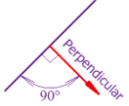
Example:



In a cyclic quadrilateral, opposite angles sum to  $180^\circ$   
So that means:

$$\begin{aligned} 97^\circ + x &= 180^\circ \\ -97^\circ & \quad -97^\circ \\ \hline x &= 83^\circ \end{aligned}$$

$$\begin{aligned} 76^\circ + y &= 180^\circ \\ -76^\circ & \quad -76^\circ \\ \hline y &= 104^\circ \end{aligned}$$

Keyword/Skill	Definition/Tips
Radius	A straight line from the centre of the circle to the <b>circumference</b> of a circle
Diameter	A straight-line passing side to side through the centre of a circle
Circumference	The perimeter of a circle
Tangent	A line that hits the circle at only one point
Perpendicular	At right angles ( $90^\circ$ ) to 
Chord	A straight line joining two points on a circle
Segment	The section of a circle made from a <b>chord</b>
Cyclic Quadrilateral	A quadrilateral with every vertex on a circle's circumference
Arc	A part of a curve, or a part of the <b>circumference</b> of a circle

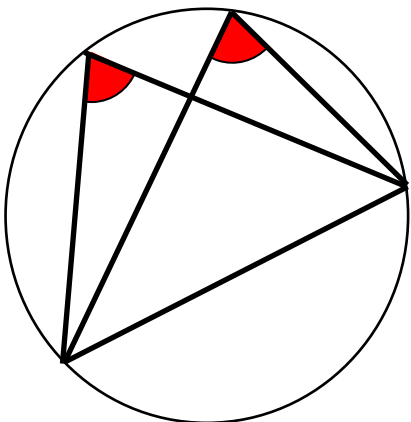
### Exams!

You must write a reason for each stage of your working out when it comes to circle theorems, even basic facts (such as angles in a triangle sum to  $180^\circ$ ).  
You will miss out on marks if you do not put a reason.

### Other Topics/Units this could appear in:

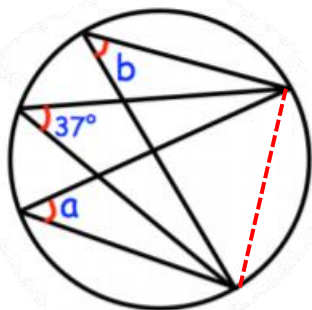
- Core – Trigonometry
- Core – Coordinate Geometry

## Angles in the Same Segment



Angles created by triangles are equal if they are in the same segment

Example:



Here, these angles are all in the same segment (you can add in the line to make the segment to show it).

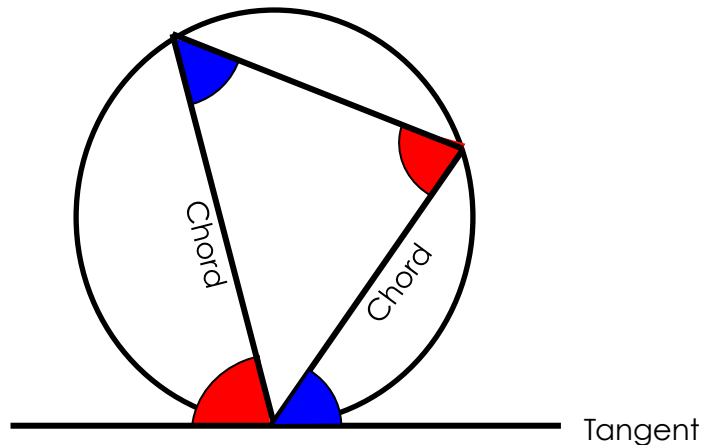
This means

$$a = b = 37^\circ$$

So:  $a = 37^\circ$      $b = 37^\circ$

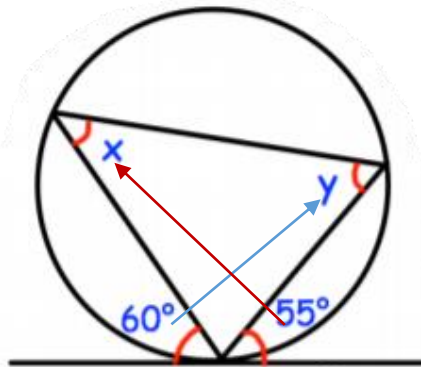
Because angles in the same segment are equal

## Alternate Segment Theorem



Angle between a tangent and a chord is equal to the angle at the circumference in the alternate segment

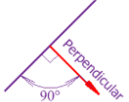
Example:



You need to recognise when to use this theorem. Here you can apply the alternate segment theorem (remember the equal angles are in **alternate** segments, follow the arrows for the equal angles).

$y = 60^\circ$  as angles in the alternate segment are equal

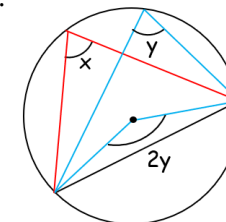
$x = 55^\circ$  as angles in the alternate segment are equal

Keyword/Skill	Definition/Tips
Radius	A straight line from the centre of the circle to the <b>circumference</b> of a circle
Diameter	A straight-line passing side to side through the centre of a circle
Circumference	The perimeter of a circle
Tangent	A line that hits the circle at only one point
Perpendicular	At right angles ( $90^\circ$ ) to 
Chord	A straight line joining two points on a circle
Segment	The section of a circle made from a <b>chord</b>
Cyclic Quadrilateral	A quadrilateral with every vertex on a circle's circumference
Arc	A part of a curve, or a part of the <b>circumference</b> of a circle

### Exams!

They may ask you to prove a theorem. Sometimes you can prove a theorem by using another theorem.

For example to prove the angles in same segment:



- First, draw in radii

apply 'angle at centre'

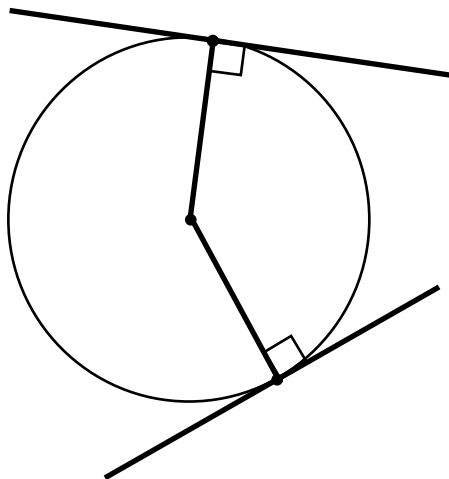
$$\Rightarrow 2x = 2y$$

$$x = y$$

=> Angles in same segment are equal

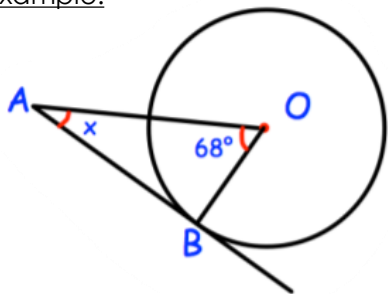


## Tangents & Radii



The angle between the tangent and a radius is equal to  $90^\circ$  as they form a set of perpendicular lines

Example:

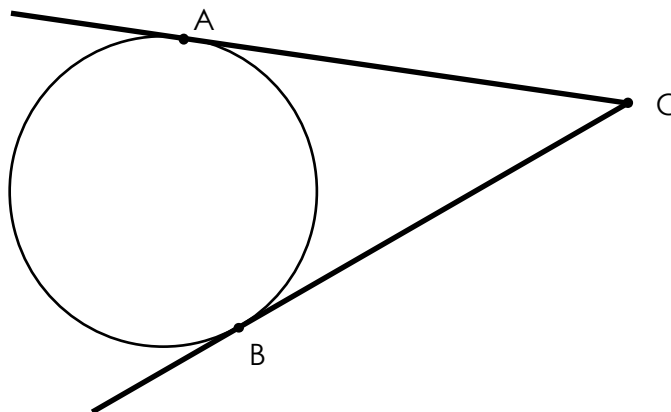


Here, the angle  $ABO$  will equal  $90^\circ$  as the tangent and the radius form perpendicular lines.

As angles in a triangle sum to  $180^\circ$ ,  $x = 180^\circ - 90^\circ - 68^\circ$

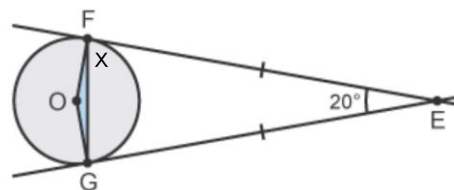
$$x = 22^\circ$$

## Lengths of Tangents



Tangents to a circle which meet at a point are equal in length ( $AC = AB$ )

Example:

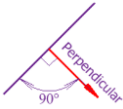


You need to calculate  $x$ , which is angle  $EFG$ .

Triangle  $EFG$  is an isosceles triangle as the lines  $FE$  and  $GE$  are equal because when two tangents to a circle meet at a point, they are equal.

Angle  $EFG = FGE$  as base angles are equal in isosceles triangles.

$$\text{Angle } EFG = FGE = \frac{180^\circ - 20^\circ}{2} = 80^\circ \quad x = 80^\circ$$

Keyword/Skill	Definition/Tips
Radius	A straight line from the centre of the circle to the <b>circumference</b> of a circle
Diameter	A straight-line passing side to side through the centre of a circle
Circumference	The perimeter of a circle
Tangent	A line that hits the circle at only one point
Perpendicular	At right angles ( $90^\circ$ ) to 
Chord	A straight line joining two points on a circle
Segment	The section of a circle made from a <b>chord</b>
Cyclic Quadrilateral	A quadrilateral with every vertex on a circle's circumference
Arc	A part of a curve, or a part of the <b>circumference</b> of a circle

### Exams!

For some circle theorem questions they will combine different theorems. You will need to identify each theorem and state it in your working out.

You do not get these theorems in the exam so you need to learn them!

### Other Topics/Units this could appear in:

- Core – Trigonometry
- Core – Coordinate Geometry

When calculating with algebraic fractions, you use the same rules for fractions with numbers!

## Multiplying & Dividing Algebraic Fractions

To multiply fractions together, we simply multiply the numerators and then multiply the denominators. This is the same for algebraic fractions:

Example:  $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$

To divide fractions we can use a very simple method: Keep Change Flip (KCF – Not quite KFC)

Example:  $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

**Keep** Keep this one the same

**Change** Change the divide to a multiply

**Flip** Flip the second one upside down (this is called the reciprocal)

## Adding and Subtracting Fractions

To add or subtract fractions we must first make the denominators the same. Once the denominators are the same, we simply add or subtract the numerators (keeping the denominators the same) and simplify (if possible).

Example:  $\frac{a}{b} + \frac{c}{d}$  Here the common denominator would be  $bd$ .  
(as you can multiply the denominators together)

$$\frac{a}{b} + \frac{c}{d} = \frac{ad}{bd} + \frac{bc}{bd} = \frac{ad + bc}{bd}$$

## Simplifying Algebraic Fractions

To simplify a fraction you need to find a common factor of the **numerator** and the **denominator**. This isn't always just a number, with algebraic fractions it can be letters too.

Example: Simplify:  $\frac{45abc}{60a}$  Here 15a is a common factor so I can divide the top and bottom by 15a

$$= \frac{3bc}{4}$$

Example: Simplify:  $\frac{(x+3)(x+6)}{x+3}$  Here (x + 3) is a common factor

$$\frac{x+6}{1} = x+6$$

### Exam!

If there is no obvious common factor, then you should factorise both the numerator and the denominator and then cancel any common factors.

Example: Simplify:  $\frac{x^2+5x+4}{x^2+4x+3}$

Factorise:  $x^2 + 5x + 4 \rightarrow (x+4)(x+1)$  Now (x + 1) is a common factor  
Factorise:  $x^2 + 4x + 3 \rightarrow (x+3)(x+1)$

$$\frac{x+4}{x+3}$$

Keyword/Skill	Definition/Tips
Expression	One or a group of symbols representing a number or a value. Can contain numbers, variables & operations
Identity	An equation that is true no matter what values are chosen
Variable	A symbol for a number we do not know yet
Numerator	How many parts of a whole. The top number/variable in a fraction.
Denominator	How many parts the whole is split into. The bottom number/variable in a fraction.
Common Denominator	When two or more fractions have the same denominator
Simplify Expression	To remove unnecessary terms and numbers
Simplify Fraction	To reduce a fraction to make it as simple as possible
Expand	To multiply out terms to remove the brackets ( ) (Opposite of <b>factorise</b> )
Coefficient	A number used to multiply a variable <div style="text-align: center;"> <span style="color: yellow;">Coefficient</span>     <span style="color: yellow;">Variable</span>  </div>
Factor	An integer that divides the number exactly leaving no remainder
Factorise	Write an expression as a product of its factors. (Opposite of <b>expanding</b> )
Term	A single number or a variable
Highest Common Factor (HCF)	The highest number or variable that divides exactly into two or more numbers or variables
Reciprocal	One of two numbers that multiply to make 1. e.g. the reciprocal of 2 is $\frac{1}{2}$ because $2 \times \frac{1}{2} = 1$

Other Topics/Units this could appear in:

- Core – Algebra & Functions

A function is a mathematical operation that maps one number on to another. It is essentially a set of instructions telling you what calculations to carry out. The number you substitute into the function is the input. The answer is called the output. A function can be written in a few different ways, here are two examples:  $f(x) = 3x + 4$        $f:x \rightarrow 3x + 4$

## Basic Functions

### Substitution:

$$f(x) = 3x + 4$$

When you see **f(2)** this means you substitute the value of 2 into the function.

$$f(2) = (3 \times 2) + 4 = 10$$

### Solving Equations:

$$f(x) = 3x - 4$$

When you see **f(x) = 2** this means the equation = 2 and you must solve it.

$$\begin{aligned} f(x) = 2 \quad 3x - 4 = 2 \\ 3x = 6 \\ x = 2 \end{aligned}$$

## Composite Functions

As said in the keywords, a composite function is a function made up of other functions.

**gf(x)** means put the function of 'f' into 'g'

**fg(x)** means put the function of 'g' into 'f'

**gf(7)** means put the function of 'f' into 'g' and substitute 7 into x.

### Example:

$$f(x) = 3x - 4$$

$$g(x) = 2x$$

$$gf(x) = 2(3x - 4) = 6x - 8$$

$$fg(x) = 3(2x) - 4 = 6x - 4$$

$$fg(5) = 3(2 \times 5) - 4 = 3(10) - 4 = 30 - 4 = 26$$

## Inverse Functions

An inverse function reverses the effect of a function.

The inverse of f(x) is written as **f<sup>-1</sup>(x)**

### Example:

Find the inverse function of:  $f(x) = \frac{3x - 1}{4}$

It can get confusing with all these x's so it is easier to replace f(x) with y

Let f(x) = y

$$y = \frac{3x - 1}{4}$$

Now rearrange to get 'x' on it's own

$$y = \frac{3x - 1}{4}$$

$$4y = 3x - 1$$


$$4y - 1 = 3x$$

$$\frac{4y - 1}{3} = x$$

Now replace y with x and you have your inverse function

$$\frac{4x - 1}{3}$$

$$f^{-1}(x) = \frac{4x - 1}{3}$$

Keyword/Skill	Definition/Tips
Expression	One or a group of symbols representing a number or a value. Can contain numbers, variables & operations
Identity	An equation that is true no matter what values are chosen
Equation	An equation says that two things are equal
Variable	A symbol for a number we do not know yet
Function	A special relationship where each input has a single output. It is often written as "f(x)" where x is the input value. 
Input	The number you feed into an expression or function
Output	The result of an operation, depends on the input
Inverse	The reverse of. Opposite in effect.
Composite Function	A function made of other functions, where the output of one is the input of the other
Set	A collection of things
Range	The set of all output values of a function.
Domain	All the values that go into a function.
Substitute	In algebra it means replacing letters with numbers.

### Exam!

It's easy to make a mistake with composite functions.

With gf(x) try to think that the f is in-between g and (x) so that is the one that goes into the function i.e. put 'f' into 'g'

Other Topics/Units this could appear in:

- Core – Algebra & Functions

Before starting work with algebraic proof, you may find it useful to look back at the **Crossover Unit 19 & 20 – Expanding & Simplifying/Factorising & WA Unit 2a – Expanding & Factorising** knowledge organisers.

## Representing Algebraically

When proving statements algebraically you need to remember some important facts of how to represent certain number algebraically.

**Even Number** –  $2n$                       **Odd Numbers** –  $2n + 1$  or  $2n - 1$                       **Consecutive Numbers** –  $n, n+1, n+2, \dots$

**Multiples of a Number** (Using multiples of 5 as an example) –  $5n, 5(n + 1), 5(3n + 7)$  If you can factor 5 out of an expression, that expression is a multiple of 5,

## Proving Identities

You may be given an equation and need to prove that it is an identity. In this case you need to manipulate the equation so the exact same expression is on either side of the equals sign.

### Example:

Prove  $(n + 1)^2 + (n + 3)^2 - (n + 5)^2 = (n + 3)(n - 5)$

First expand the brackets on the left hand side of the equation.

$$(n + 1)^2 = n^2 + 2n + 1$$

$$(n + 3)^2 = n^2 + 6n + 9$$

$$(n + 5)^2 = n^2 + 10n + 25$$

Then simplify

$$n^2 + 2n + 1 + n^2 + 6n + 9 - (n^2 + 10n + 25)$$

$$= n^2 - 2n - 15$$

Then if you factorise that expression:

$$n^2 - 2n - 15 = (n + 3)(n - 5)$$

Now you have shown that they are the exact same expression:

$$(n + 3)(n - 5) = (n + 3)(n - 5) \quad \text{QED}$$

## Proof Questions

### Example:

Prove that  $(3n + 1)^2 - (3n - 1)^2$  is a multiple of 4, for all positive integers of  $n$ .

Always start by expanding the expression.

$$(3n + 1)^2 = 9n^2 + 6n + 1 \quad (3n - 1)^2 = 9n^2 - 6n + 1$$

Then simplify:

$$9n^2 + 6n + 1 - (9n^2 - 6n + 1) = 12n$$

Whatever multiple it is asking you to prove, factor that number out of the expression. So in this example factor out 4 from the expression

$$12n = 4(3n)$$

Now, no matter what the value of  $n$  is, as you are multiplying it by 4 it will always be a multiple of 4.

### Example:

Prove, using algebra, that the sum of two consecutive numbers is always an odd number.

Algebraically, two consecutive numbers are represented like this:

$$n \text{ and } n + 1$$

Adding them together:

$$n + n + 1 = 2n + 1$$

As  $2n$  is the  $n$ th term for the multiples of 2 (the even numbers),  $2n+1$  is always going to be odd.

Keyword /Skill	Definition/Tips
Expression	One or a group of symbols representing a number or a value. Can contain numbers, variables & operations
Identity	An equation that is true no matter what values are chosen
Equation	An equation says that two things are equal shown by the = sign
Variable	A symbol for a number we do not know yet
Integer	A whole number
Proof/Prove	Logical mathematical arguments to show the truth of a mathematical statement. You must show it is true in all cases.
Expand	To multiply out terms, to remove the brackets () (Opposite of <b>factorise</b> )
Factorise	Write an expression as a product of its factors. (Opposite of <b>expanding</b> )
Counter-Example	An example that disproves a statement.
Consecutive Numbers	Numbers which follow each other in order, without gaps, from smallest to largest.
Multiple	Multiples of 4 is anything in the 4 times table. We can write this algebraically as '4n'. Whatever the value of $n$ is, it will be a multiple of 4.
QED	Literally means 'That which was to be demonstrated'. You can put this at the end of proofs to show it is complete.

## Exam!

**You should always justify your answer.**

If you need to prove an expression is going to be an even number. Show it has a factor of 2 by factoring out 2 from the expression and also explain what you have shown.

Other Topics/Units this could appear in:

- Core – Proof

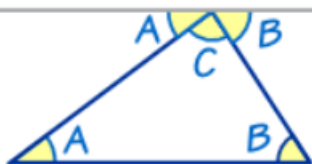
Before starting work with congruency & geometric proof, you may find it useful to look back at the **Crossover Unit 36 – Alternate/Corresponding Angles & Crossover Unit 46 – Congruence & Similar Shapes** knowledge organisers.

## Angles in a Triangle Sum to 180° Proof



$$A + B + C = 180^\circ$$

We can prove that angles in a triangle add up to 180°.



The top line (that touches the top of the triangle) is running parallel to the base of the triangle.

Using **alternate angles on parallel lines** we can say that both angle A's are the same.

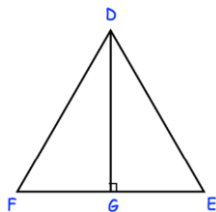
We can also use **alternate angles** to show that angle B's are the same.

Then using **angles on a straight line** we can say that  $A + B + C = 180^\circ$

This proves that angles in a triangle sum to 180°

## Exam Style Question

**DEF is an equilateral triangle.**  
**G lies on EF.**  
**DG is perpendicular to FE.**  
**Prove DFG is congruent to DEG. (3)**



DG is shared by both triangles.

DF = DE as it is an equilateral triangle

Angle DGE = DGF = 90° as DG is perpendicular to FE

Therefore DFG is congruent to DEG using RHS (Right-Angle, Hypotenuse, Side)

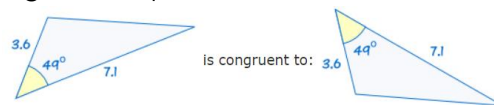
## Proving the Congruence of Triangles

You will need to be able to prove that two triangles are **congruent**. There are four ways you can do this:

**SSS** – Side, Side, Side – We have two triangles where all 3 sides are equal



**SAS** – Side, Angle, Side – We have two triangles where two sides and the included angle are equal.



**ASA** – Angle, Side, Angle – We have two triangles where two angles and the included side are equal



**RHS** - Right-Angle, Hypotenuse, Side – We have two triangles where they both have a right-angle and have the same hypotenuse and a side which is the same.



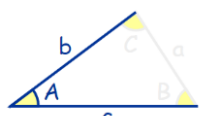
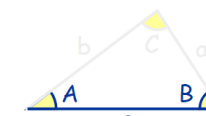
Angle EFD = FED = 60° as it is an equilateral triangle.

**OR**

Side DF = DE as it is an equilateral triangle.

Angle EDG = FDG = 30° as angles in a triangle sum to 180°  
 $(180^\circ - 90^\circ - 60^\circ = 30^\circ)$

So triangle DFG is congruent to DEG using ASA (Angle, Side, Angle)

Keyword/Skill	Definition/Tips
Proof/Prove	Logical mathematical arguments to show the truth of a mathematical statement. You must show it is true in all cases.
QED	Literally means 'That which was to be demonstrated'. You can put this at the end of proofs to show it is complete.
Congruence	Two shapes are congruent if they are exactly the same shape and size.
Similar Shapes	Shapes are similar if they are the same shape but different sizes. The proportion of the matching sides must be the same.
Scale Factor	The ratio of corresponding sides of two similar shapes.
Congruent Triangles Abbreviations	<b>SSS</b> – Side, Side, Side <b>SAS</b> – Side, Angle, Side <b>ASA</b> – Angle, Side, Angle <b>RHS</b> – Right-Angle, Hypotenuse, Side
Included Angle	The angle between two sides. 
Included Side	The side between two angles. 

**You only need one of these explanations. This is just showing that sometimes there will be more than one way to prove two triangles are congruent!**

Other Topics/Units this could appear in:

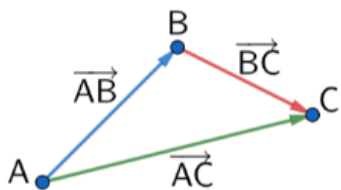
- Core – Proof

Before starting work with vectors, you may find it useful to look back at the **Crossover Unit 15 – Ratio & Crossover Unit 48 – Vectors** knowledge organisers

## Representing Vectors

A vector that goes from point A to point B is denoted as  $\vec{AB}$ . We write a vector depending on where it starts and ends.

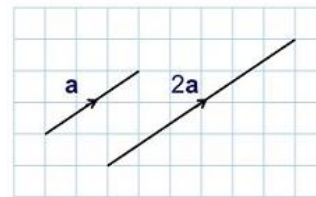
For example, if we add  $\vec{AB}$  to  $\vec{BC}$  the result is a vector that starts at A and ends at C so we write it as  $\vec{AC}$  (it doesn't matter that it goes through B, it matters where it starts and ends)



## Parallel Vectors

Vectors are parallel if they are going in the same direction. They do not need to be the same size, they can be **scalar multiples** of the other.

You can prove two vectors are parallel by showing that one is a multiple of the other.



Here  $\mathbf{a}$  and  $2\mathbf{a}$  are parallel and  $2\mathbf{a}$  is twice the length of  $\mathbf{a}$

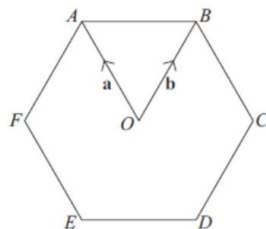
## Solving Geometric Problems

You will have to use vectors to solve geometrical problems.

### Example:

ABCDEF is a regular hexagon with centre O.

$$\vec{OA} = \mathbf{a} \quad \vec{OB} = \mathbf{b}$$



Write the vector  $\vec{AB}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

$\vec{OA} = \mathbf{a}$  so going in the opposite direction will be  $\vec{AO} = -\mathbf{a}$

To get vector  $\vec{AB}$  we can add vectors:

$$\vec{AO} \text{ and } \vec{OB} \rightarrow \vec{AO} + \vec{OB} = -\mathbf{a} + \mathbf{b}$$

Therefore  $\vec{AB} = -\mathbf{a} + \mathbf{b}$

### Exam!

If you need to prove two vectors are parallel then you need to show that one is a multiple of the other.

*Example:* If you have the vectors  $\mathbf{a} + \mathbf{b}$  and  $2\mathbf{a} + 2\mathbf{b}$

For the second vector you can factor out 2 so it leaves you with:

$\mathbf{a} + \mathbf{b}$  and  $2(\mathbf{a} + \mathbf{b})$  this shows one is a multiple of the other which proves they are parallel.

## Solving Geometric Problems with Ratio

Some vector problems will also involve ratio.

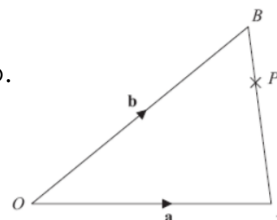
### Example:

OAB is a triangle.  $\vec{OA} = \mathbf{a}$   $\vec{OB} = \mathbf{b}$

a) Find  $\vec{AB}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$

P is the point on AB such that AP : PB = 3 : 1

b) Find  $\vec{OP}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$  (Give your answer in it's simplest form)



For part a we can add the vectors  $\vec{AO}$  and  $\vec{OB}$  together:

$$\vec{AO} = -\mathbf{a} \quad \vec{OB} = \mathbf{b} \quad \vec{AO} + \vec{OB} = -\mathbf{a} + \mathbf{b} \quad \vec{AB} = -\mathbf{a} + \mathbf{b}$$

For part b, we need to find the vector  $\vec{OP}$ . Always think of the path you need to take first (There may be more than one path).

The path we need is  $\vec{OA} + \vec{AP}$

We know  $\vec{OA} = \mathbf{a}$

$\vec{AP}$  is  $\frac{3}{4}$  of the path of  $\vec{AB}$  so we need  $\frac{3}{4}$  of  $-\mathbf{a} + \mathbf{b} = -\frac{3}{4}\mathbf{a} + \frac{3}{4}\mathbf{b}$

$$\text{Then } \vec{OA} + \vec{AP} = \mathbf{a} - \frac{3}{4}\mathbf{a} + \frac{3}{4}\mathbf{b} = \frac{1}{4}\mathbf{a} + \frac{3}{4}\mathbf{b}$$

$$\text{Therefore, } \vec{OP} = \frac{1}{4}\mathbf{a} + \frac{3}{4}\mathbf{b}$$

Keyword/Skill	Definition/Tips
Vector	A quantity having a direction as well as magnitude. Determines the position of one point in space to another. Vectors can be denoted in as column vectors or like this: $2\mathbf{a}$ or $\vec{AB}$
Direction	Where something is pointing. ( Left, right, up, down north south are all directions).
Magnitude	A number that gives the size of something. We represent the magnitude of a vector with $ a $
Scalar	A single number we multiply a vector by. E.g. We can multiply the vector $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ by the scalar 3 and get $\begin{pmatrix} 6 \\ 9 \end{pmatrix}$
Multiple	The result of multiplying a number by an integer.
Parallel	Always the same distance apart and they will never meet.
Collinear	When three or more points lie on a straight line.
Ratio	Shows the relative sizes of two or more values
Column Vector	In a column vector, the top number moves left (-) or right (+) and the bottom number moves up(+) or down(-).

## Magnitude of a Vector

We calculate the magnitude of a vector by using Pythagoras' Theorem:

$$\text{Vector } \mathbf{a} = \begin{pmatrix} x \\ y \end{pmatrix} \quad |a| = \sqrt{x^2 + y^2}$$

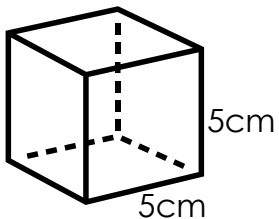
*Example:* What is the magnitude of vector  $\begin{pmatrix} 5 \\ 12 \end{pmatrix}$ ?

$$|a| = \sqrt{5^2 + 12^2} = \sqrt{169} = 13$$

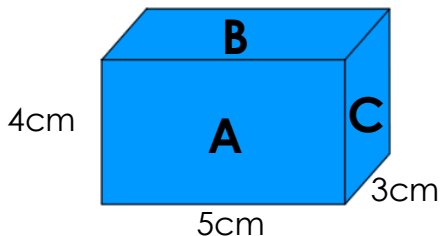
## Other Topics/Units this could appear in:

- Core - Vectors
- Mechanics - Kinematics & Forces and Newton's Law

### Cubes and cuboids



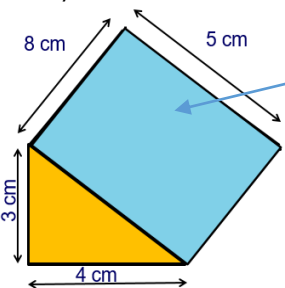
Each face has the same area.  
 Area of one face:  
 $5 \times 5 = 25\text{cm}^2$   
 Total surface area:  
 $25 \times 6 = 150\text{cm}^2$



A cuboid will have 3 pairs of equal faces:  
 $2 \times A = 2 \times (5 \times 4) = 40\text{cm}^2$   
 $2 \times B = 2 \times (5 \times 3) = 30\text{cm}^2$   
 $2 \times C = 2 \times (3 \times 4) = 24\text{cm}^2$   
 Surface Area =  $40 + 30 + 24 = 94\text{cm}^2$

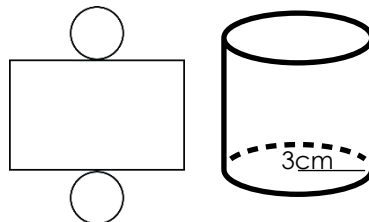
### Triangular Prisms & Cylinders

Make sure you find the area of each face on a prism. They may not be all the same shape!



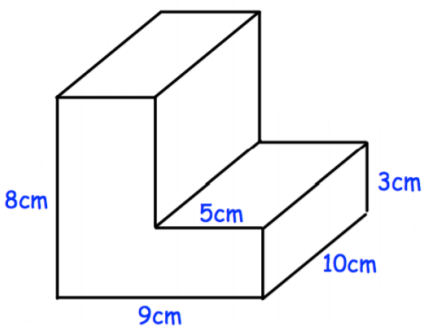
$5 \times 8 = 40\text{cm}^2$   
 $3 \times 8 = 24\text{cm}^2$   
 $4 \times 8 = 32\text{cm}^2$   
 $(3 \times 4) \div 2 = 6\text{cm}^2$   
 $(3 \times 4) \div 2 = 6\text{cm}^2$   
 $40 + 24 + 32 + 6 + 6 = 108\text{cm}^2$

A cylinder's surface is made from two circles and a rectangle, you can see this from the net of a cylinder. The dimensions of the rectangle are the height of the cylinder and the circumference of one of the circles.



Area of the two circles:  
 $2 \times (\pi \times 3^2) = 56.6\text{cm}^2$  (1d.p.)  
 Area of the curved surface:  
 Circumference  $\times$  Height  
 $(2 \times \pi \times 3) \times 10 = 188.5\text{cm}$  (1d.p.)  
 Total:  $56.6 + 188.5 = 245.1\text{cm}^2$

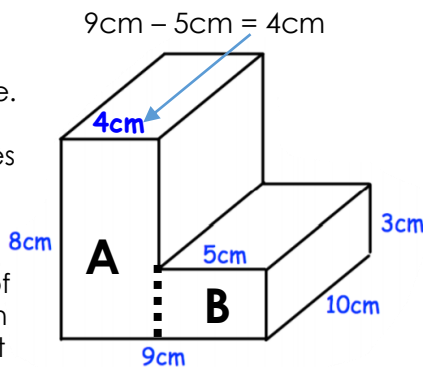
### Compound Shape Prisms



The area of the bottom and the top of the shape will be the same.

The area of the left and right sides of the shape will also be the same.

You then need to split the face of the shape up into shape you can find the area of, in this example it will be two rectangles.



Area of the top and bottom:  
 $2 \times (9 \times 10) = 180\text{cm}^2$   
 Area of the left and right:  
 $2 \times (8 \times 10) = 160\text{cm}^2$   
 Area of rectangle A (front & back):  
 $2 \times (8 \times 4) = 64\text{cm}^2$   
 Area of rectangle B (front & back):  
 $2 \times (5 \times 3) = 30\text{cm}^2$

Total Surface Area:  
 $180\text{cm}^2 + 160\text{cm}^2 + 64\text{cm}^2 + 30\text{cm}^2 = 434\text{cm}^2$

Keyword /Skill	Definition/Tips
Prism	A 3D shape that has two identical ends and flat sides.
Cross Section	A view into the inside of something by cutting through it.
Diameter	The distance from one point of a circle to another passing through the centre. It is twice the radius.
Radius	The distance from the centre of the circle to the circumference. It is half the diameter.
Formula/Formulae	A rule or fact written with mathematical symbols. ( $V = l \times w \times h$ ).
Compound Shape	A compound shape is made up of two or more basic shapes.
Face	A flat surface of any object.
Perimeter	The distance around the outside of a shape.
Area	The space inside a 2D shape.
Surface Area	The total area of the outside of a 3D shape.
Volume	The amount of 3-dimensional space something takes up.

### Other topics/units this may appear in:

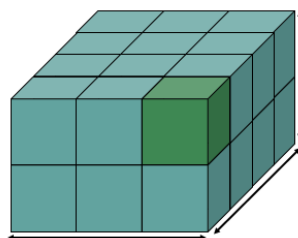
- Perimeter and Area
- 3D forms
- Mensuration

### Volume Using Unit Cubes

This is a unit cube. It has a volume of  $1\text{cm}^3$ . You may get shapes made from unit cubes and you will need to find the volume of that shape by counting how many cubes there are.

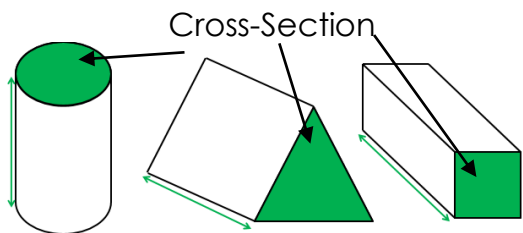


Example:



The volume of this cuboid would be  $24\text{cm}^3$  as there are 24 unit cubes altogether.

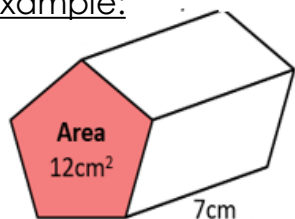
### Volume of Prisms



A prism has a constant cross-section. To find the volume of it you first need to find the area of the cross section and multiply it by the height/depth of the shape.

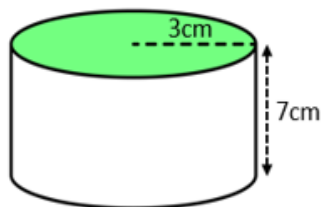
Formula for Volume of Prisms: **Area of Cross-Section x Height**

Example:



You are given the area of the cross-section so you need to multiply the area by the depth:

$$12\text{cm}^2 \times 7 = 84\text{cm}^3$$



$$\begin{aligned} \text{Area of cross-section} &= \pi \times r^2 \\ &= \pi \times 3^2 = 28.27\text{cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Volume} &= \text{Area of Cross-Section} \times \text{Height} \\ &= 28.27 \times 7 = 197.89\text{cm}^3 \end{aligned}$$

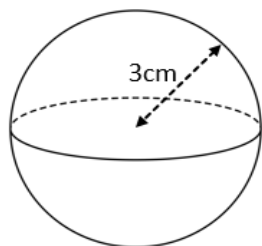
### Volume of Spheres

Formula for volume of a Sphere:  $\frac{4}{3} \times \pi \times r^3$

You are given this formula in the exam, you just need to be able to use it!

Example:

$$\text{Volume} = \frac{4}{3} \times \pi \times 3^3 = 113.1\text{cm}^3 \text{ (1d.p.)}$$



**Exam!**

Make sure you use the correct units with your answer.

Area uses square units and volume uses cubic units.

Examples:

Area units:  $\text{cm}^2$ ,  $\text{m}^2$ ,  $\text{mm}^2$ ,  $\text{km}^2$ , etc.

Volume:  $\text{cm}^3$ ,  $\text{m}^3$ ,  $\text{mm}^3$ ,  $\text{km}^3$ , etc.

Keyword /Skill	Definition/Tips
Prism	A 3D shape that has two identical ends and flat sides.
Cross Section	A view into the inside of something by cutting through it.
Diameter	The distance from one point of a circle to another passing through the centre. It is twice the radius.
Radius	The distance from the centre of the circle to the circumference. It is half the diameter.
Formula/Formulae	A rule or fact written with mathematical symbols. ( $V = l \times w \times h$ ).
Compound Shape	A compound shape is made up of two or more basic shapes.
Face	A flat surface of any object.
Perimeter	The distance around the outside of a shape.
Area	The space inside a 2D shape.
Surface Area	The total area of the outside of a 3D shape.
Volume	The amount of 3-dimensional space something takes up.

Other topics/units this may appear in:

- Perimeter and Area
- 3D forms
- Mensuration



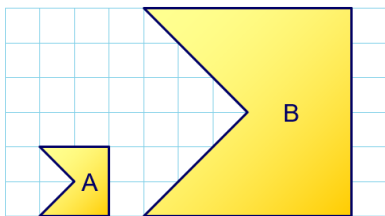
# Crossover Unit 46 – Similarity and Congruence

Before progressing through this section of work, you may find it useful to look back at **Crossover Unit 44 – Constructions** knowledge organiser.

## DON'T FORGET

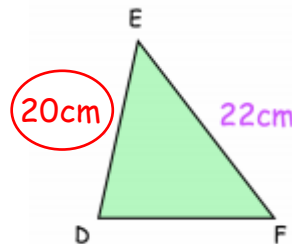
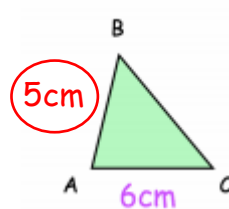
**Enlargements** make the object bigger or smaller.  
**Scale factors** tell us how much bigger or smaller.

An enlarged shape will ALWAYS produce a **similar** pair of shapes.



Shape A has been enlarged by a scale factor of 3 (all sides multiplied by 3) but all the angles will remain the same.

## Finding and Using a Scale Factor



In order to find length DF  
 Write two of the corresponding sides as a ratio =  $AB : DE$

$$5 : 20$$

With a scale factor of 4

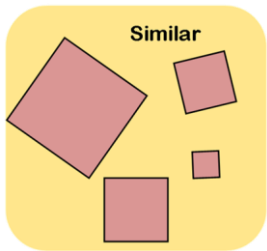
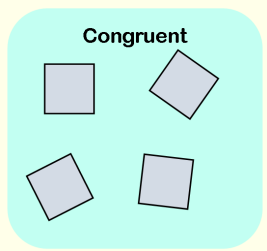
Simplify →

$$1 : 4$$

This is the scale factor

To find DF- look at the corresponding length  $AC = 6\text{cm}$   
 $6 \times 4 = 24\text{cm}$

## Similarity Vs. Congruence



## Rules for Congruent Triangles

If each of the three identified measurements (in the diagrams below) are equal, then the triangles are congruent.

SSS (Side – Side – Side)



3 sides are respectively equal

SAS (Side – Angle – Side)



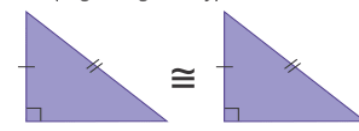
2 sides and the included angle are respectively equal

ASA (Angle – Side – Angle)



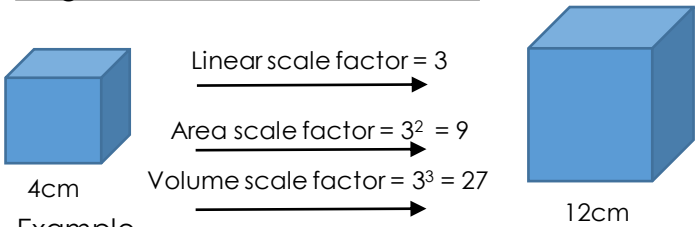
2 angles and the included side are respectively equal

RHS (Right angle – Hypotenuse – Side)




Hypotenuse and one side are respectively equal

## Length, Area & Volume Scale Factor



Example

Volume =  $64\text{cm}^3$  →  $64 \times 27$  → Volume =  $1728\text{cm}^3$

Keyword/Skill	Definition/tip
Similar	Two shapes are <b>similar</b> when one can become the other after a <b>resize</b> , flip, slide or turn.
Congruence	Two shapes are congruent if they are exactly equal in size and shape.
Scale factor	The ratio by which a length or other measurement is increased or decreased.
Ratio	A ratio shows the relative sizes of 2 or more values.
Enlargement	When a shape/length changes size (bigger or smaller) using a scale factor.
Compass	Piece of mathematical equipment 
Construction	Use ruler, pencil, protractor and/or compasses to accurately draw a given shape.

## Other topics/Units this could appear in:

- Transformation
- Construction

## Exam Tips

- To help you start similarity questions you will need to find the scale factor.
- You will gain a mark for recognising and using area and volume scale factor.

## Translations

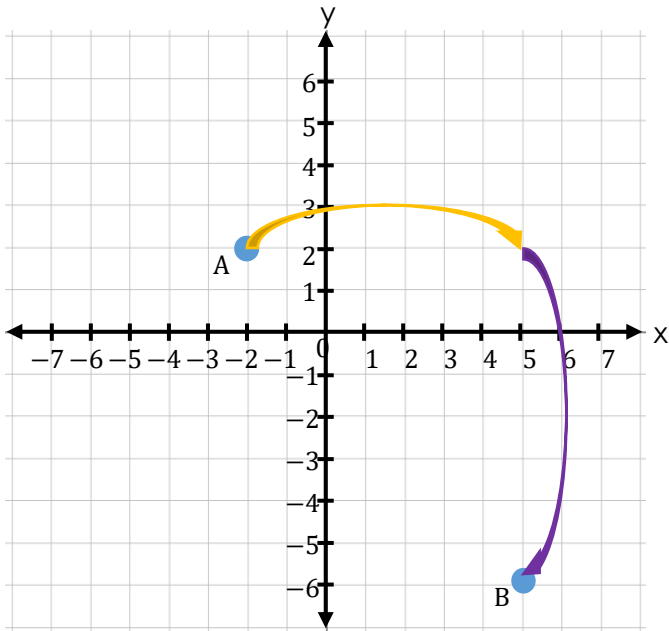
**Translations** are movements in a direction.  
**Column vectors** can be used to describe translations.

7 units in the positive  $x$ -direction

From point A to point B  
the translation is:

$$\begin{pmatrix} 7 \\ -8 \end{pmatrix}$$

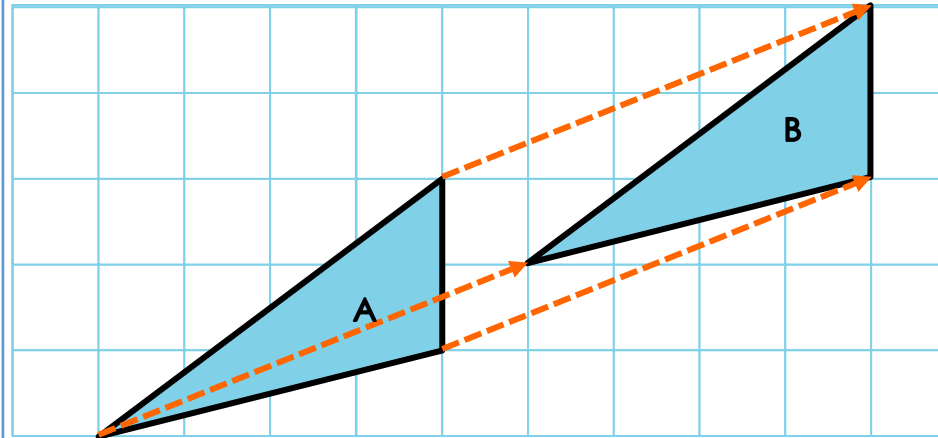
8 units in the negative  $y$ -direction



First count the number of squares moved in the  $x$ -direction and then count the number of squares moved in the  $y$ -direction.

When a whole shape is translated, every vertex (corner) moves by the **same** column vector.

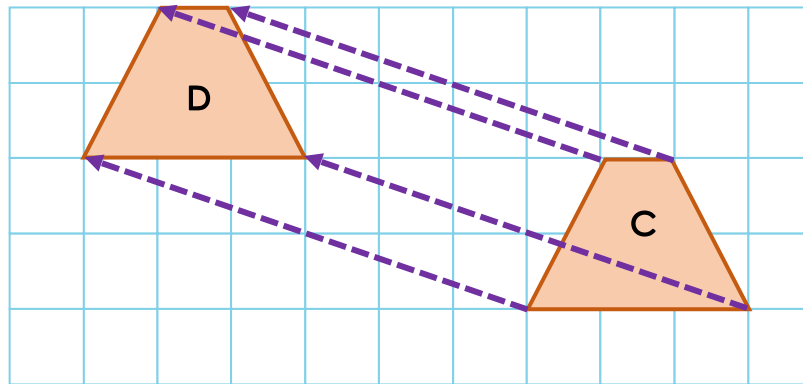
## Translating a shape



The translation from triangle A to triangle B is  $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$

Every vertex (corner) has moved by exactly the same column vector.

## Describing a Translation



When we **describe** this type of transformation, we state that from C to D is:  
A translation with vector  $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$

We must always give both pieces of information to fully describe a translation.

Other Topics/Units this could appear in:  
Crossover Unit 46 - Congruence/Similar Shapes  
Working Above Unit 5 - Transformations  
Working Above Unit 10 - Similarity in 2D & 3D  
Working Above Unit 17 - Functions  
A level Core - Graph Transformations

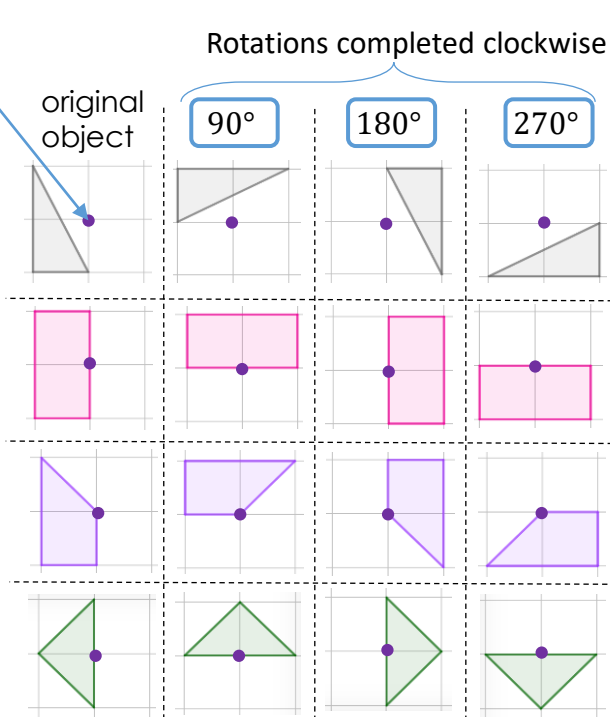
Keyword/Skill	Definition/Tips
Column vector $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$	Used to describe the movement of a translation, eg 4 right, 3 down
Similar	Shapes that are have the same angles, but the side lengths on one have been enlarged by a scale factor.
Congruent	Shapes that are exactly the same, but may be rotated (turned around) or reflected (flipped over).
Invariant point	A point on the original shape which has not been affected by the transformation, so is in the same place on the transformed shape.
Describe	State exactly what <b>single</b> transformation has been performed on a shape.

## Rotations

**Rotations** are turns around a point, which is called the **centre of rotation**.

Each **object** has been **rotated** by  $90^\circ$ ,  $180^\circ$  and  $270^\circ$  **clockwise** about the purple **centre of rotation** to form these **images**.

A rotation of  $90^\circ$  **anti-clockwise** would give the same image as a rotation of  $270^\circ$  clockwise about the same centre.

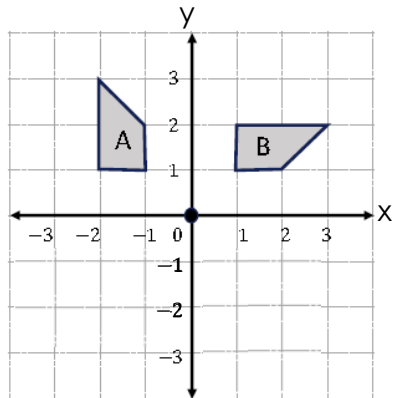


## Describing Rotations

When we **describe** this type of transformation, we state that from A to B is:

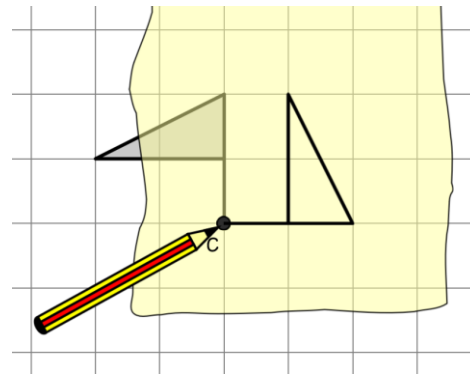
- A rotation
- From centre (0,0)
- By  $90^\circ$  clockwise

We must always give all three pieces of information to fully describe a rotation.



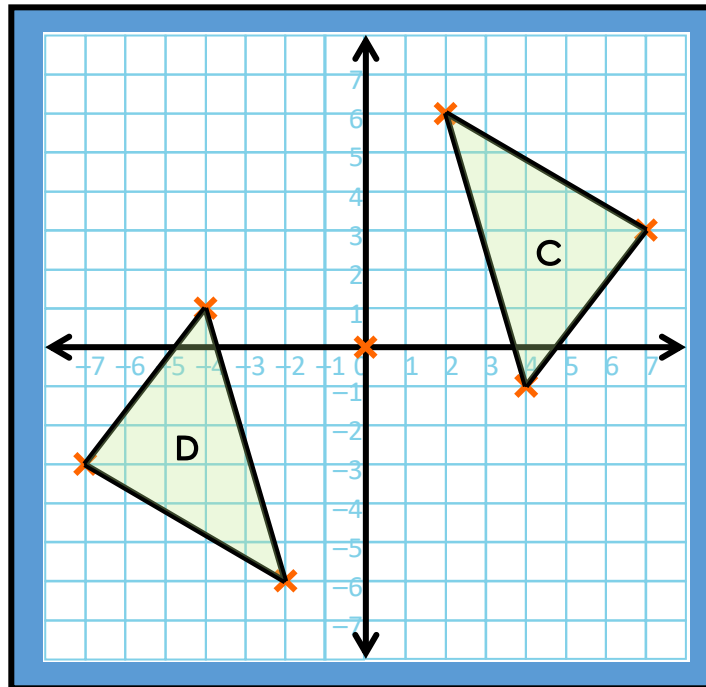
## Equipment for Rotations

We can use tracing paper to help us perform rotations or find the centre of rotation.



## Example

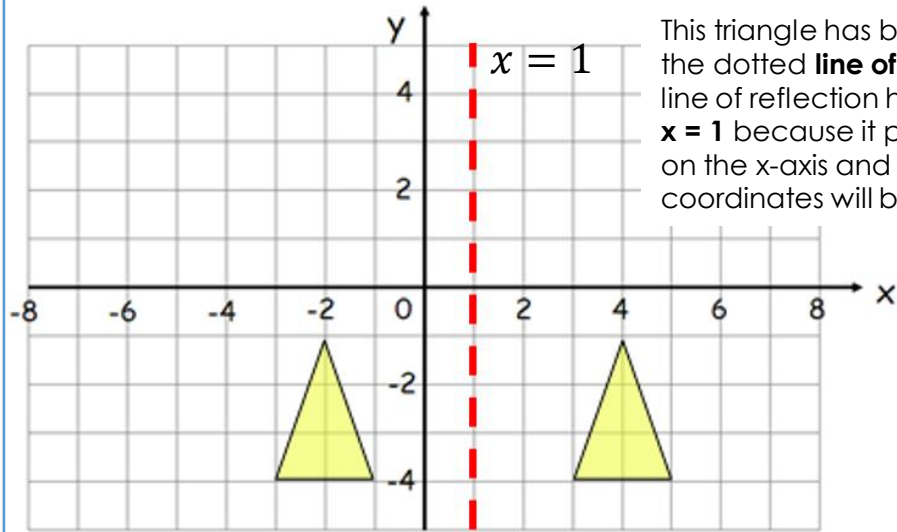
Triangle C has been rotated about the origin (0,0) by  $180^\circ$  to give triangle D. The direction does not matter because  $180^\circ$  is a half turn, and a half turn clockwise has the same effect as a half turn anti-clockwise.



Other Topics/Units this could appear in:  
Crossover Unit 46 - Congruence/Similar Shapes  
Working Above Unit 5 - Transformations

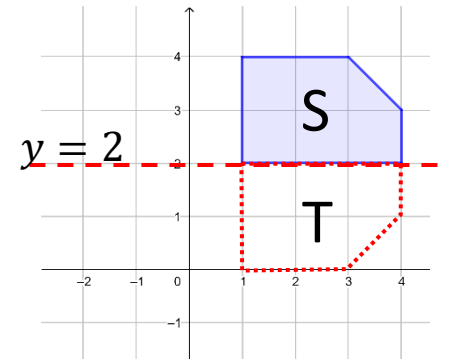
Keyword/Skill	Definition/Tips
Origin	The centre of the axes, where the x-axis and y-axis cross at the point with coordinates (0,0)
Similar	Shapes that are have the same angles, but the side lengths on one have been enlarged by a scale factor.
Congruent	Shapes that are exactly the same, but may be rotated (turned around) or reflected (flipped over).
Centre of rotation	The point from which a rotation has taken place - where you would put your pencil point to keep the tracing paper still when rotating a shape.
Angle	How many degrees ( $90^\circ$ , $180^\circ$ for rotations.
Direction	Clockwise or anti-clockwise turn around the centre of rotation.
Invariant point	A point on the original shape which has not been affected by the transformation, so is in the same place on the transformed shape.
Describe	State exactly what <u>single</u> transformation has been performed on a shape.

**Reflections** flip an object, but its size and shape remain the same. The mirror line is called the **line of reflection**.



This triangle has been **reflected** in the dotted **line of reflection**. The line of reflection has the equation  $x = 1$  because it passes through 1 on the x-axis and all its x-coordinates will be 1.

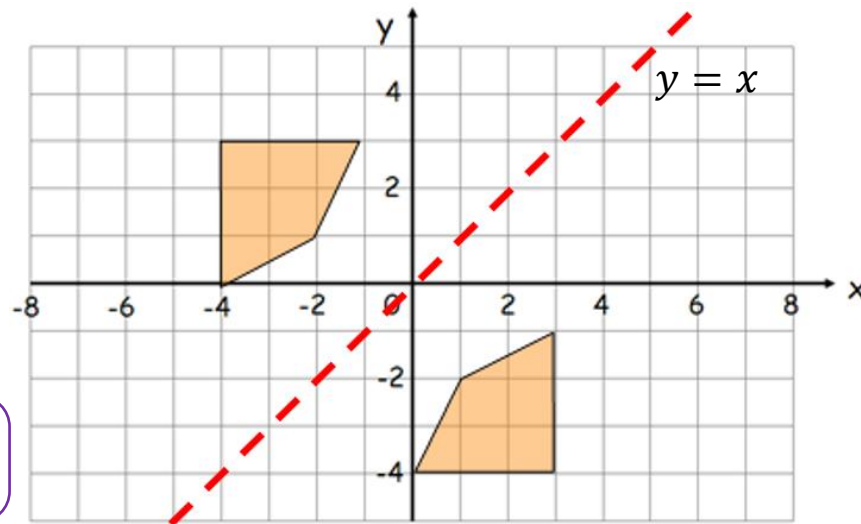
## Reflections



This shape has been **reflected** in the dotted **line of reflection**. The line of reflection has the equation  $y = 2$  because it passes through 2 on the y-axis and all its y-coordinates will be 2.

## Diagonal lines of reflection

This shape has been **reflected** in the dotted **line of reflection**. The line of reflection has the equation  $y = x$  because it passes through the origin and all its pairs of coordinates will have matching x and y values, such as (1,1), (2,2), (-4,-4)...



There are two diagonal lines you need to know. They are:  
 $y = x$  (shown on the diagram)  
 and  $y = -x$  (slopes the opposite direction)

Other Topics/Units this could appear in:  
 Crossover Unit 46 - Congruence/Similar Shapes  
 Working Above Unit 5 - Transformations

Keyword/Skill	Definition/Tips
Similar	Shapes that are have the same angles, but the side lengths on one have been enlarged by a scale factor.
Congruent	Shapes that are exactly the same, but may be rotated (turned around) or reflected (flipped over).
Invariant point	A point on the original shape which has not been affected by the transformation, so is in the same place on the transformed shape.
Equidistant	Two points are the same distance away from the line of reflection.
Mirror line/line of reflection	The line that is equidistant from both the original shape and its reflection.
Describe	State exactly what <b>single</b> transformation has been performed on a shape.

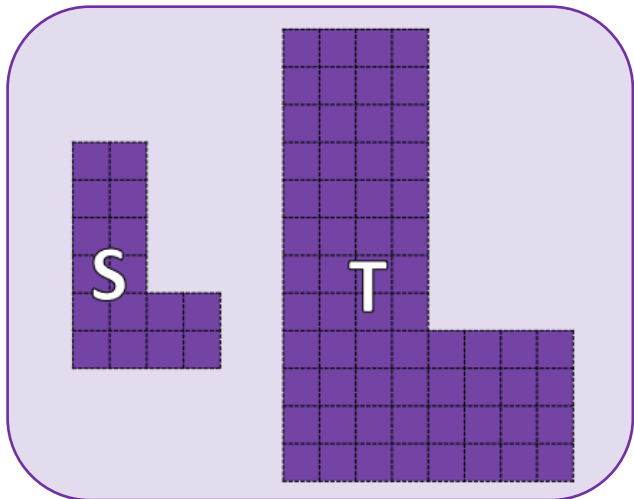
## Enlargements

**Enlargements** make the object bigger or smaller.  
**Scale factors** tell us how much bigger or smaller.

S is an enlargement of T  
 by scale factor  $\frac{1}{2}$

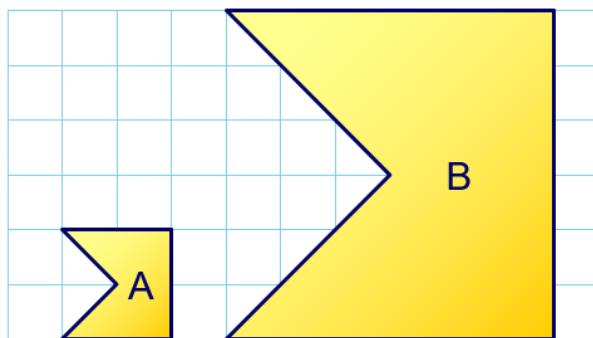
T is an enlargement of S  
 by scale factor 2

Each side of the shape gets multiplied by the scale factor to make it longer or shorter.



## Example

A is an enlargement of B  
 by scale factor  $\frac{1}{3}$

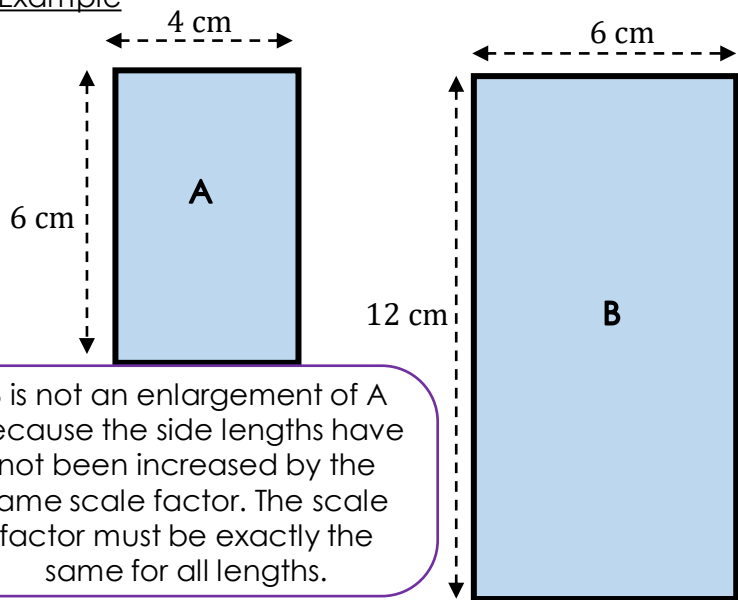


B is an enlargement of A  
 by scale factor 3

Other Topics/Units this could appear in:  
 Crossover Unit 46 - Congruence/Similar Shapes  
 Working Above Unit 5 - Transformations

Keyword/Skill	Definition/Tips
Scale factor	The multiplier used to change the side lengths of a shape being enlarged. If it is less than 1, the shape will get smaller.
Centre of enlargement	The point from which all distances have been enlarged. The distances from this centre to each vertex on the shape are multiplied by the scale factor to enlarge them.
Origin	The centre of the axes, where the x-axis and y-axis cross at the point with coordinates (0,0)
Similar	Shapes that are have the same angles, but the side lengths on one have been enlarged by a scale factor.
Invariant point	A point on the original shape which has not been affected by the transformation, so is in the same place on the transformed shape.
Describe	State exactly what <b>single</b> transformation has been performed on a shape.

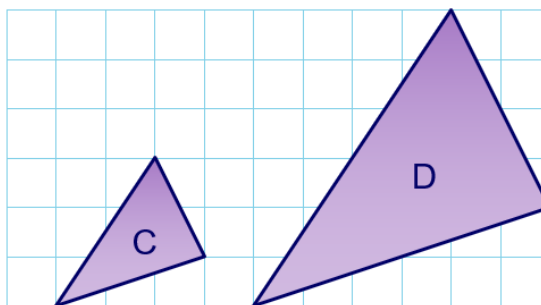
## Non-Example



B is not an enlargement of A because the side lengths have not been increased by the same scale factor. The scale factor must be exactly the same for all lengths.

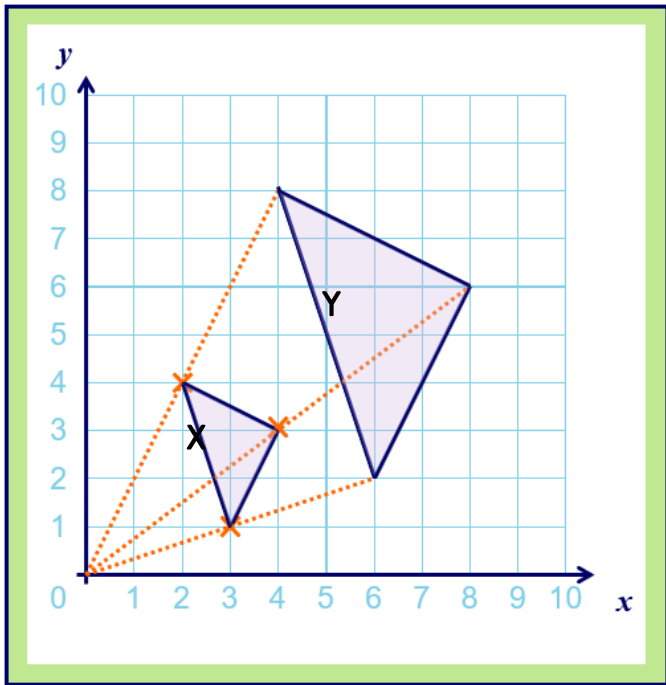
## Example

C is an enlargement of D  
 by scale factor  $\frac{1}{2}$



Even when the scale factor makes a shape smaller, the transformation is still called an enlargement.

D is an enlargement of C  
 by scale factor 2



When a centre of enlargement is given, you need to measure the distance from this point to each vertex of your shape.

This distance then gets multiplied by the scale factor as well.

Y is an enlargement of X by scale factor 2, from centre (0,0)

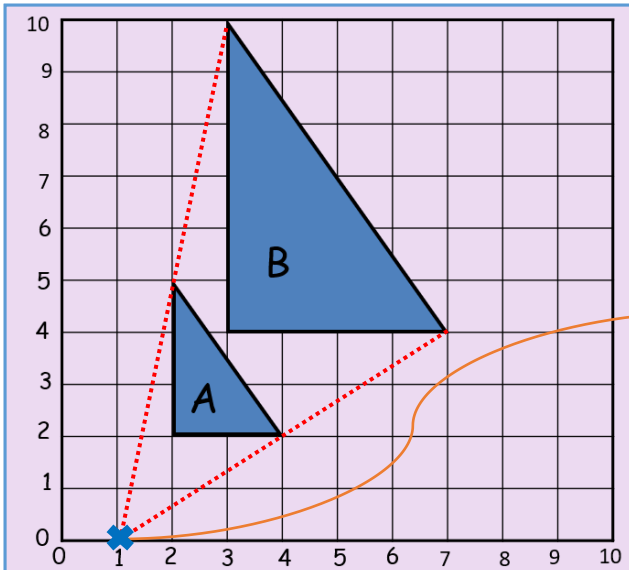
The vertex (3,1) on shape X is 3 right, 2 up from the centre of enlargement at (0,0).

This distance has been multiplied by the scale factor 2 to give the vertex (6,2) on shape Y.

### Enlargements from a centre

Other Topics/Units this could appear in:  
Crossover Unit 46 - Congruence/Similar Shapes  
Working Above Unit 5 - Transformations

Keyword/Skill	Definition/Tips
Scale factor	The multiplier used to change the side lengths of a shape being enlarged. If it is less than 1, the shape will get smaller.
Centre of enlargement	The point from which all distances have been enlarged. The distances from this centre to each vertex on the shape are multiplied by the scale factor to enlarge them.
Origin	The centre of the axes, where the x-axis and y-axis cross at the point with coordinates (0,0)
Similar	Shapes that are have the same angles, but the side lengths on one have been enlarged by a scale factor.
Invariant point	A point on the original shape which has not been affected by the transformation, so is in the same place on the transformed shape.
Describe	State exactly what <b>single</b> transformation has been performed on a shape.



To find the centre of enlargement, draw lines joining each vertex of the enlargement to the same vertex on the original shape and extend to the edge of the grid.

The point where they cross is the centre of enlargement.

### Describing an enlargement

When we **describe** this type of transformation, we state that from A to B is:

- An enlargement
- By scale factor 2
- From centre (1,0)

We must always give all three pieces of information to fully describe an enlargement.

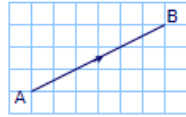
# Crossover Unit 48 – Vectors

Vectors have a quantity that has size or magnitude and direction. E.G Velocity, force.

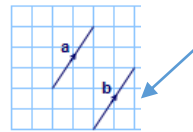
A scalar only has size or magnitude E.G length, mass.

A vector can be represented using a line segment with an arrow on it.

The **magnitude** of the vector is given by the length of the line. The **direction** of the vector is given by an arrow on the line.

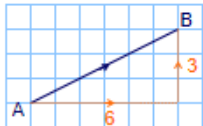


These vectors are equal as they have the same length and are parallel

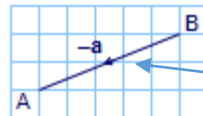


## Representing Vectors

The vector goes from point a to point b. So we can write this as  $\vec{AB}$ . We have moved 6 units right and 3 units up so we can write this as a column vector.



this is the vector  $-a$ .



$$\vec{AB} = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$$

This is the horizontal component. It tells us the number of units in the x-direction.

This is the vertical component. It tells us the number of units in the y-direction.

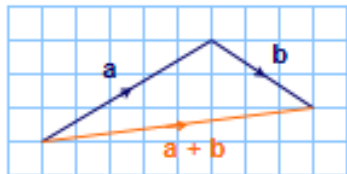
A negative vector is the same length, but the arrow is in the opposite direction

## Adding Vectors

When two or more vectors are added the result is called the resultant vector.

Example. Find  $a + b$   
Add the horizontal components and add the vertical components.

$$a = \begin{pmatrix} 5 \\ 3 \end{pmatrix} \quad \text{and} \quad b = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$$



$$a + b = \begin{pmatrix} 8 \\ 1 \end{pmatrix}$$

This can be shown on a diagram.

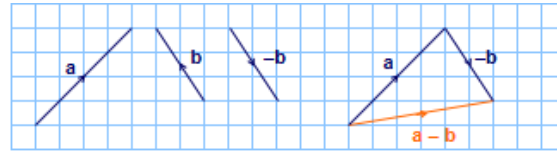
## Subtracting Vectors

Example: Find  $a - b$ .  
Subtract the horizontal components and subtract the vertical components

$$a = \begin{pmatrix} 4 \\ 4 \end{pmatrix} \quad \text{and} \quad b = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$$

To show in a diagram, think  $a - b$  as  $a + (-b)$

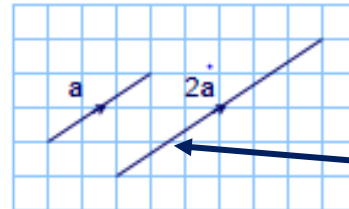
$$a - b = \begin{pmatrix} 4 \\ 4 \end{pmatrix} - \begin{pmatrix} -2 \\ 3 \end{pmatrix} = \begin{pmatrix} 4 - (-2) \\ 4 - 3 \end{pmatrix} = \begin{pmatrix} 6 \\ 1 \end{pmatrix}$$



$$a - b = \begin{pmatrix} 6 \\ 1 \end{pmatrix}$$

## Multiplying Vectors by scalars.

A scalar quantity has size but not direction. A scalar can be written as a single number. A vector can be multiplied by a scalar.



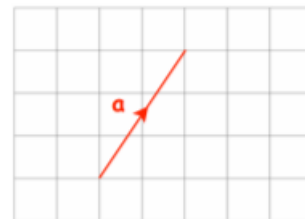
$$a = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

The vector  $2a$  is twice as long as  $a$ , so  $2a$

$$2a = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$$

## Exam Type Question

Mark has been asked to draw the vector  $a = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$



**What mistake has Mark made?**

Mark has mixed up the directions of the vector

Mark has drawn 2 right and 3 up, rather than 3 right and 2 up.

Keyword/Skill	Definition/Tips
Vector	A quantity that has both size and magnitude. (E.G. velocity, force)
Velocity	How fast something is moving but with a direction.
Magnitude	A number that gives the size of something. (E.G. the magnitude of 6 is 6).
Direction.	Where something is pointing. ( left, right, up, down north south are all directions).
Scalar	A single number used with vectors. (E.G. vector (5,2) can be multiplied by scalar 3 to give (15,6).
Horizontal	Going from side to side like the horizon.
Vertical	Goes up and down
Parallel	Always the same distance apart, never touching.
Parallelogram	A 4-sided shape where opposite sides are equal. Angles A are the same, angles B are the same. $A + B = 180$
Column Vectors	Components are written down vertically. $\vec{AB} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ The top number is the x axis The bottom number is the y axis
Components	Each part of the vector is a component

Other Topics/Units this could appear in:

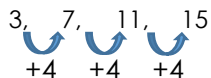
- Pythagoras
- Transformations

## Term to Term Rule

2, 6, 10, 14... This sequence follows the rule "add 4"  
 81, 27, 9, 3... This sequence follows the rule "divide by 3"  
 5, 8, 14, 23... This sequence follows the rule "add 3, add 6, add 9..."

You may be given the starting number then the rule.

Example Start at 3 add 4 each time



## Position to Term Rule (Using the nth Term)

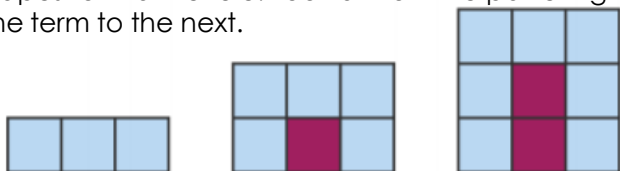
The nth term can be used to find any term in a sequence. To use the nth term you substitute in the value of the position you need.

### Example

If the nth term is  $3n - 5$  and you need to find the 10<sup>th</sup> term:  
 Substitute  $n = 10$  into the nth term  
 $(3 \times 10) - 5 = 25$   
 10<sup>th</sup> Term = 25

## Recognising Patterns from Diagrams

A number pattern in a diagram often requires counting shapes to find the rule. Look at how the pattern grows from one term to the next.



Pattern 1

Pattern 2

Pattern 3

0 purple  
3 blue  
3 in total

1 purple  
5 blue  
6 in total

2 purple  
7 blue  
9 in total

You can now predict that in pattern 4 there will be:  
3 purple, 9 blue and 12 in total

## Finding the nth term

To find the nth term of a sequence, you first start by finding the difference of each term.

$$7, 12, 17, 22, 27, 32, 37, \dots$$

$$+5 \ +5 \ +5 \ +5 \ +5 \ +5$$

The difference between each term is 5. That means the sequence has something to do with the 5 times table, we can call this  $5n$

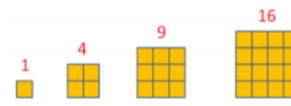
Then see what you need to do from the 5 times table to get to the number in the sequence

<b>n(position)</b>	1	2	3	4	5
	$\times 5$	$\times 5$	$\times 5$	$\times 5$	$\times 5$
<b>5n</b>	5	10	15	20	25
	$+2$	$+2$	$+2$	$+2$	$+2$
<b>5n + 2</b>	7	12	17	22	27

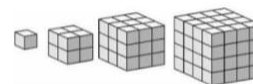
Therefore, the nth term of the sequence =  $5n + 2$

## Special Sequences

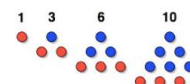
Square numbers – 1, 4, 9, 16, 25, 36, ...





Cube Numbers – 1, 8, 27, 64, 125, 216, ...



Triangle Numbers – 1, 3, 6, 10, 15, 21, 28, ...



A Fibonacci Sequence – 1, 1, 2, 3, 5, 8, 13, 21, ...

Keyword/Skill	Definition/Tips
Sequence	An ordered list of numbers or objects arranged according to a rule
Term	One of the numbers/objects in a sequence
Arithmetic/Linear Sequence	A <b>sequence</b> made by adding or subtracting the same value
Geometric Sequence	A <b>sequence</b> made by multiplying by the same value each time.
Term to term rule	A rule that allows you to find the next <b>term</b> in a sequence if you know the previous term
nth term	The rule for finding any value in the sequence. Also called the Position to Term rule
Triangular Number	A number that can make a triangle pattern. E.g. 
Fibonacci Sequences	A sequence where the next number is found by adding up the previous two terms
Function	A special relationship where each input has a single output
Coefficient	A number used to multiply a variable 

## Other topics/units this could appear in:

- Rearranging Equations
- Quadratic Sequences
- A Level Topics

## Exam!

All sequences are not linear. If a sequence is going up by a different number each time, it can still be a sequence, it means it's just not linear.



Before starting work with forming and solving equations, you may find it useful to look back at the **Crossover Unit 21 – Solving Equations** knowledge organiser.

## Solving Linear Equations

A good example of this is the simple equation  $3y = 12$ .

If we want to find out the value of  $y$  we need to divide both sides of the equation by 3. Dividing both sides gives  $y = 4$ .

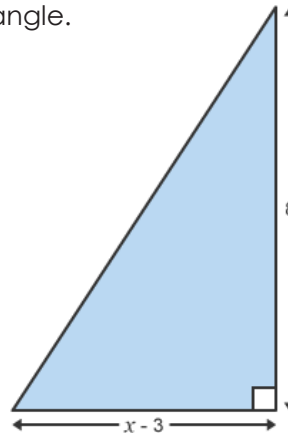
$$\begin{array}{r} 3y = 12 \\ \div 3 \quad \div 3 \\ y = 4 \end{array}$$



## Forming and Simplifying Equations - Area

### EXAMPLE

Write a simplified expression for the area of the following triangle.



As this question is asking for an expression for the area we need to recall how to calculate the area of a triangle.

$$\text{Area of a triangle} = \frac{\text{base} \times \text{height}}{2}$$

Substituting in our base and height into the equation:

$$\text{Area of a triangle} = \frac{(x-3) \times 8}{2}$$

Expanding the brackets:

$$\text{Area of a triangle} = \frac{8x - 24}{2}$$

Simplifying:

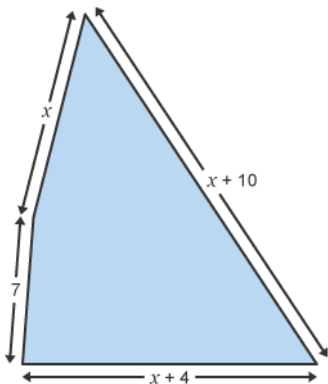
$$\text{Area of a triangle} = 4x - 12$$

## Forming and Simplifying Equations - Perimeter

Usually, when we are asked to form an equation, it is based on some knowledge of area, perimeter or angles.

### EXAMPLE

Write and simplify an expression for the perimeter of the shape below.



### SOLUTION

To calculate perimeter, you simply add up all the sides. This will give the result:

$$x + 7 + x + 10 + x + 4$$

We can then simplify this expression to give:

$$3x + 21$$

Other questions may then involve being given a value for the perimeter and having to solve for.

### EXAMPLE

The perimeter for the above shape is measured to be 33 cm. Calculate the value of  $x$ .

### SOLUTION

Start by setting our expression equal to 33

$$3x + 21 = 33$$

$$\begin{array}{r} -21 \quad -21 \\ 3x = 12 \end{array}$$

Subtract 21 from both sides:

$$3x = 12$$

Divide both sides of the equation by 3:

$$\begin{array}{r} \div 3 \quad \div 3 \\ x = 4\text{cm} \end{array}$$

Keyword /Skill	Definition/Tips
Form	The way in which something is written. Combine parts to create an expression/equation.
Solve	To solve something is to find the solution.
Linear	A linear function traces a straight line.
Quadratic	An equation that has an $x^2$ as the highest power.
Rearrange	To change the subject or move the subject.
Expression	An expression is a sentence with at least two numbers and one mathematical operation.
Equation	A mathematical statement including an equals sign to show that two expressions are the same.
Integer	A positive or negative number or zero. Not a fraction or a decimal.
Proof	To show a mathematical statement to be true.

### Other Topics/Units this could appear in:

- Algebra
- Expand & Simplify
- Factorising
- Solving Equations
- Subject of
- Expanding & Factorising
- Rearranging Equations
- Mechanics

# Crossover Unit 51- Simultaneous Equations.

In order to be able to solve simultaneous equations you will need to be able to **solve linear equations** (see units 2a, 21,22 and 50 for recap)

You also need to be able to use **substitution**. (Unit 2b)

### Elimination Method

#### Example 1

Solve the equation:  $6x + y = 15$  and  $4x + y = 11$

It is useful to label the equations to help with method.

$$6x + y = 15 \quad (1)$$

$$4x + y = 11 \quad (2)$$

The y-term in both equations has the same coefficient. (No need to balance them)

$$6x + y = 15 \quad (1)$$

$$4x + y = 11 \quad (2)$$

Equation (1) minus equation (2)

$$\underline{2x = 4}$$

$$x = 2$$

÷ 2

**Substitute**  $x = 2$  into one of the original equations. (Usually the one with the smaller numbers)

So substitute  $x = 2$  into:  $4x + y = 11$

$$8 + y = 11$$

$$y = 3$$

Solve

You can then test the solutions by substituting values found back into the original equations

#### Example 2

$$5x + y = 22 \quad (1)$$

$$2x - y = 6 \quad (2)$$

Both equations have the same y-coefficient but with **DIFFERENT SIGNS**

As the signs are different you **ADD** the two equations to eliminate the y-terms. [Equation (1) + equation (2)]

$$5x + y = 22 \quad (1)$$

$$2x - y = 6 \quad (2)$$

Add

$$\underline{7x = 28}$$

$$x = 4$$

÷ 7

**Substitute**  $x = 4$  into one of the original equations,  $5x + y = 22$  which gives  $20 + y = 22$

$$y = 2$$

Solve

Sometimes you will have to change both equations to get identical terms.

#### Example 3

Solve these equations:

$$4x + 3y = 27 \quad (1)$$

$$5x - 2y = 5 \quad (2)$$

Both equations have to be changed to get identical terms in either x or y.

Equation (1) x 2

Equation (2) x 3

Here it will be best to make the y-coefficients the same so that we can add the equations. (Easier than subtracting)

$$8x + 6y = 54 \quad (3)$$

$$15x - 6y = 10 \quad (4)$$

Label new equations (3) and (4)

Eliminate by adding (3) + (4)

$$23x = 69$$

$$x = 3$$

÷ 23

**Substitute** into equation (1)=

$$12 + 3y = 27$$

$$3y = 15$$

$$y = 5$$

Solve

#### Example 4- Apply to solve problems

Three chews and four bubbles cost 72p. Five chews and two bubbles cost 64p. What would three chews and five bubbles cost?

You need to set up two simultaneous equations in c and b and then solve them.

$$3c + 4b = 72$$

$$5c + 2b = 64$$

Solve the simultaneous equations as in example 1

$$c = 8$$

$$b = 12$$

Use these answers to calculate 3 chews =  $3 \times 8 = 24p$

5 bubbles =  $5 \times 12 = 60p$

Keyword/Skill	Definition/tip
Simultaneous Equation	A pair of equations with two unknown variables. Both equations need to be solved at the same time (simultaneously)
Eliminate	To remove a variable in order to help solve the equation.
Substitution	When a letter in an equation, expression or formula is replaced by a number, we have substituted the number for the letter.
Variable	A symbol for a number that we don't know yet. Often this is a letter such as x or y.
Coefficient	The number in front of an unknown quantity (the letter) in an algebraic term.

### Other topics/Units this could appear in:

- Working above
- Unit 7 – Simultaneous equations
- A-level
- Core – algebra and functions
- Statistics- statistical distributions

### Exam Tips

- You will gain 1 mark by correctly starting a process to eliminate a coefficient.

# Crossover Unit 51 – Simultaneous Equations - Solving Graphically

To be able to solve simultaneous equations graphically, you may be asked to draw the line of given equations. In order to do this you may need to look back at **Crossover Unit 29- Straight Line Graphs knowledge organiser**.

## Example

Solve the following simultaneous equations graphically

$$y = 2x + 1$$

$$y = y = 3$$

**Step 1-** Draw the line  $y = 2x + 1$

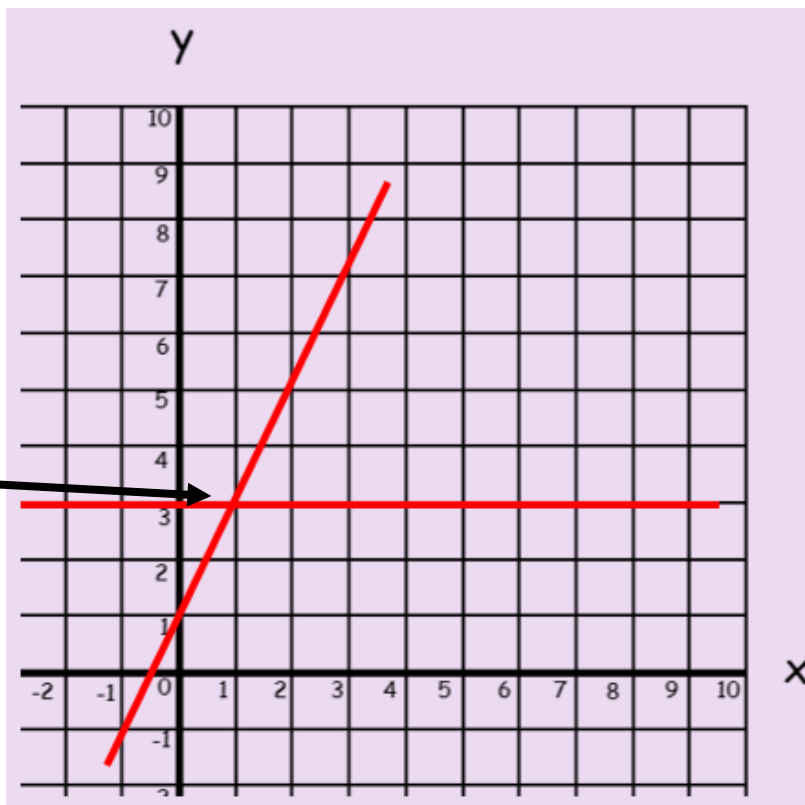
**Step 2-** Draw the line  $y = 3$

**Step 3 -** Your solution is the coordinates where the lines cross

Coordinates = (1, 3)

$$x = 1$$

$$y = 3$$



Keyword/Skill	Definition/tip
Simultaneous Equation	A pair of equations with two unknown variables. Both equations need to be solved at the same time (simultaneously)
Eliminate	To remove a variable in order to help solve the equation.
Substitution	When a letter in an equation, expression or formula is replaced by a number, we have substituted the number for the letter.
Variable	A symbol for a number that we don't know yet. Often this is a letter such as x or y.
Coefficient	The number in front of an unknown quantity (the letter) in an algebraic term.

Other topics/Units this could appear in:

- Working above
- Unit 7 – Simultaneous equations
- A-level
- Core – algebra and functions
- Statistics- statistical distributions

Further questions relating to this topic may include solving simultaneous equations graphically when **one equation is linear and the other is quadratic**. As with the example above, you would draw the graph of the equations and look for where your straight line crosses two parts of the quadratic curve.

### Exam Tips

- If you need to draw your own straight line graph you will gain marks for that
- If the graph has been drawn for you LOOK at where the lines cross.

# Crossover Unit 52 – Direct and Inverse Proportion.

**Direct Proportion** means as one quantity increases or decreases, so does the other one. Example: The more hours you work, the more you will earn.

A is directly proportional to B is written as:

$$A \propto B$$

$$A = k \times B$$

$$A = kB$$

“k” is the constant of proportionality that links our two numbers. We need to put it into our formula.

### Example 1

It takes 3 hours to fill 12 boxes with food. How long does it take to fill 5 boxes?

Step 1: Write an equation of proportionality.  $A = kB$

Step 2: Substitute A and B to find k.  $12 = k \times 3$   
 $4 = k$

Step 3: Rewrite the equation using k and substitute A and B.  $A = 4B$   
 $A = 4 \times 5$   
 $A = 20$

### Example 2

a is directly proportional to b.  
a = 27 when b = 9 Find the value of a when b = 5

a = kb  
27 = k x 9  
3 = k

Find the value of k first using the steps above.

a = 3 x b  
a = 3 x 5  
a = 15

Rewrite and substitute the value of k into the equation.

**Inverse Proportion** means as one quantity increases, the other decreases.

Example: If one quantity doubles the other is halved. If it takes 4 people 5 hours to dig a hole, it would take 8 people 2.5 hours.

### Example 1

2 cows eat a tonne of food in 6 days. How long would it take 3 cows to eat a tonne of food?

Step 1: Write an equation  $y = \frac{k}{x}$

Step 2: Substitute x and y to find k  $6 = \frac{k}{2}$  ← cows

$k = 12$

Step 3: Rewrite the equation using k and substitute x to find y

$$y = \frac{12}{x}$$

$$y = \frac{12}{3} \quad \mathbf{y = 4 \text{ days}}$$

### Example 2

y is inversely proportional to x  
y = 6 when x = 5. Find the value of y when x = 10

$y = \frac{k}{x}$   
 $6 = \frac{k}{5}$   
 $30 = k$

Use the same steps as above

x	1	2	4	8	16	32
y	32	16	8	4	2	1

1 job takes 32 hours to complete. We can show the inverse relationship on a graph

REWRITE & SUBSTITUTE

$$y = \frac{30}{x}$$

$$y = \frac{30}{10} = 3$$

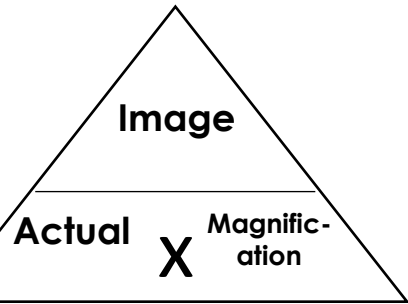
Keyword/Skill	Definition/Tips
Ratio	Shows the relative sizes of two or more values. E.G. 1 boy and 3 girls would be written as 1:3
Inverse	The opposite or the reverse E.g. the inverse of addition is subtraction.
Proportion	Two ratios or fractions that are equal.
Direct Proportion.	Two quantities change in the same way. When one increases or decrease, so does the other one.
Variable	A symbol for a number we don't know yet, often a letter x or y.
Equation	Says that two things are the equal. (1+1=2).
Linear	A graph that has a straight line.
Substitute	Putting values where the letters are.
Constant of Proportionality	A constant value, written as k, relating to amounts that rise or fall uniformly together.

Other topics/units this may appear in:

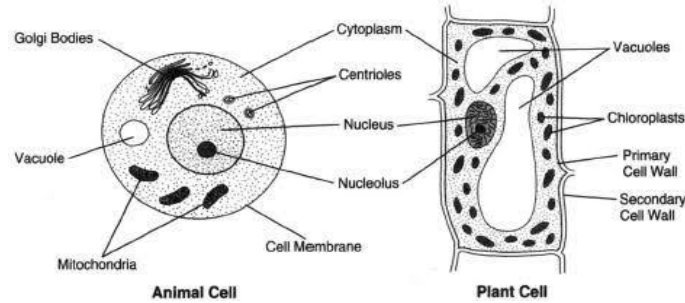
- Best Value
- Exchange Rates
- Proportion Recipes
- Straight Line Graphs

# Biology Knowledge Organisers

## 1. Magnification



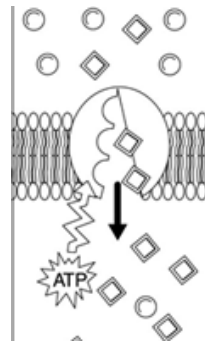
## 2. Plant and animal cells : compare and contrast



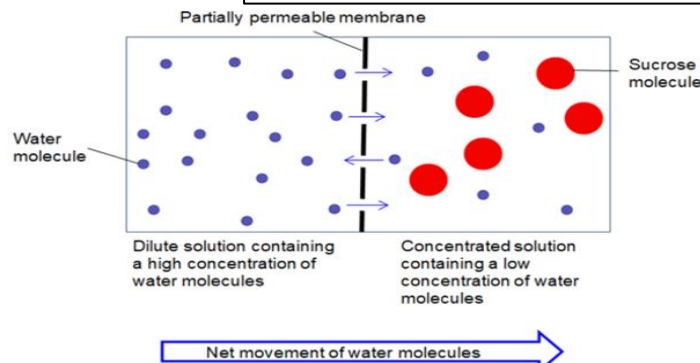
## 3. Enzymes and food tests

Name of large biological molecule	Name of enzyme that digests it	Digested molecule	Food test	Positive result
Carbohydrates – Starch 	Carbohydrase	Glucose 	Starch – Iodine solution Glucose – Benedict's solution	Blue/black colour Green, yellow, orange, brick red colour
Proteins 	Protease	Amino acids 	Biuret reagent	Violet colour
Lipids 	Lipase	Glycerol and three fatty acids 	N/A	N/A

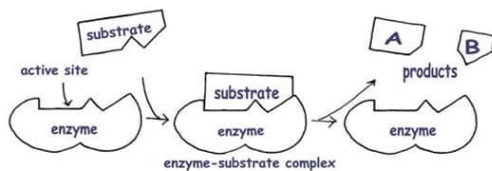
## 6. Active transport



## 5. Osmosis

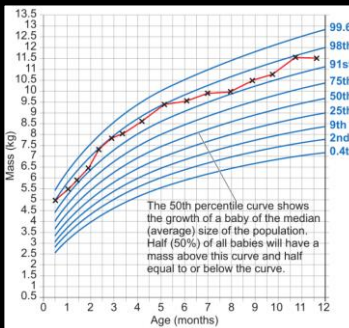
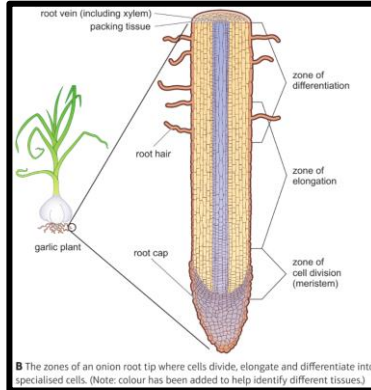
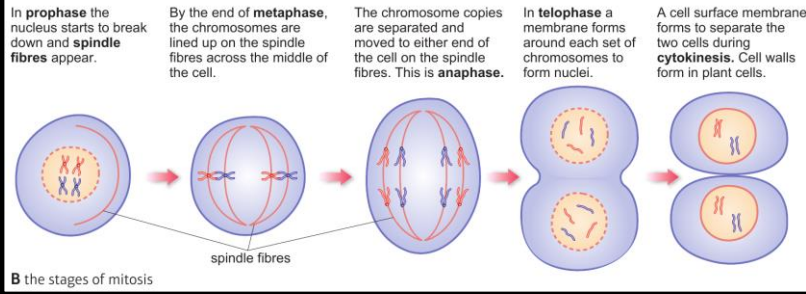


## 4. Enzyme substrate complex

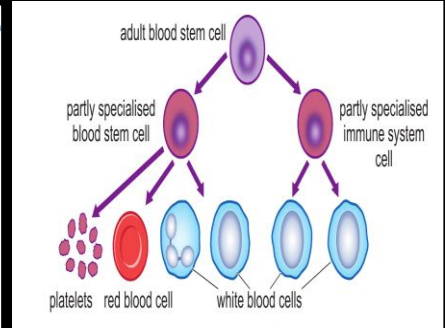


Keyword	Definition
<b>Magnification</b>	The number of times larger an image is than the initial object that produced it
<b>Objective lens</b>	The part of the microscope that is closest to the specimen
<b>Resolution</b>	The smallest change that can be measured by an instrument
<b>Nucleus</b>	The control centre of the "eukaryotic cell"
<b>Eukaryotic</b>	A cell with a nucleus
<b>Microvilli (us)</b>	A tiny fold in the cell surface membrane of a cell, increase the surface area of the cell
<b>Adaptations</b>	The features of something that enable it to do a certain function
<b>Gametes</b>	A haploid cell produced by meiosis used for sexual reproduction
<b>Haploid</b>	A cell or nucleus that has one set of chromosomes. Gametes are haploid
<b>Epithelial cells</b>	A cell found on the surface of internal organs
<b>Chromosomal DNA</b>	The main bulk of DNA found in a cell. In humans, this DNA is found in chromosomes
<b>Prokaryotic</b>	A cell with no nucleus is prokaryotic
<b>Monomers</b>	A small molecule that can join with other molecules like itself to form a polymer
<b>Polymers</b>	A long-chain molecule made by joining many smaller molecules (monomers)
<b>Biuret test</b>	A test that uses copper sulfate solution and potassium hydroxide solution to test for proteins. It turns from blue to purple in the presence of proteins
<b>Benedicts solution</b>	A solution used to detect the presence of reducing sugars (eg. Glucose) in foods
<b>Calorimeter</b>	Apparatus used to measure the energy content of substances by burning them and measuring the temperature increase
<b>Ethanol emulsion test</b>	A test using ethanol to detect lipids (fats) in food
<b>Active site</b>	The space in an enzyme where the substrate fits during an enzyme-catalysed reaction
<b>Denatured</b>	A denatured enzyme is one where the shape of the active site has changed so much that the substrate no longer fits and the reaction can no longer happen
<b>Optimum temperature</b>	The temperature at which an enzymes rate of reaction is greatest, or at which a population of microorganisms grow most rapidly
<b>Osmosis</b>	The movement of water from a high concentration to a low concentration through a partially permeable membrane
<b>Active Transport</b>	The pumping of particles across a cell membrane from a low concentration to high concentration (requires energy)

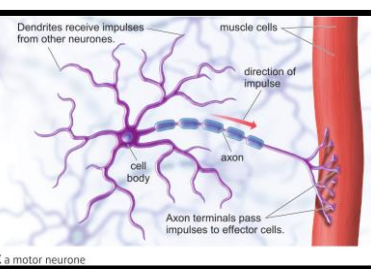
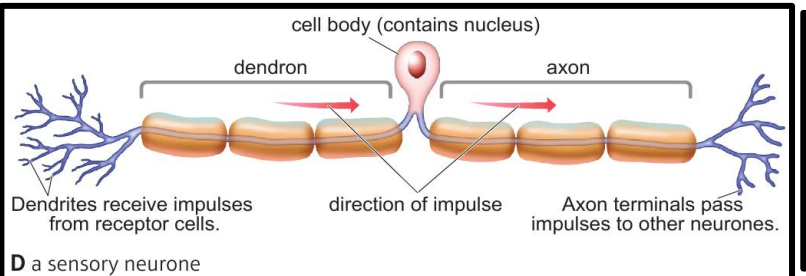
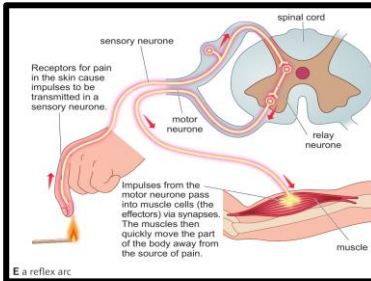
# KS4 Biology – Cells and Control



**B** Percentile growth curves for UK baby boys from 2 weeks to 1 year, for mass. The red line that has been plotted on the curves shows the growth of one baby.

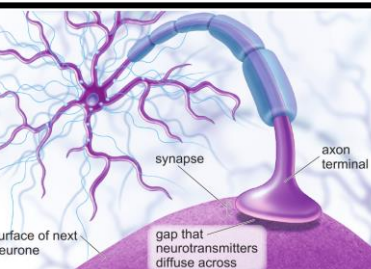


**C** Blood stem cells are found in marrow in the middle of long bones (such as the femur). They continue to divide throughout life to produce new blood cells.



## Cell differentiation

Although all animals develop from a single cell, not all the cells in their bodies are the same. Cells produced by mitosis are the same as the cell from which they were formed. However, the new cells may then change in different ways, so they become specialised for different functions. The process that changes less specialised cells into more specialised ones is called **differentiation**.



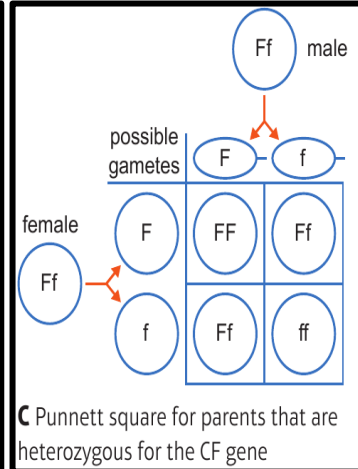
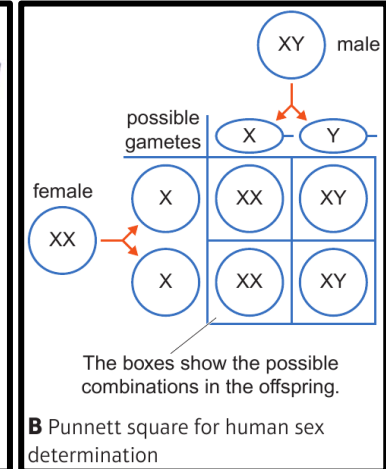
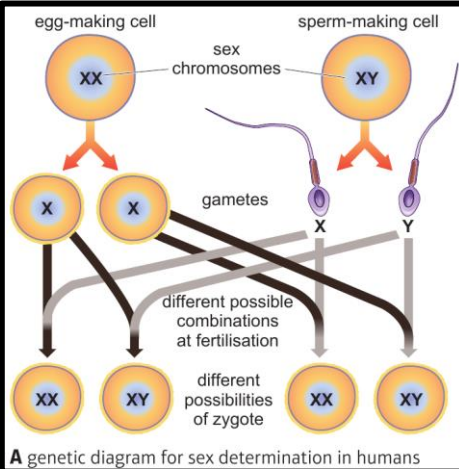
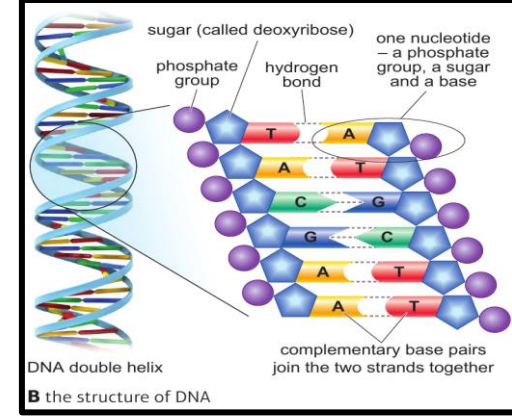
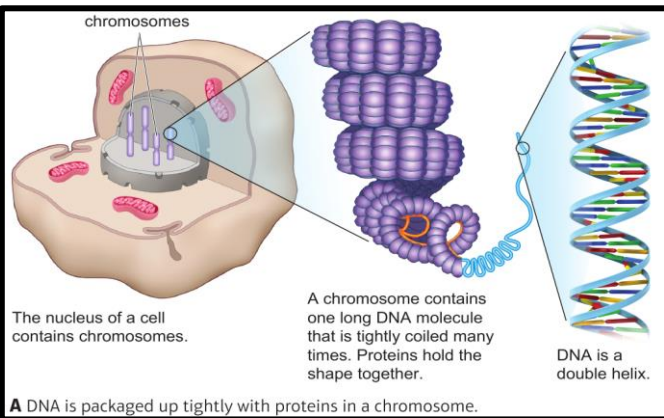
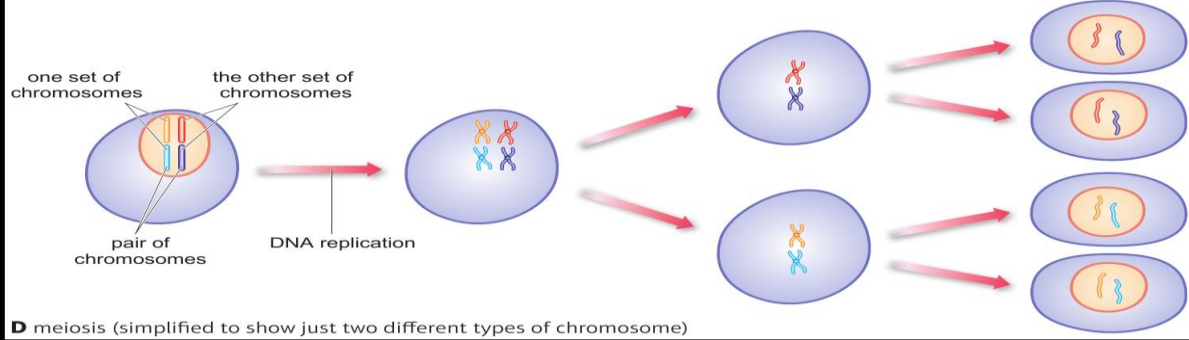
Keyword	Definition
<b>anaphase</b>	The stage of mitosis in which the separated chromosomes move away from each other.
<b>cancer cell</b>	Cell that divides uncontrollably.
<b>cell cycle</b>	A sequence of growth and division that happens in cells. It includes interphase and mitosis, and leads to the production of two daughter cells that are identical to the parent cell.
<b>clone</b>	Offspring from asexual reproduction. All the cells in a clone are genetically identical to each other and to the parent's cells.
<b>cytokinesis</b>	When the cytoplasm of the cell is separated as the cell membrane is pinched to divide the cell into two daughter cells.
<b>daughter cell</b>	New cell produced by cell division.
<b>diploid</b>	A cell with two sets of chromosomes.
<b>DNA replication</b>	The copying of the DNA within a cell.
<b>haploid</b>	A cell with one set of chromosomes.
<b>interphase</b>	The stage when the cell prepares itself for the process of cell division, and DNA replication takes place. The cell also makes more of its sub-cellular structures.
<b>metaphase</b>	The stage of mitosis when the chromosomes line up across the middle of the cell.
<b>mitosis</b>	The process of cells dividing to produce two daughter cells that are genetically identical to the parent.
<b>prophase</b>	The stage of mitosis in which the nucleus starts to break down and spindle fibres appear.
<b>telophase</b>	The stage of mitosis in which the chromosomes arrive at opposite ends of the cell and the nucleus membrane reforms.
<b>differentiation</b>	When a group of similar things, such as cells, become different in form from each other.
<b>percentile</b>	A $\frac{1}{100}$ th division of a group. For example, 10 per cent of the data items are below the 10th percentile and 50 per cent are below the 50th percentile.
<b>elongation</b>	When something gets longer (such as a cell in a plant root or shoot before it differentiates into a specialised cell).
<b>adult stem cell</b>	Stem cell found in specialised tissue that can produce more of the specialised cells in that tissue for growth and repair.
<b>cancer</b>	Disease caused by the uncontrolled division of stem cells in a part of the body.
<b>embryonic stem cell</b>	Stem cell from an early embryo that can produce specialised cells of many different types.
<b>rejection</b>	When the immune system attacks and kills cells and tissue that come from another person, such as blood (after transfusion) or stem cells.
<b>axon</b>	The long extension of a neurone that carries an impulse away from the dendron or dendrites towards other neurones.

# KS4 Biology – Genetics

The gamete-making cell has two sets of chromosomes. It is diploid (2n).

The chromosomes replicate (and the copies stay stuck to one another).

The cell divides into two and then into two again. Each of the final four daughter cells has a copy of one chromosome from each pair. They are haploid (1n).



Keyword	Definition
<b>chromosome</b>	A structure found in the nuclei of cells. Each chromosome contains one enormously long DNA molecule packed up with proteins.
<b>daughter cell</b>	A cell produced by another cell that has divided.
<b>diploid</b>	A cell or nucleus that has two sets of chromosomes. In humans, almost all cells except the sperm and egg cells are diploid.
<b>DNA</b>	Deoxyribonucleic acid. A polymer made of sugar and phosphate groups joined to bases. One molecule of DNA is found in each chromosome.
<b>fertilisation</b>	Fusing of a male gamete with a female gamete.
<b>gamete</b>	A haploid cell used for sexual reproduction.
<b>gene</b>	Section of the long strand of DNA found in a chromosome, which often contains instructions for a protein.
<b>genome</b>	All the DNA in an organism. Each body cell contains a copy of the genome.
<b>haploid</b>	A cell or nucleus that has one set of chromosomes. Gametes are haploid.
<b>meiosis</b>	A form of cell division in which one parent cell produces four haploid daughter cells.
<b>replicate</b>	When DNA replicates it makes a copy of itself.
<b>zygote</b>	Another term for 'fertilised egg cell'.
<b>base (in DNA)</b>	Four substances that help make up DNA, often shown by the letters A, C, G and T. Pairs of bases form 'links' between two 'spines' formed of phosphate groups and a type of sugar.
<b>chromosome</b>	A structure found in the nuclei of cells. Each chromosome contains one enormously long DNA molecule packed up with proteins.
<b>complementary base pair</b>	Two DNA bases that fit into each other and link by hydrogen bonds. There are two types of complementary base pair: A linking with T, and C linking with G.
<b>double helix</b>	Two helices joined together.
<b>allele</b>	Most genes come in different versions called alleles. So a gene for eye colour may have one version (allele) that can cause dark eyes, and another allele that can cause pale eyes.
<b>phenotype</b>	The characteristics that a certain set of alleles display.
<b>genotype</b>	The alleles for a certain characteristic that are found in an organism. Written in a shorthand using letters to represent the alleles (with the dominant allele having a capital and being written first).
<b>dominant</b>	Allele that will always affect the phenotype (as opposed to a recessive allele, whose effect will not be seen if a dominant allele is present).
<b>recessive</b>	Allele that will only affect the phenotype if the other allele is also recessive. It has no effect if the other allele is dominant.
<b>heterozygous</b>	When both the alleles for a gene are different in an organism.
<b>homozygous</b>	When both the alleles for a gene are the same in an organism.



## 1. Evidence for human evolution

<b>Ardi (Ardipithecus ramids)</b>	<ul style="list-style-type: none"> <li>Human like female fossil</li> <li>Walked upright</li> <li>Long arms and short legs</li> <li>Small skull and brain</li> </ul>
<b>Lucy (Australopithecus afarensis)</b>	<ul style="list-style-type: none"> <li>More human like female fossil than Ardi</li> <li>Walked upright better than Ardi</li> <li>Arm and legs were the length between ape and human</li> <li>Skull and brain slightly larger than Ardi</li> </ul>
<b>Turkana Boy (Homo erectus) discovered by Richard Leakey</b>	<ul style="list-style-type: none"> <li>More human like female fossil than Lucy</li> <li>Walked upright better than Lucy</li> <li>Arm and legs were human length</li> <li>Skull and brain larger than Lucy</li> </ul>

Evidence for human evolution can also be gained from looking at stone tools, which become more sophisticated overtime



## 2. Darwin's Theory of Evolution

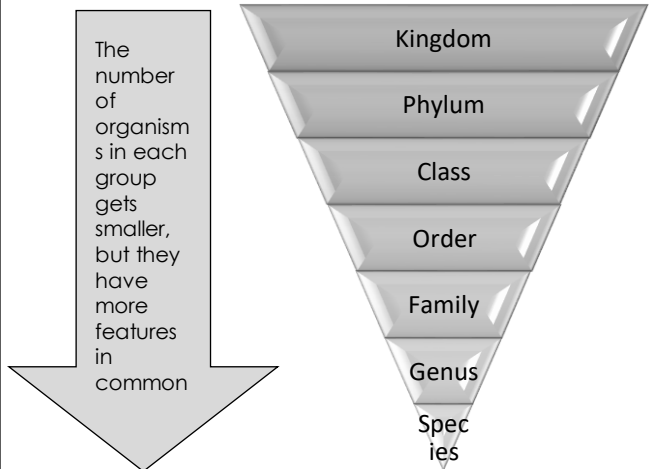
Evolution is a change in the inherited characteristics of a population over time. This occurs through a process called natural selection.

- The differences in a population gives some individuals an advantage.
- This individual is more likely to survive for longer and be able to breed to pass on desirable genes.
- Nature is selecting the individual with the phenotypes most suited to survival ('survival of the fittest'). This is called natural selection.

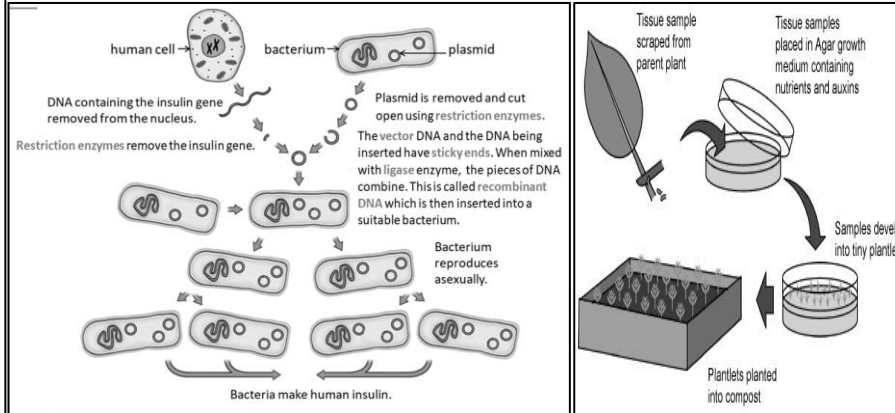
Our understanding of evolution has also been helped by the study of antibiotic resistance in bacteria.



## 3. Classification



## 4. Genetic Engineering and Tissue Culture



Keyword	Definition
<b>Binomial system</b>	The system of naming organisms using two Latin words
<b>Evolution</b>	A change in one or more characteristic of a population over a long period of time
<b>Genetic variation</b>	Differences between organisms caused by differences in the alleles they inherit from their parents, or differences in genes caused by mutation. Also called inherited variation
<b>Natural selection</b>	A process in which certain organisms are more likely to survive and reproduce than other members of the same species because they possess certain genetic variations
<b>Resistance</b>	When an organism has resistance to something, it is unaffected by it, or not affected very much
<b>Pentadactyl limb</b>	A limb that has five digits (fingers and thumbs). Amphibians, reptiles, birds and mammals share this characteristics
<b>Classification</b>	The process of sorting organisms into groups based on their characteristics
<b>Kingdoms</b>	There are five kingdoms into which organisms are usually divided: plants, animals, fungi, protists and prokaryotes
<b>Selective breeding</b>	When humans choose an organism that has a certain characteristic and breed more of these organisms, making that chosen characteristic more and more obvious
<b>Varieties</b>	Groups of plants of the same species that have characteristics that make them different to other members of the species
<b>Genetic engineering</b>	Altering the genome of an organism, usually by adding genes from another species.
<b>GMOs</b>	An organism that has had its genome genetically altered (genetic modification)
<b>Yield</b>	The amount of useful product that you can get from something
<b>Disease resistance</b>	Unaffected or less affected by a certain disease
<b>Stem cells</b>	An unspecialised cell that continues to divide by mitosis to produce more stem cells and other cells that differentiate into specialised cells
<b>Tissue culture</b>	Growing tiny pieces of tissue, or cells, in the lab
<b>Pests</b>	Animals that cause problems, such as damaging crops
<b>Biological control</b>	Using organisms to kill problem organisms, such as pests or weeds
<b>Insecticides</b>	A substance used to kill insect pests

In **genetic engineering**, genes from the chromosomes of **humans** and other organisms are **cut out** of the **DNA** using **enzymes**. The **genes** are then **transferred** to the **cells of the organism** to be genetically modified.

# KS4 Biology - Health, Disease and the Development of Medicine

## Transmission of Disease

Disease	Symptom	Method of transmission	Control spread of disease by:	Caused by:
Malaria	Recurrent fever	Animal vector	Preventing breeding of mosquitoes or use of a net to prevent being bitten.	Protist
Chalara ash dieback	Leaf loss and bark lesions	Airborne	Remove infected leaf litter. Clean all tools, vehicles and footwear.	Fungus
Cholera	Diarrhoea	Waterborne	Clean drinking water and good hygiene and sanitation.	Bacteria
Tuberculosis	Lung damage	Airborne	Vaccination programme. Treat infection with antibiotics.	Bacteria
HIV	Flu like illness	Sexual contact or bodily fluids. Direct contact.	Use of condoms / clean needles. Treat infection with antiretroviral drugs.	Virus
Ebola	Haemorrhagic fever	Bodily fluid - direct contact	Avoid contact with people infected with Ebola.	Virus

## Communicable diseases:

Common cold

Influenza

STDs

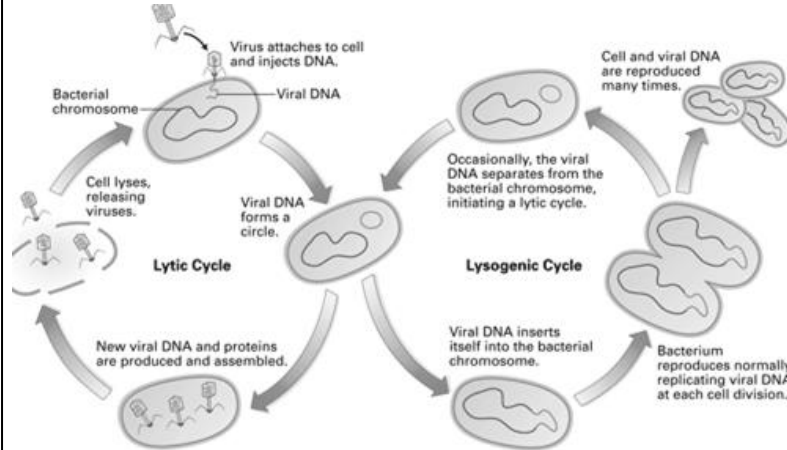
## Non-communicable diseases:

Diabetes

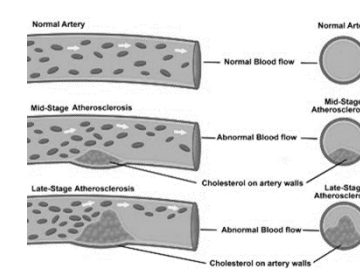
Cancer

Cardiovascular disease

## Lysogenic Vs Lytic Virus Lifecycle

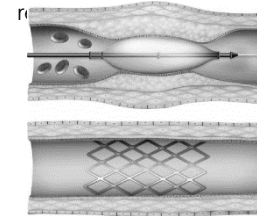


## Cardiovascular Disease



**Cardiovascular disease (CVD)** is a general term for disease which involve the **heart** or **blood vessels**. **Atherosclerosis** is a cause of **coronary heart disease** where **layers of fatty material** build up inside the coronary arteries, **narrowing** them. This **reduces** the flow of blood through the coronary arteries, resulting in a **lack of oxygen** for the **heart muscle**.

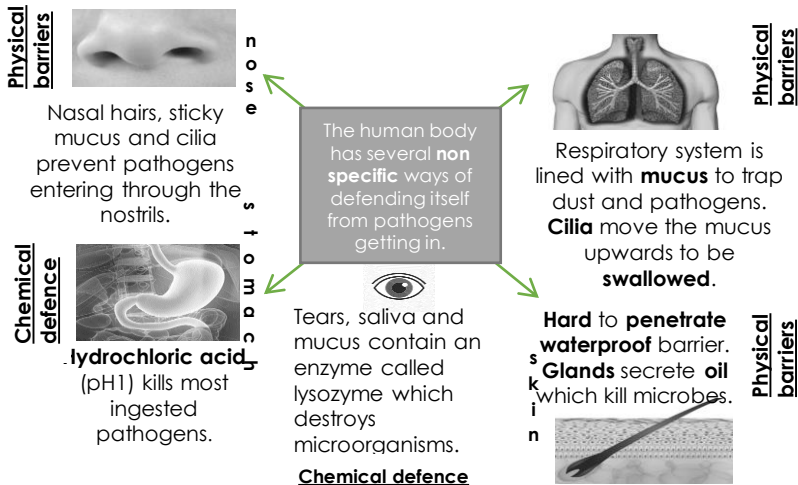
**Atherosclerosis** can be **treated** in two main ways by placing a **stent** in the coronary artery and/or using **lifelong medication** called **statins**. Lifestyle changes such as a healthy diet, exercise and no smoking are also vital in



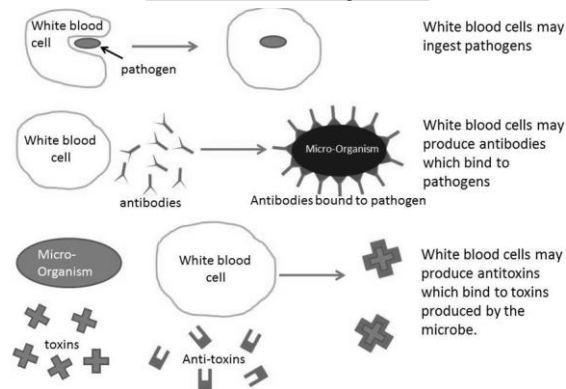
**Stents** are metal cylinder grids which can be **inserted** into an artery to maintain blood flow by **keeping the artery open** so that the heart continues to receive **enough oxygen** to function effectively.

**Statins** are drugs that lower harmful **cholesterol** in the blood and stop the **liver** producing too much cholesterol and reduce the rate at which it is deposited. Patients should change their **lifestyle** and have a healthy **diet**. This **reduces** the risk of heart disease.

## Defence Against Disease



## The Immune System



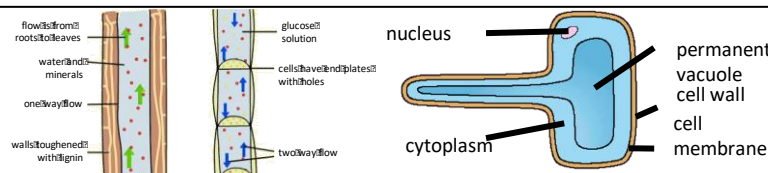
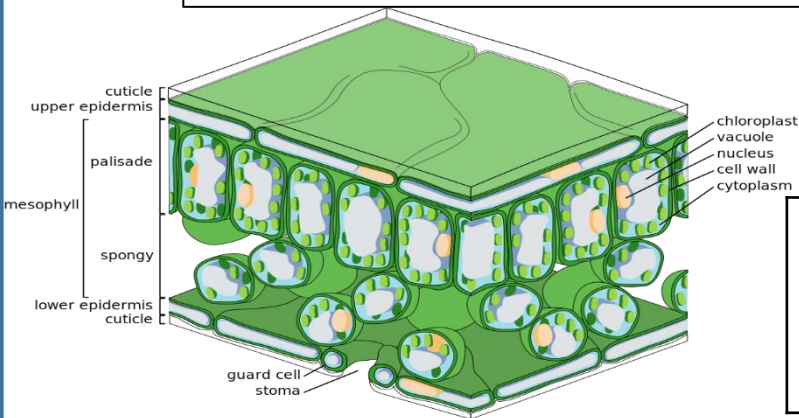
## Obesity

**Excess weight** (obesity) can make a person at **risk of cardiovascular disease**, a stroke and Type 2 diabetes. A tool called the **Body Mass Indicator (BMI)** can be used to calculate whether a person's weight lies within a healthy range.

$$BMI = \frac{\text{mass (kg)}}{(\text{height (m)})^2}$$

The use of **BMI** has **limitations** because it simply shows if a person is carrying too much weight. It does not calculate if this is excess fat, muscle or bone. The **waist to hip ratio** should be considered alongside the BMI figure.

# KS4 Biology – Plant Structures and their Functions



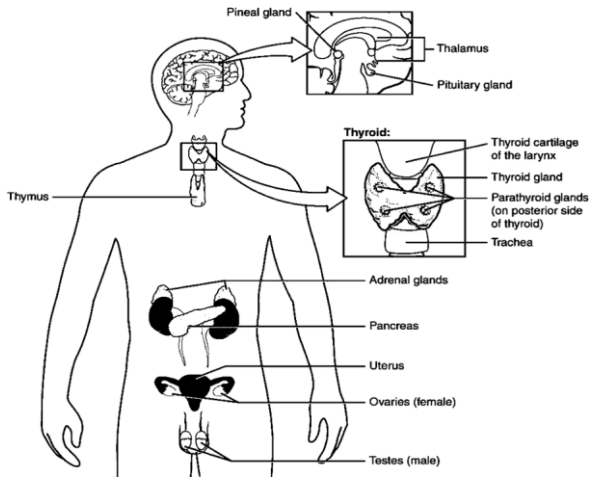
Photosynthesis	Plants make use of light energy from the environment (ENDOTHERMIC) to make food (glucose)	Carbon dioxide + Water → Oxygen + Glucose
		$CO_2 + H_2O \rightarrow O_2 + C_6H_{12}O_6$

<b>Epidermal tissues</b>	Waxy cuticle (top layer of the leaf)	Reduces water loss from the leaf
	Guard cells and stomata	Guard cells open and close the stomata to control water loss and allow for gas exchange (oxygen and carbon dioxide).
<b>Palisade mesophyll</b>	Palisade cells	Cells near the top surface of the leaf that are packed with chloroplasts that contain chlorophyll. Both adaptations maximize photosynthesis.
<b>Spongy mesophyll</b>	Air spaces in the leaf between cells	Increased surface area for gas exchange so that carbon dioxide can diffuse into photosynthesising cells.
<b>xylem</b>	Hollow tubes strengthened by lignified dead cells adapted for the transportation of water and mineral ions through the plant in the transpiration stream	Allows transport of water and mineral ions from the roots to the stem and the leaves.
<b>phloem</b>	Cell sap moves from one phloem cell to the next through pores in the end walls	Transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage (translocation).
<b>Meristem tissue</b>	New cells (roots and shoot tips) are made here including root hair cells	Root hair cells have an increased surface area for the uptake of water by osmosis, and mineral ions by active transport.

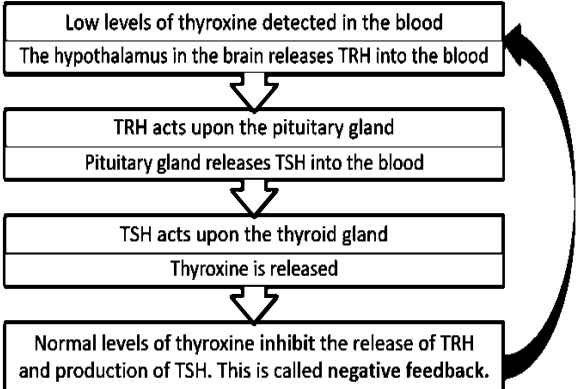
Factors affecting the rate of photosynthesis	<b>Factor</b>	<b>How the rate is affected</b>	<b>Limiting factors (why the rate stops going up)</b>
	<b>Temperature</b>	As the temperature of the environment the plant is in increases rate of photosynthesis increases (up to a point) as there is more energy for the chemical reaction.	Photosynthesis is an enzyme controlled reaction. If the temperature increases too much, then the enzymes become denatured and the rate of reaction will decrease and stop
	<b>Light intensity</b>	Light intensity increases as the distance between the plant and the light sources increases. As light intensity increases so does the rate of photosynthesis (up to a point) as more energy is available for the chemical reaction.	At point X another factor is limiting the rate of photosynthesis. This could be carbon dioxide concentration, temperature or the amount of chlorophyll
	<b>Carbon dioxide concentration</b>	Carbon dioxide is needed for plants to make glucose. The rate of photosynthesis will increase when a plant is given higher concentrations of carbon dioxide (up to a point).	At point X another factor is limiting the rate of photosynthesis. This could be light intensity, temperature or the amount of chlorophyll

Keyword	Definition
Active Transport	Active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). The energy is provided by respiration
Xylem	Form hollow tubes made of dead tissue. Long cells with walls toughened by waterproof lignin. Water and minerals flow from the roots towards the leaves in one direction in a process called TRANSPIRATION. Xylem vessels also provide support to the stem of the plant.
Phloem	Form tubes made of living tissue. Cells have end plates with holes in them. Sucrose in solution move from the leaves to growing tips and storage tissues in both directions. This process is called TRANSLOCATION. There are no forces causing translocation to occur and so the sucrose is moved along using active uptake which requires energy.
Stoma	
Guard Cell	Cells either side of the stoma that
Gibberellins	End seed dormancy, promote flowering, increase fruit size.
Ethene	Control ripening of fruit during storage and transport.
Auxins	Weed killers, rooting powders, promoting growth in tissue culture.

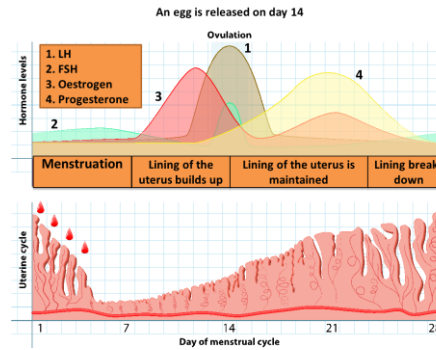
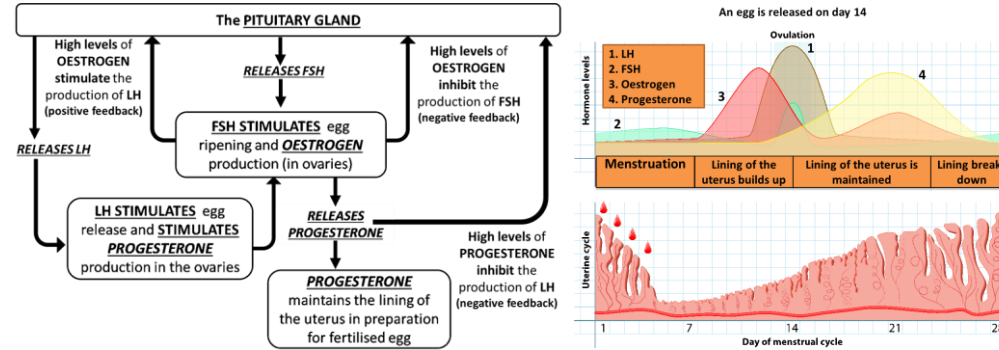
## The Human Endocrine System



Anti-diuretic hormone (ADH)	Kidney	Controls water levels in the blood
Thyroid-stimulating hormone (TSH)	Thyroid	Stimulates the thyroid gland to secrete thyroxine
Luteinising hormone (LH)	Ovaries	Stimulates egg release and progesterone production in the ovaries
Follicle-stimulating hormone (FSH)	Ovaries	Stimulates egg ripening and oestrogen production (in ovaries)
Prolactin (PRL)	Breasts	Stimulates the breasts to produce milk
Growth hormone (GH)	All cells in the body	Stimulates growth and repair



## The Menstrual Cycle



Hormone	Produced in...	Causes...
<b>FSH</b> Follicle stimulating hormone	<b>Pituitary Gland</b>	<b>Stimulates egg ripening and oestrogen production (in ovaries)</b>
<b>Oestrogen</b>	<b>Ovaries</b>	<b>Lining of the womb to develop. Stimulates pituitary gland to make LH</b>
<b>LH</b> Luteinising hormone	<b>Pituitary Gland</b>	<b>Stimulates egg release and progesterone production in the ovaries</b>
<b>Progesterone</b>	<b>Ovaries</b>	<b>Maintains the lining of the womb</b>

## Contraception

**The pill** - oral contraceptives that contain oestrogen to inhibit FSH production so that no eggs develop and mature. After taking for a while egg development and release will stop completely.

The **mini pill** and **injections** contain progesterone. High levels stimulate the cervix to produce a thick mucus which stops sperm entering the uterus.

**Implant** or **skin patches** of slow release progesterone inhibit the maturation and release of eggs for a number of months or years.

**Spermicidal** agents which kill or disable sperm.

Barrier methods such as **condoms and diaphragms** prevent the sperm reaching an egg

The **'coil' or other intrauterine devices** which prevent the implantation of an embryo

**Sterilisation or vasectomy** - surgical methods of male and female sterilisation.

Keyword	Definition
Endocrine system	Collection of organs/glands in the human body that release hormones
Hormones	Chemical messengers released from endocrine glands that cause a change in bodily responses
Target organ	The organ where a particular hormone is released and effects
Metabolic rate	The rate at which the energy stored is transferred by all the reactions that take place in your body
Glycogen	How glucose is stored as a polymer
Fight or flight response	When the body prepares to fight or run away from a perceived danger. This response is caused by the hormone adrenaline
Menstrual cycle	A roughly 28 day cycle of changes that occurs in the female reproductive system
Menstruation	When the lining of the uterus breaks down and passes out through the vagina, Also known as a period
Ovulation	When an egg is released from its follicle in the ovary, happens roughly on day 14 of the menstrual cycle
Contraception	A method that prevents fertilisation and therefore pregnancy. Contraception can be hormonal or physical/barrier methods
ART	Assisted reproductive technology that uses hormones and other techniques to increase the chance of pregnancy in infertile women. Clomifene therapy is an example of ART

# KS4 Biology – Animal Coordination, Control and Homeostasis (part 2)

## Control of Blood Glucose

Blood glucose concentration **TOO HIGH**



The **PANCREAS** releases the hormone **insulin**

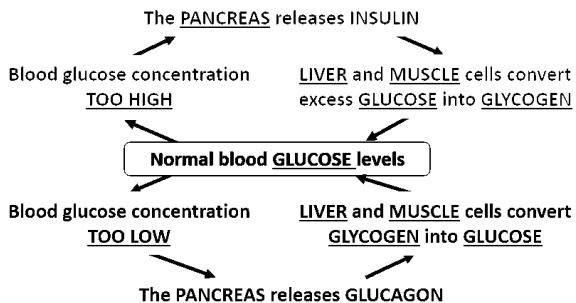


**Insulin** stimulates the movement of **GLUCOSE** from the blood into cells



**Liver** and **muscle** cells convert excess **glucose** into **glycogen**

The control of blood glucose concentration is an example of **NEGATIVE FEEDBACK**. This ensures that, in any control system, changes are reversed and returned back to the set level.



## Diabetes- a condition that causes a person's blood sugar level to become too high.

### Type 1 diabetes

A disorder in which the pancreas fails to produce enough insulin.

The lack of insulin causes uncontrolled high blood glucose levels.

Type 1 is normally treated with insulin injections.

### Type 2 diabetes

A disorder where the body cells no longer respond to insulin produced by the pancreas.

Obesity is a risk factor for Type 2 diabetes.

Type 2 is normally treated by controlling the carbohydrate in the diet and by exercise.

Excess weight (obesity) can make a person have a greater risk of developing type 2 diabetes.

A tool called the **Body Mass Indicator (BMI)** can be used to calculate whether a person's weight lies within a healthy range.

$$\text{BMI} = \frac{\text{mass (kg)}}{(\text{height (m)})^2}$$



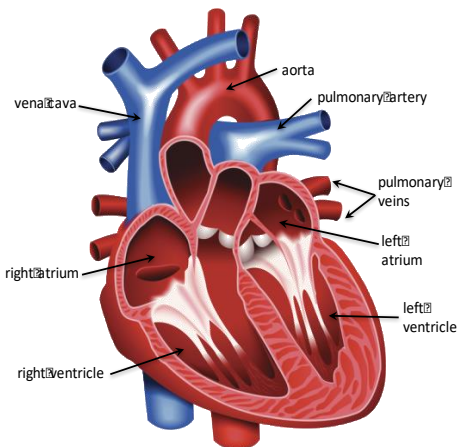
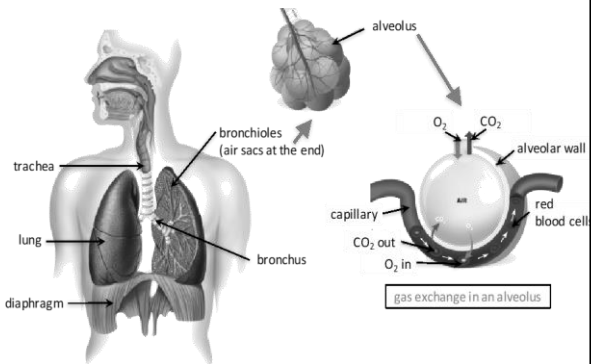
The use of BMI has **limitations** because it simply shows if a person is carrying too much weight. It does not calculate if this is excess fat, muscle or bone.

Very muscular adults and athletes may be classed as overweight or obese even though their body fat is low.

The **waist to hip ratio** should be considered alongside the BMI figure.

Male (waist : hip ratio)	Female (waist : hip ratio)	Health risk based on Waist : hip ratio
0.95 or below	0.80 or below	Low risk
0.96 to 1.0	0.81 to 0.85	Moderate risk
1.1 or more	0.86 or more	High risk

# KS4 – Biology Exchange and Transport



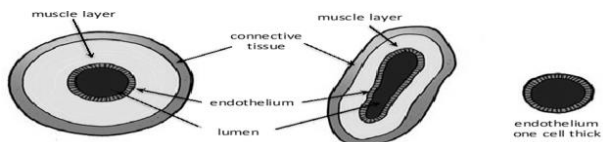
Different structure in the heart have different functions

Right ventricle	Pumps blood to the lungs where gas exchange takes place.
Left ventricle	Pumps blood around the rest of the body. Thicker cardiac muscle in the wall.
Pacemaker (in the right atrium)	Controls the natural resting heart rate. Artificial electrical pacemakers can be fitted to correct irregularities.
Coronary arteries	Carry oxygenated blood to the cardiac muscle.
Heart valves	Prevent blood in the heart from flowing in the wrong direction.

<b>Trachea</b>	Carries air to/from the lungs	Rings of cartilage protect the airway.
<b>Bronchioles</b>	Carries air to/from the air sacs (alveoli)	Splits into multiple pathways to reach all the air sacs.
<b>Alveoli</b>	Site of gas exchange in the lungs	Maximises surface area for efficient gas exchange.
<b>Capillaries</b>	Allows gas exchange between into/out of blood	Oxygen diffuses into the blood and carbon dioxide diffuses out.

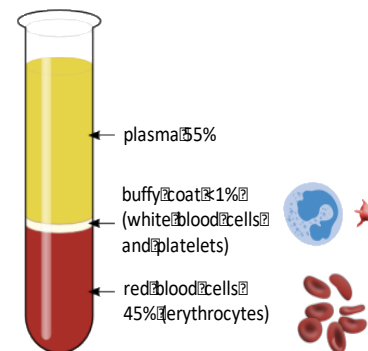
<b>Aerobic respiration</b>
Respiration with oxygen. Occurs inside the mitochondria continuously
Glucose is oxidised by oxygen to transfer the energy the organism needs to perform it's functions.
$\text{Glucose} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water}$

<b>Anaerobic respiration</b>
Respiration when oxygen is in short supply. Occurs during intensive exercise
During hard exercise, muscle cells are respiring so fast that blood cannot transport enough oxygen to meet their needs. Glucose is partially oxidised to produce lactic acid which builds up in muscle tissue causing them to become painful and fatigued.
$\text{Glucose} \rightarrow \text{lactic acid}$



<b>Artery</b>	<b>Vein</b>	<b>Capillary</b>
Carry blood away from the heart	Carry blood to the heart	Connects arteries and veins
Thick muscular walls, small lumen, carry blood under high pressure, carry oxygenated blood (except for the pulmonary artery).	Thin walls, large lumen, carry blood under low pressure, have valves to stop flow in the wrong direction, carry deoxygenated blood (except for the pulmonary vein).	One cell thick to allow diffusion, Carry blood under very low pressure.

<b>Factors affecting rate of diffusion (Biology only)</b>		
<b>Surface area</b>	<b>Concentration gradient</b>	<b>Diffusion distance</b>
Increased surface area on exchange surface increases diffusion.	Diffusion is from area of high concentration to low concentration. A large difference in concentration will increase rate of diffusion.	The smaller the diffusion distance to faster the rate of diffusion,

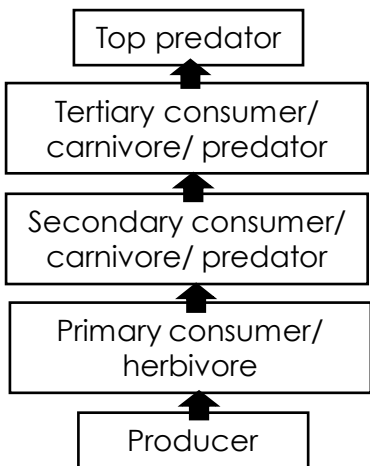


<b>Keyword</b>	<b>Definition</b>
Diffusion	The spreading of the particles of a gas or substances in solution, resulting in a net movement of particles from a region where they are of a higher concentration to an area of lower concentration
Surface areas to volume ratio	The surface area to volume ratio can be calculated by dividing an object's surface area (SA) by its volume
Cardiac Output	Cardiac output = stroke volume x heart rate
Stroke Volume	Cardiac output is the volume of blood pumped by a ventricle per minute. The units are $\text{cm}^3 \text{min}^{-1}$
Heart Rate	Heart rate is the number of beats per minute (bpm)
Stroke Volume	Stroke volume is the volume of blood pumped by one ventricle per contraction ( $\text{cm}^3$ )

<b>Plasma (55%)</b>	Pale yellow fluid	Transports $\text{CO}_2$ , hormones and waste.
<b>Red blood cells (erythrocytes) (45%)</b>	Carries oxygen	Large surface area, no nucleus, full of haemoglobin.
<b>White blood cells (phagocytes and lymphocytes) (&lt;1%)</b>	Part of the immune system	Some produce antibodies, others surround and engulf pathogens.
<b>Platelets (&lt;1%)</b>	Fragments of cells	Clump together to form blood clots.

# KS4 Biology – Ecosystems and material cycles (part 1)

A food web shows the feeding relationship between organisms in a community.



Separates

Species availability that indicate <b>water</b> pollution
Clean → Stonefly Some → Shrimp Moderate → Bloodworm Very polluted → Sludge worm
Species availability that indicate <b>air</b> pollution
Clean → Bushy lichens and blackspot fungus Some → Leafy lichens Very polluted → Crusty lichens

Examples of abiotic factors

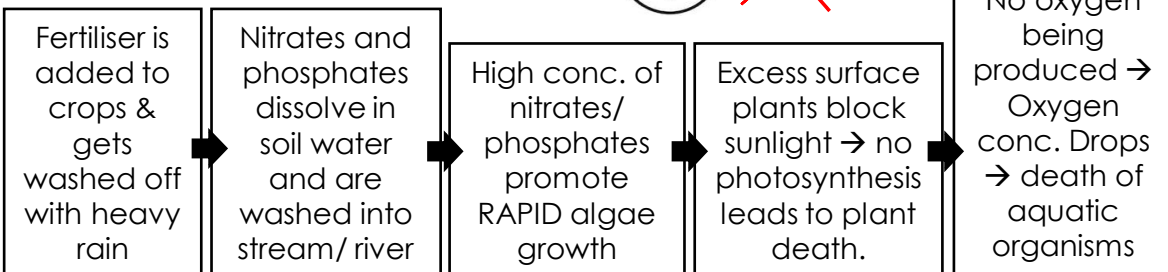
Extremes of an abiotic factor can reduce the biodiversity of the ecosystem. For example, ecosystems with a very low temperature tend to have low biodiversity  
**Example: Temperature, light, water and pollutants.**

Examples of biotic factors

Biotic factors are the interactions between the living things in an ecosystem. This can include grazing and predation. Animals which graze on the plant species in an ecosystem can influence which species of plants can survive  
**Example: competition and predation.**

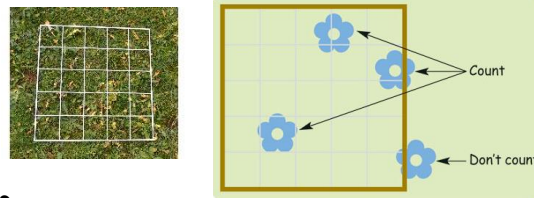
Keyword	Definition
Ecosystems	a biological community of interacting organisms and their physical environment.
Biodiversity	the variety of plant and animal life in the world or in a particular habitat
Resources	a substance or object in the environment required by an organism for normal growth, maintenance, and reproduction.
Community	two or more populations of organisms.
Populations	the number of organisms of the same species that live in a particular geographic area at the same time.
Interdependent	this means that all the organisms in an ecosystem are dependent upon each other. If the population of one organism rises or falls, then this can affect the rest of the ecosystem.
Habitats	the place where an organism lives.
Biomass	the total dry mass of one animal or plant species in a food chain or food web
Abiotic	non-living chemical and physical factors in the environment which affect ecosystems.
Adaptations	the biological mechanism by which organisms adjust to new environments or to changes in their current environment.
Eutrophication	the gradual increase in the concentration of phosphorus, nitrogen, and other plant nutrients in an aging aquatic ecosystem such as a lake.
Indigenous	a species can be indigenous to a given region or ecosystem if its presence in that region is the result of only natural processes, with no human intervention.
Preservation	The act or process of keeping the environment safe from harmful effects of human activity.
Parasitism	relationship between two species of plants or animals in which one benefits at the expense of the other, sometimes without killing the host organism. Examples include tapeworms and fleas.
Mutualism	The interaction between two or more different species in an environment where each species has a net benefit. Example includes an oxpecker bird landing on the back of zebra eating ticks. The oxpecker gets fed and the zebra gets pest control.

**Eutrophication process**



# KS4 Biology – Ecosystems and material cycles (part 2)

**Quadrats** are square frames of wire usually 0.25 m<sup>2</sup>. These are placed on the ground to look at the plants or slow-moving animals within them. Throwing these randomly in the area we can obtain the following information:



- **The number of individuals in one species.**
- **Species richness:** the number of different plant or animal species
- **Percentage cover:** the percentage of the quadrat area that is covered by one species (e.g grass). This is easier to estimate if a quadrat has wires making smaller sections. Percentage cover rather than number of individuals is used when estimating plant frequencies if it is difficult to identify individual plants, such as grasses or moss.

**Abundance** is the measure of how common something is in its area (example population size)



$$\text{Population size} = \text{no. of organisms in all quadrats} \times \frac{\text{Total size of area}}{\text{Total area of quadrats}}$$



$$\text{Efficiency of energy transfer} = \frac{\text{Energy transferred to biomass}}{\text{Total energy supplied to organisms}}$$



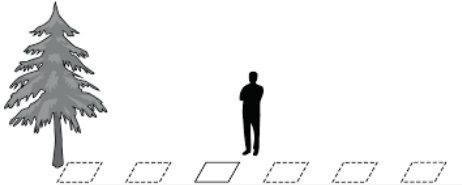
$$\% \text{ biomass transfer from producers to primary consumers} = \frac{\text{Primary consumers}}{\text{Producers}} \times 100\%$$



$$\text{Rate of decomposition} = \frac{\text{Mass lost}}{\text{No. of days}}$$

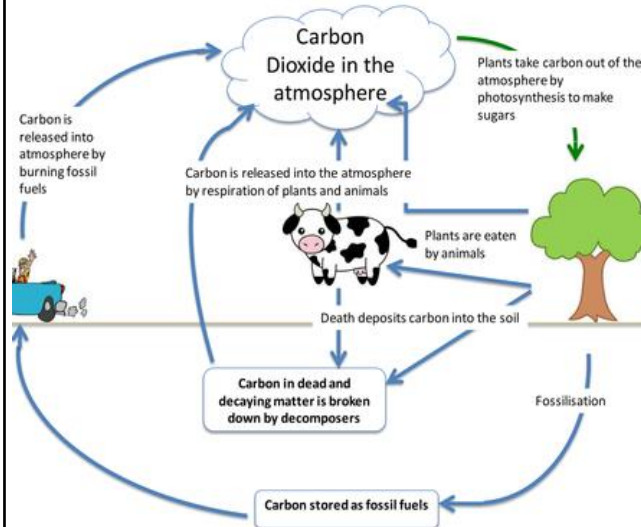
Separates

**Belt transect:** used when there is a gradual change from one side of a habitat to another.

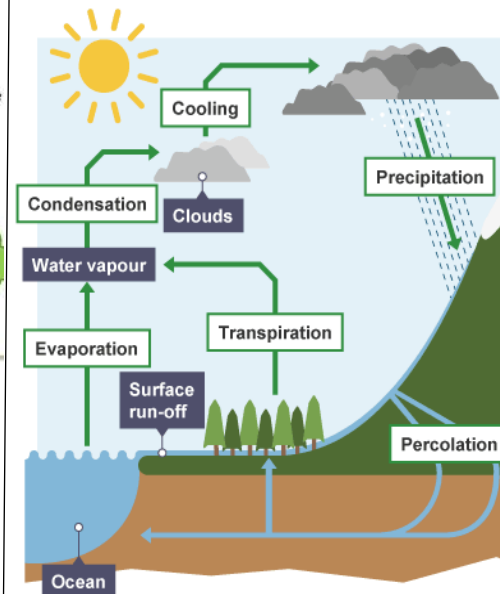


1. Extend a measuring tape from one side of the habitat to another.
2. Place a quadrat at 0m on the tape.
3. Count the numbers/estimate percentage cover of each species.
4. Use a key to identify each species.
5. Record results in a table.
6. Move the quadrat along the measuring tape.
7. Repeat step 3-5 at regular intervals along the measuring tape.
8. Continue until the full length of the measuring tape has been sampled.
9. Calculate the average of each species.

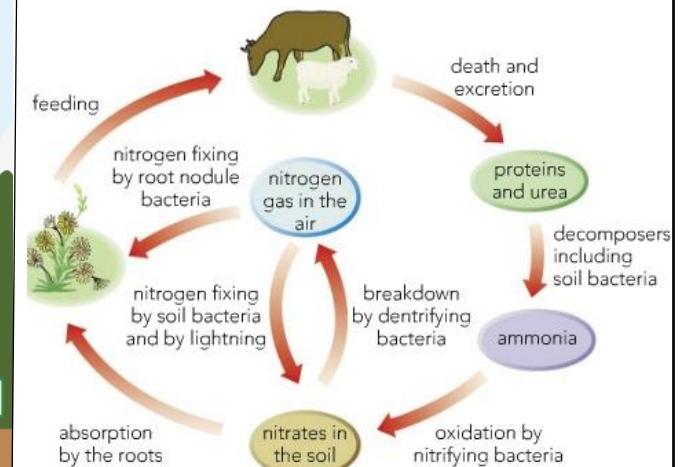
## The Carbon Cycle



## The Water Cycle



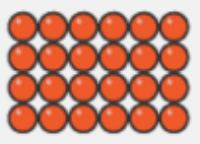

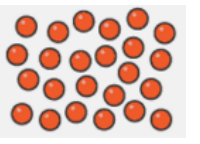
## The Nitrogen Cycle

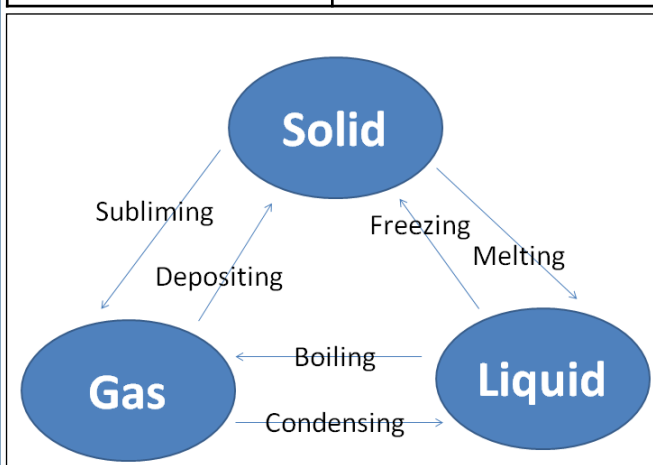




# Chemistry Knowledge Organisers

# Year 9 – Science – C3a. Purifying substances

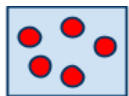
	Solids	Liquids	Gases
			
Arrangement	Particles are close together, next to each other. Particles are in rows. Regular arrangement.	Particles touch each other and are next to each other. Particles are not in a regular pattern.	Particles are not in a regular arrangement. The particles are spaced out.
Movement	Very little movement, particles vibrate in their fixed positions. They do not move from one place to another.	Particles have some movement. The particles are able to rollover each other.	Particles in gases have lots of movement and move in all directions.
Challenge – energy and attraction of particles	Particles have very little energy. The particles are attracted to each other.	Particles have some energy. The particles are attracted to each other.	Particles have lots of energy and there is no or very little attraction between the particles.



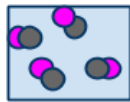
Physical change (Reversible)	Chemical change (Irreversible)
For example – melting chocolate Freezing water into ice	For example – frying an egg - rusting
No new substances or products formed. There has just been a change of state (solid, liquid, gas)	One or more new substances has been formed.

<b>Chromatogram</b>	The end product in chromatography (paper with separated components).
<b>Solute</b>	The solid that dissolves.
<b>Solvent</b>	The liquid that dissolves the solute.
<b>Solution</b>	Formed when a solvent dissolves a solute.
<b>Dissolve</b>	The act in which a solution is made (forming a solution).
<b>Saturated</b>	When no more solute can be dissolved in a solvent.
<b>Unsaturated</b>	When more solute can be dissolved in a solvent.
<b>Atom</b>	Smallest component of an element.
<b>Molecule</b>	A group of atoms chemically bonded together.
<b>Compound</b>	Two or more different atoms chemically bonded together.
<b>Evaporation</b>	Change of state where a liquid turns to a gas.
<b>Condensation</b>	Change of state where a gas turns to a liquid.
<b>Filtration</b>	Separation technique where insoluble particles are separated from soluble particles and liquid.
<b>Crystallisation</b>	Separation technique where the solvent in a solution is left to evaporate, leaving the solute behind.
<b>Distillation</b>	Separation technique where liquid mixtures or soluble solutions can be separated based on their boiling points.
<b>Soluble</b>	Can dissolve in water.
<b>Insoluble</b>	Cannot dissolve in water.
<b>Baseline</b>	The pencil line drawn at the base of the chromatography paper during chromatography.
<b>Mixture</b>	Two or more different atoms not chemically bonded together.
<b>Boiling point</b>	The temperature that a liquid turns into a gas.

**A pure substance contains atoms of one single element only.**

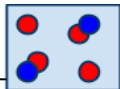


a. pure substance - 1 element

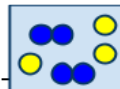


b. pure substance - 1 compound

**An impure substance is 2 or more different elements and/or compounds together that are not chemically bonded. AKA, a mixture.**



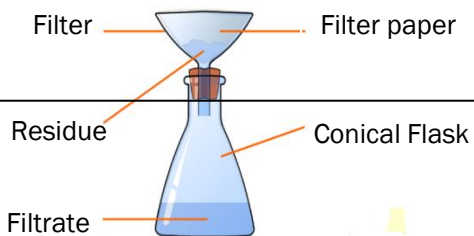
a. mixture - 1 element & 1 compound



b. mixture - 2 elements

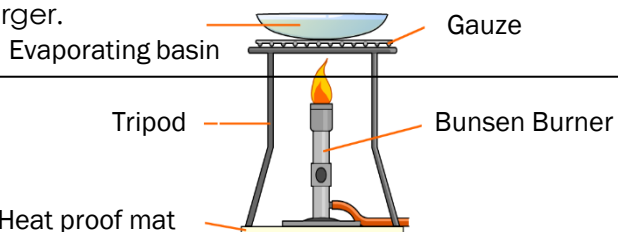
## Filtration

- Filtration separates insoluble from soluble.
- Soluble substances and liquid are allowed through the small holes in the filter paper and form filtrate.
- Insoluble particles cannot fit through the small holes and are kept in the filter papers as the residue.



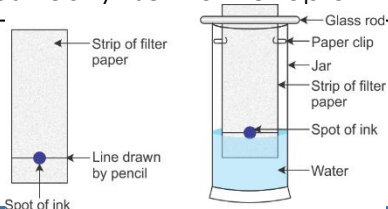
## Crystallisation

- Heat the solution.
- Evaporate off the solvent, leaving the solute behind.
- Crystallisation forms crystals of different sizes.
- If the solvent takes longer to evaporate, the crystals have more time to form an order and therefore larger.



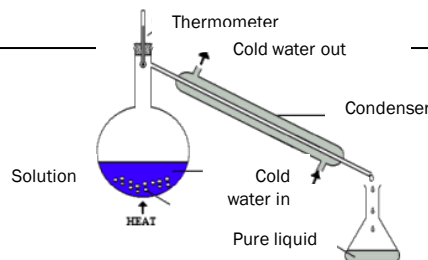
## Chromatography

- Draw a horizontal line, using pencil and ruler, 2cm up from the bottom filter paper (pencil is insoluble).
- Add a dot of ink mixture to each 'x' mark evenly spaced on the baseline.
- Measure 1cm depth of water (or other solvent) in a beaker.
- Stand the filter paper up in the water, making sure the waterline is UNDER the baseline (to ensure the solvent moves up the stationary phase).
- Take out the chromatogram when the mobile phase has nearly risen to the top of the paper.



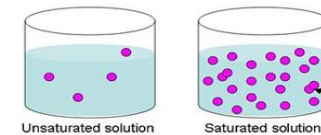
## Distillation

- Heat the mixture until one solution evaporates to become a gas (one with the lowest boiling point).
- The evaporated liquid will rise up as a gas.
- The gas will enter the condenser.
- In the condenser delivery tube, energy will be taken from the solution by the circulating water outside.
- The gas will turn to a liquid- condensation.
- The pure liquid will fall into a separate beaker.
- The other liquid in the mixture will be left in the round-bottom flask.



## Solutions

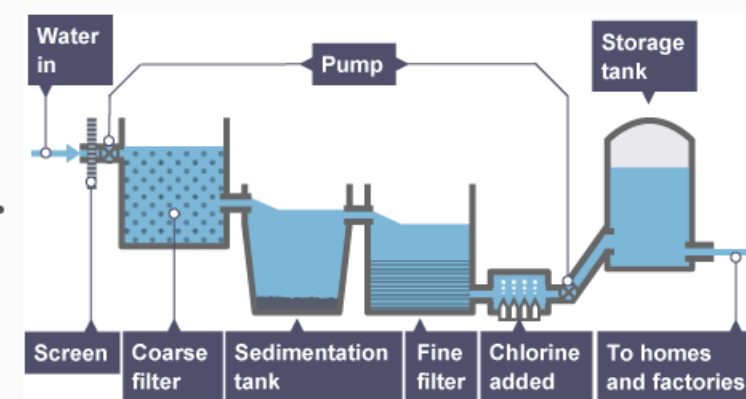
Solvent + Solute → Solution



## Making a saturated solution

1. Add solute to a solvent and stir.
2. Continue to add the solute until it no longer dissolves.

## Making drinking water potable



Water is essential for life. Water that is safe for humans to drink is called potable water. Potable water is not pure water because it almost always contains dissolved impurities.

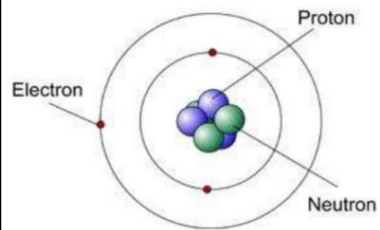
For water to be potable, it must have sufficiently low levels of dissolved salts and microbes. This is because:

dissolved salts can sometimes be harmful for humans microbes can cause illnesses

# Year 9 – Science – C3b. Atomic Structure and the Periodic Table

## Atomic Structure

Dalton's atomic model



## Isotopes

- Versions of an element with same atomic number but different atomic mass.
- Number of protons is the same, but number of neutrons is different.
- Relative Atomic Mass is average of the masses of the isotopes, weighted by their **relative abundance**
- For example, Neon has three isotopes

Neon Isotope Mass	Relative Abundance (%)
20	90.5
21	0.3
22	9.2

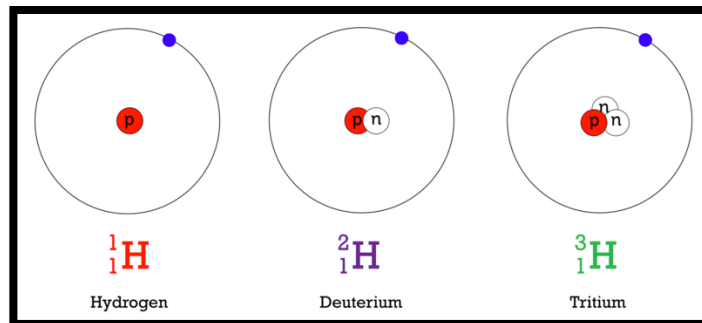
• Relative atomic mass of Neon = 
$$\frac{20 \times 90.5 + 21 \times 0.3 + 22 \times 9.2}{90.5 + 0.3 + 9.2} = 20.2$$

- This is why some atoms have a relative atomic mass with a decimal point.

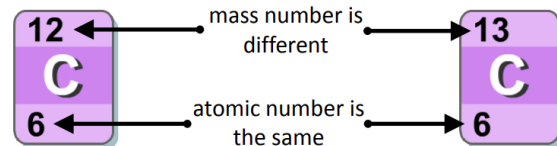
## Sub-atomic particles

Atoms are made from smaller particles called subatomic particles. There are three type:

Particle	Relative mass	Relative charge	Found?
Proton	1	Positive, +1	In nucleus
Neutron	1	Neutral, 0	In nucleus
Electron	Negligible ( $\frac{1}{1840}$ )	Negative, -1	In shells orbiting nucleus



- For example, two isotopes of carbon:



- The existence of isotopes results in relative atomic masses not being whole numbers

## Reading the Periodic Table

19  
F  
fluorine  
9

**Relative Atomic Mass** (aka nucleon number):  
The total number of protons and neutrons added together.

**Atomic number** (aka proton number):  
The number of protons or electrons.

**Note:** on some periodic tables, they are the wrong way up, just remember that the smaller number is the proton number.

## What's in my atom?

**Protons** = atomic number

**Electrons** = atomic number

**Neutrons** = relative atomic mass subtract atomic no.

19  
F  
fluorine  
9

Atomic number = 9  
Relative Atomic mass = 19

Protons = 9  
Electrons = 9  
Neutrons = 19-9 = 10

32  
S  
sulfur  
16

Atomic number = 16  
Relative Atomic mass = 32

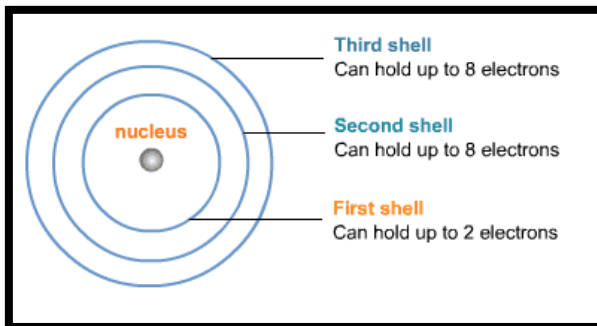
Protons = 16  
Electrons = 16  
Neutrons = 32-16 = 16

## Mendeleev

- Arranged elements by increasing atomic mass but...
- He broke this rule and left some gaps if an element's properties weren't similar to the one above it.
- He thought the gaps were for elements that hadn't been discovered yet and predicted their properties.
- When they were discovered, the properties matched the predictions

## Electron Configuration

- Electrons orbit the nucleus in **shells**.
- **First** shell holds up to two electrons
- **Second** shell can hold up to 8 electrons
- **Third** shell can also hold up to 8 electrons



Silicon: **2.8.4**

1<sup>st</sup> shell      2<sup>nd</sup> shell      3<sup>rd</sup> shell

3 shells used = so the element is in the 3<sup>rd</sup> period

PERIODS....increasing atomic mass, differing properties

1		2												3	4	5	6	7	0		
				<b>Key</b> relative atomic mass <b>atomic symbol</b> name atomic (proton) number																	
				<b>Element Type</b> = non-metal      = metal																	
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4											11 <b>B</b> boron 5	12 <b>C</b> carbon 6	14 <b>N</b> nitrogen 7	16 <b>O</b> oxygen 8	19 <b>F</b> fluorine 9	20 <b>Ne</b> neon 10				
23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12											27 <b>Al</b> aluminium 13	28 <b>Si</b> silicon 14	31 <b>P</b> phosphorus 15	32 <b>S</b> sulfur 16	35.5 <b>Cl</b> chlorine 17	40 <b>Ar</b> argon 18				
39 <b>K</b> potassium 19	40 <b>Ca</b> calcium 20	45 <b>Sc</b> scandium 21	48 <b>Ti</b> titanium 22	51 <b>V</b> vanadium 23	52 <b>Cr</b> chromium 24	55 <b>Mn</b> manganese 25	56 <b>Fe</b> iron 26	59 <b>Co</b> cobalt 27	59 <b>Ni</b> nickel 28	63.5 <b>Cu</b> copper 29	65 <b>Zn</b> zinc 30	70 <b>Ga</b> gallium 31	73 <b>Ge</b> germanium 32	75 <b>As</b> arsenic 33	79 <b>Se</b> selenium 34	80 <b>Br</b> bromine 35	84 <b>Kr</b> krypton 36				
85 <b>Rb</b> rubidium 37	88 <b>Sr</b> strontium 38	89 <b>Y</b> yttrium 39	91 <b>Zr</b> zirconium 40	93 <b>Nb</b> niobium 41	96 <b>Mo</b> molybdenum 42	[98] <b>Tc</b> technetium 43	101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45	106 <b>Pd</b> palladium 46	108 <b>Ag</b> silver 47	112 <b>Cd</b> cadmium 48	115 <b>In</b> indium 49	119 <b>Sn</b> tin 50	122 <b>Sb</b> antimony 51	128 <b>Te</b> tellurium 52	127 <b>I</b> iodine 53	131 <b>Xe</b> xenon 54				
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	178 <b>Hf</b> hafnium 72	181 <b>Ta</b> tantalum 73	184 <b>W</b> tungsten 74	186 <b>Re</b> rhenium 75	190 <b>Os</b> osmium 76	192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	197 <b>Au</b> gold 79	201 <b>Hg</b> mercury 80	204 <b>Tl</b> thallium 81	207 <b>Pb</b> lead 82	209 <b>Bi</b> bismuth 83	[209] <b>Po</b> polonium 84	[210] <b>At</b> astatine 85	[222] <b>Rn</b> radon 86				
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108	[268] <b>Mt</b> meitnerium 109	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated										

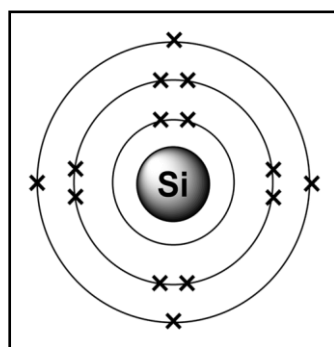
\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.  
 The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

**Example:** Silicon  
 Atomic number is 14, so it has 14 electrons.

You build up electrons from the first shell outwards, so in this case:

- First shell has 2
- Second shell has 8
- Third shell has 4

28
<b>Si</b>
silicon
14



This can be written as: **2.8.4**; or drawn as:

## Electron configuration and how it links to the Periodic Table:

Group number: shows the number of electrons in the outer electron shell  
 Period number: shows the number of electron shells  
 In the above example, we can see Silicon belongs to group 4, and is in period 3.

# KS4 Chemistry - Chemical Bonding and Types of Substances (part 1)

Ionic	Particles are oppositely charged ions	Occurs in compounds formed from metals combined with non metals.
Covalent	Particles are atoms that share pairs of electrons	Occurs in most non metallic elements and in compounds of non metals.
Metallic	Particles are atoms which share delocalised electrons	Occurs in metallic elements and alloys.

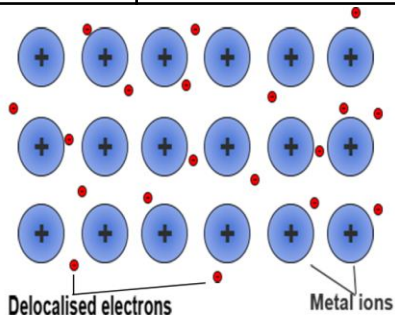
Keyword	Definition
Ion	<i>An atom with an electric charge, caused by the loss or gain of electrons.</i>
Cation	<i>A positively charged ion.</i>
Anion	<i>A negatively charged ion.</i>
Electrostatic force	<i>The attractive or repulsive force between two electrically charged objects.</i>
Attraction	<i>The electric force that acts between oppositely charged bodies, tending to draw them together.</i>
Intermolecular force	<i>Forces of attraction which act between molecules.</i>
Atom	<i>The smallest unit into which matter can be divided without the release of electrically charged particles.</i>
Element	<i>An element is a substance whose atoms all have the same number of protons.</i>
Compound	<i>A substance formed when two or more chemical elements are chemically bonded together.</i>
Transfer	<i>Movement of a particle from one place to another.</i>
Share	<i>Two bodies having equal portions distributed between the two.</i>
Delocalised electron	<i>An electron that is not associated with a particular atom within a shell, or held in a covalent bond.</i>
Proton	<i>A particle found in the nucleus of an atom, having a positive charge and the same mass as a neutron.</i>
Neutron	<i>A particle found in the nucleus of an atom having zero charge and a mass of 1.</i>
Electron	<i>A tiny particle with a negative charge and very little mass.</i>
Shell	<i>Area around a nucleus that can be occupied by electrons and usually drawn as circles.</i>
Nucleus	<i>The central part of an atom or ion.</i>

Keyword	Definition
Ionic bond	<i>A strong electrostatic force of attraction between oppositely charged ions.</i>
Covalent bond	<i>The bond formed when a pair of electrons is shared between two atoms.</i>
Metallic bond	<i>The type of bonding found in metals. Positively charged ions in a 'sea' of negatively charged electrons.</i>
Lattice Structure	<i>An arrangement of many particles that are bonded together in a fixed, regular, grid-like pattern</i>
Melting point	<i>The temperature at which a substance changed fro the solid state to the liquid state when heated, or from the liquid state to solid state when cooled.</i>
Boiling point	<i>The temperature at which a substance changed from a liquid to a gas.</i>
Charge	<i>Also known as electric charge, is a characteristic of a unit of matter that expresses the extent to which it has more or fewer electrons than protons.</i>
Electrical conductivity	<i>Allowing electricity to pass through.</i>
Aqueous solution	<i>A mixture that is formed when a substance is dissolved in water.</i>
Molten	<i>A substance that has been liquefied by heat.</i>
Electron pair	<i>Two electrons occupying the same orbital in an atom or molecule, especially forming a nonpolar covalent bond between atoms.</i>

## Metallic bonding

**Giant structure of atoms arranged in a regular pattern**

Electrons in the outer shell of metal atoms are delocalised and free to move through the whole structure. This sharing of electrons leads to strong metallic bonds.



**High melting and boiling points**

This is due to the strong metallic bonds.

**Pure metals can be bent and shaped**

Atoms are arranged in layers that can slide over each other.

**Good conductors of electricity and heat**

Delocalised electrons transfer energy.

## Ionic bonding

**High melting and boiling points**

Large amounts of energy needed to break the bonds.

**Do not conduct electricity when solid**

Ions are held in a fixed position in the lattice and cannot move.

**Do conduct electricity when molten or dissolved**

Lattice breaks apart and the ions are free to move.

**Electrons are transferred so that all atoms have a noble gas configuration (full outer shells).**

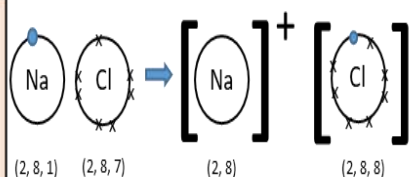
*Metal atoms lose electrons and become positively charged ions*

Group 1 metals form +1 ions  
Group 2 metals form +2 ions

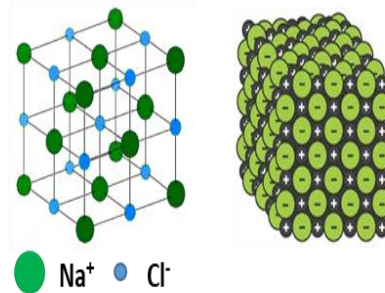
*Non metals atoms gain electrons to become negatively charged ions*

Group 6 non metals form -2 ions  
Group 7 non metals form -1 ions

**Dot and cross diagram**



**Giant structure**



Structure

- Lattices consist of a regular arrangement of atoms
- Held together by strong electrostatic forces of attraction between oppositely charged ions
  - Forces act in all directions in the lattice

**-ide**

If a compound name ends in -ide, it usually contains only two elements.

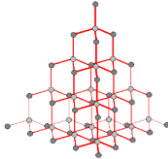
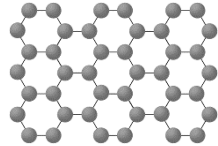
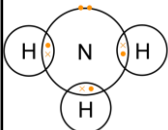
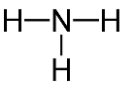

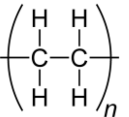
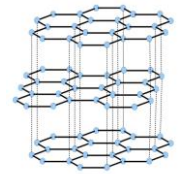
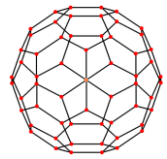
For example:  
calcium + oxygen → calcium oxide

**-ate**

If a compound name ends in -ate, it usually contains three or more elements one of which is always oxygen.

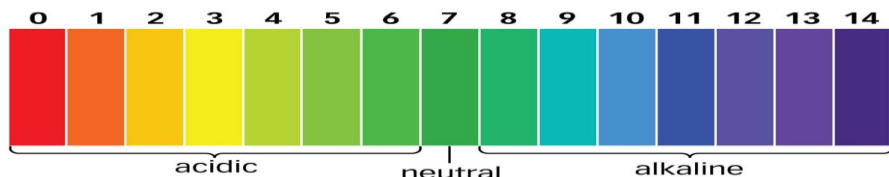
For example:  
Calcium + carbon + oxygen → calcium carbonate

## Covalent bonding

Simple molecular compounds		Giant covalent structures									
<b>Low melting and boiling points</b>	Small amounts of energy needed to overcome the intermolecular forces.	<b>Diamond</b>		<b>Graphene and fullerenes</b>							
<b>Poor conductors of electricity</b>	No free electrons to transfer energy.	<b>Each carbon atom is bonded to four others</b> 	Very hard.	Rigid structure.	<b>Graphene</b> 	Excellent conductor.	Contains delocalised electrons.				
<b>Size of atoms and molecules</b>	Simple molecular structures consist of atoms joined by strong covalent bonds. This means that atoms are smaller than simple molecules.		Very high melting point.	Strong covalent bonds.		Single layer of graphite one atom thick	Very strong.	Contains strong covalent bonds.			
			Does not conduct electricity.	No delocalised electrons.							
<b>Atoms share pairs of electrons</b>  Can be small molecules e.g. ammonia   Dot and cross : + Show which atom the electrons in the bonds come from - All electrons are identical   2D with bonds: + Show which atoms are bonded together - It shows the H-C-H bond incorrectly at 90°   3D ball and stick model: + Attempts to show the H-C-H bond angle is 109.5°  Can be giant covalent structures e.g. polymers   Simple polymers consist of large chains of hydrocarbons.		Used for cutting tools due to being very hard.									
		<b>Graphite</b>		<b>Each carbon atom is bonded to three others forming layers of hexagonal rings with no covalent bonds between the layers</b> 		<b>Fullerenes</b> 		Hexagonal rings of carbon atoms with hollow shapes. Can also have rings of five (pentagonal) or seven (heptagonal) carbon atoms.			
										Slippery.	Layers can slide over each other.
		Very high melting point.	Strong covalent bonds.								
		Does conduct electricity.	Delocalised electrons between layers.	<b>Diamond, graphite, silicon dioxide</b>		Very high melting points	Lots of energy needed to break strong, covalent <b>72</b> bonds.				
		Used for electrodes as is inert.									



# KS4 Chemistry – Acids and Alkalis (part 1)



The pH scale and indicators

<b>Acids</b>	Acids produce hydrogen ions (H <sup>+</sup> ) in aqueous solutions.
<b>Alkalis</b>	Aqueous solutions of alkalis contain hydroxide ions (OH <sup>-</sup> ).
<b>Base</b>	A base is any substance that reacts with an acid to form a salt and water only
<b>Examples of soluble bases</b>	Alkalis e.g. sodium hydroxide, potassium hydroxide

<b>Universal indicator</b>	Red in acid, green in neutral and blue in alkali
<b>Litmus</b>	Red in acid, purple in neutral and blue in alkali
<b>Methyl orange</b>	Red in acid, yellow in neutral and yellow in alkali
<b>Phenolphthalein</b>	Colourless in acid and in neutral and pink in alkali
<b>A neutralisation reaction is between an acid and a base</b>	In neutralisation reactions, hydrogen ions react with hydroxide ions to produce water: $H^+ + OH^- \rightarrow H_2O$

## Reactions with acids

<b>Metals</b>	Metal + acid → metal salt + hydrogen	Magnesium + hydrochloric acid → magnesium chloride + hydrogen
<b>Metal oxides</b>	Metal oxide + acid → metal salt + water	Copper oxide + sulfuric acid → copper sulfate + water
<b>Metal hydroxides</b>	Metal hydroxide + acid → metal salt + water	Sodium hydroxide + nitric acid → sodium nitrate + water
<b>Metal carbonates</b>	Metal carbonates + acid → metal salt + carbon dioxide + water	Calcium carbonate + sulfuric acid → calcium sulfate + carbon dioxide + water

Gas	Test	Positive result
<b>Hydrogen</b>	Burning splint	'squeaky pop' sound.
<b>Carbon dioxide</b>	Limewater	Goes cloudy (as a solid calcium carbonate forms).

Keyword	Definition
H <sup>+</sup> ion	A positively charged hydrogen ion
OH <sup>-</sup> ion	A negatively charged, diatomic hydroxide ion.
Aqueous solution	A mixture that is formed when a substance is dissolved in water.
Acid	A solution that reacts with alkalis, turns litmus red and has a pH of less than 7.
Alkali	A solution which contains an excess of OH <sup>-</sup> ions, turns litmus blue and has a pH greater than 7.
Base	A substance that will react with an acid to form only a salt and water.
pH scale	A scale going up to 14 showing acidity or alkalinity.
Indicator	A substance which can change colour depending on the pH of a solution.
Concentration	The amount of a solute dissolved in a certain volume of solvent.
Concentrated	Containing a large amount of solute dissolved in a small volume of solvent.
Dilute	A low concentration of solute in a solution.
Strong acid	An acidic solute that dissolves completely into ions when it dissolves.
Weak acid	An acidic solute that does not dissociate completely into ions when it dissolves.
Salt	A compound formed by neutralisation of an acid by a base.
Filtration	Using a filter to separate insoluble substances from a liquid.
Crystallisation	Separating the solute from a solution by evaporating the solvent.
Soluble	A substance that can be dissolved in a certain liquid.
Insoluble	A substance that cannot be dissolved in a certain liquid.
Solute	Describes a substance that dissolves in a liquid to make a solution.
Solvent	Describes the liquid in which a substance dissolves to make a solution.
Solution	Formed when a substance has dissolved in a liquid.
Burette	A piece of apparatus used to accurately measure the volume of solution that has been added during a titration.
Pipette	A piece of apparatus used in a titration to accurately measure a set volume of a solution.
End-point	When just enough solution has been added from the burette to react with all the solution in the flask in a titration experiment.
Ionic equation	A balanced equation that only shows the ions that react together. The spectator ions are not included.
Half equation	A chemical equation written to describe an oxidation or reduction half-reaction.
Spectator ion	These are ions that do not change within a reaction.

## KS4 Chemistry – Acids and Alkalis (part 2)

### Making pure, dry insoluble salts

<b>Step 1</b>	Add insoluble reactant (e.g. metal oxide) to acid	Add until there is an excess of insoluble reactant.
<b>Step 2</b>	Filter the solution	Collect the filtrate in a conical flask and dispose of the residue.
<b>Step 3</b>	Crystallisation	Heat the filtrate using a Bunsen burner to evaporate the water from the solution.
<b>Step 4</b>	Evaporation	Leave the evaporating basin with the heated filtrate to evaporate any remaining water and make pure, dry insoluble salts.

Titration is used to work out the precise volumes of acid and alkali solutions that react with each other to form salt and water.

<b>Step 1</b>	Use the pipette to add 25 cm <sup>3</sup> of alkali to a conical flask and add a few drops of indicator.
<b>Step 2</b>	Fill the burette with acid and note the starting volume. Slowly add the acid from the burette to the alkali in the conical flask, swirling to mix.
<b>Step 3</b>	Stop adding the acid when the end-point is reached (the appropriate colour change in the indicator happens). Note the final volume reading. Repeat steps 1 to 3 until you get consistent readings.

State Symbol	Meaning
<b>s</b>	Solid
<b>l</b>	Liquid
<b>g</b>	Gas
<b>aq</b>	Aqueous solution

### Producing salts from soluble reactants

<b>Soluble salts</b>	Soluble salts can be made from reacting acids with solid insoluble substances (e.g. metals, metal oxides, hydroxides and carbonates).
<b>Production of soluble salts</b>	Add the solid to the acid until no more dissolves. Filter off excess solid and then crystallise to produce solid salts.

### Solubility

<b>Sodium, potassium and ammonium</b>	All common sodium, potassium and ammonium salts are soluble e.g. sodium chloride and potassium fluoride.
<b>Nitrates</b>	All nitrates are soluble e.g. potassium nitrate.
<b>Sulfates</b>	Common chlorides (e.g. sodium chloride) are soluble, except those of silver and lead.
<b>Carbonates and hydroxides</b>	Common carbonates and hydroxides are insoluble except those of sodium, potassium and ammonium.

### Strong and weak acids (HT ONLY)

<b>Concentrated</b>	High mass of substance in a given volume of solution
<b>Dilute</b>	Low mass of substance in a given volume of solution
<b>Strong acids</b>	Completely ionised in aqueous solutions e.g. hydrochloric, nitric and sulfuric acids.
<b>Weak acids</b>	Only partially ionised in aqueous solutions e.g. ethanoic acid, citric acid.
<b>Hydrogen ion concentration</b>	As the pH decreases by one unit (becoming a stronger acid), the hydrogen ion concentration increases by a factor of 10. <b>74</b>

# KS4 Chemistry – Calculations involving masses

## 1. How to find an empirical formula:

Example: 10.0g of calcium reacts with 17.8g of chlorine. Find the empirical formula of the product that is formed.

1. Symbol	Ca	Cl
2. Mass (g)	10.0	17.8
3. $A_r$	40.0	35.5
4. Divide mass by $A_r$	$\frac{10.0}{40} = 0.25$	$\frac{17.8}{35.5} = 0.50$
5. Divide answers by smallest number	$\frac{0.25}{0.25} = 1$	$\frac{0.50}{0.25} = 2$
6. Empirical formula	CaCl <sub>2</sub>	

## 2. How to deduce the molecular formula from the empirical formula and relative formula mass:

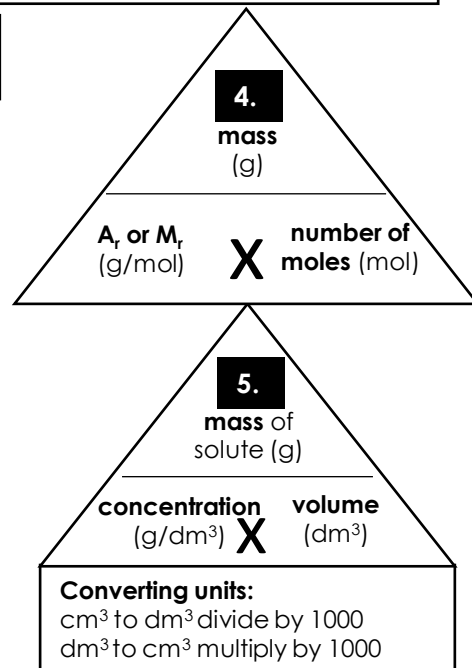
Example: The empirical formula for glucose is CH<sub>2</sub>O and its relative formula mass is 180. Deduce the molecular formula for glucose.

1. Find the empirical formula mass by adding up the relative atomic masses of all of the atoms	C + H + H + O 12 + 1 + 1 + 16 = 30
2. Divide the relative formula mass by the empirical formula mass	$\frac{180}{30} = 6$
3. Multiply the numbers in the empirical formula to get the molecular formula	<ul style="list-style-type: none"> <li>• CH<sub>2</sub>O x 6</li> <li>• So C<sub>6</sub>H<sub>12</sub>O<sub>6</sub></li> </ul>

## 3. How to calculate the masses of reactants or products:

Example: Calculate the mass of chlorine needed to make 53.4g of aluminium chloride.

1. Write the balanced equation	2Al + 3Cl <sub>2</sub> -> 2AlCl <sub>3</sub>
2. Calculate $M_r$ of substances in the question	<ul style="list-style-type: none"> <li>• <math>M_r</math> Cl<sub>2</sub> = 2 x 35.5 = 71</li> <li>• <math>M_r</math> AlCl<sub>3</sub> = 27 + (3 x 35.5) = 133.5</li> </ul>
3. Calculate the ratio of masses	<ul style="list-style-type: none"> <li>• 3Cl<sub>2</sub> makes 2AlCl<sub>3</sub></li> <li>• (3 x 71) Cl<sub>2</sub> makes (2 x 133.5)AlCl<sub>3</sub></li> <li>• 213g Cl<sub>2</sub> makes 267g AlCl<sub>3</sub></li> </ul>
4. Divide to work out the mass for 1g of product	<ul style="list-style-type: none"> <li>• <math>\frac{213g}{267}</math> Cl<sub>2</sub> makes <math>\frac{267g}{267}</math> AlCl<sub>3</sub></li> <li>• 0.798g Cl<sub>2</sub> makes 1g AlCl<sub>3</sub></li> </ul>
5. Multiply to scale up	<ul style="list-style-type: none"> <li>• (0.798g x 53.4) Cl<sub>2</sub> makes (1g x 53.4) AlCl<sub>3</sub></li> <li>• 42.6g Cl<sub>2</sub> makes 53.4g AlCl<sub>3</sub></li> </ul>



## 6. Keyword

## 7. Definition

atom	The smallest neutral part of an element that can take place in chemical reactions.
Avogadro constant*	The number of particles in one mole of a substance ( $6.02 \times 10^{23}$ atoms, molecules, formulae or ions).
closed system	Substances cannot enter or leave such as a precipitation reaction in a stoppered flask.
concentration	The amount of solute dissolved in a stated volume of a solution. Units include g/dm <sup>3</sup> .
conservation of mass	During a chemical reaction, the overall mass of substances does not change so the total mass of reactants is equal to the total mass of products.
empirical formula	The simplest whole number ratio of atoms or ions of each element in a substance.
excess reactant	There is more of this reactant present than is needed so it is not completely used up in a reaction.
limiting reactant	There is less of this reactant present than is needed so it is completely used up in a reaction. The mass of product formed is controlled by this reactant.
mole*	One mole of particles of a substance is defined as: a) the Avogadro constant number of particles ( $6.02 \times 10^{23}$ atoms, molecules, formulae or ions) of that substance b) a mass of 'relative particle mass' g. The SI unit symbol is mol.
molecular formula	This represents the actual number of atoms of each element in one molecule.
molecule	A particle consisting of two or more atoms joined together by bonds.
open system	Substances can enter or leave such as a reaction in an open flask that takes in or gives out a gas.
precipitate	An insoluble substance that is formed when two soluble substances react together in solution.
precipitation	A reaction in which a precipitate is formed.
product	A substance formed in a reaction.
reactant	A substance used up in a reaction.
reaction	A process in which reactants are converted to different substances called products.
relative atomic mass	( $A_r$ ) The mean mass of an atom relative to the mass of an atom of C-12 which is assigned a mass of 12. Unit is g/mol.
relative formula mass	( $M_r$ ) The sum of the relative atomic masses of all the atoms or ions in its formula. Unit is g/mol.
stoichiometry*	The ratio of moles of each substance in a reaction.
volume	The amount of space that a liquid takes up. Units include cm <sup>3</sup> and dm <sup>3</sup> .

# KS4 Chemistry – Electrolytic Processes

Key Word	Definition
<b>Electrolysis</b>	Decomposition/break down of a compound using electrical energy.
<b>Ions</b>	Charged particle.
<b>Cations</b>	Positively charged ions, formed by losing electrons. Usually metal form cations.
<b>Anions</b>	Negatively charged ions, formed by gaining electrons. Usually non-metal form anions.
<b>Electrodes</b>	A rod made of metal or carbon which carries the current in the electrolyte.
<b>Cathode</b>	An electrode that is negatively charged.
<b>Anode</b>	An electrode that is positively charged.
<b>Electrolyte</b>	Ionic liquid where moving ions carry the current during electrolysis
<b>Reduction</b>	When a positive ion gains electrons.
<b>Oxidation</b>	When a negative ion loses electrons.
<b>Discharged</b>	When ions convert to elements due to transfer of electrons during electrolysis.
<b>(H) Half equations</b>	Ionic equation showing transfer of electrons in oxidation and reduction.

<b>Process of electrolysis</b>	<b>Splitting up using electricity</b>	When an ionic compound is melted or dissolved in water, the ions are free to move. These are then able to conduct electricity and are called electrolytes. Passing an electric current through electrolytes causes the ions to move to the electrodes.
<b>Electrode</b>	<b>Anode Cathode</b>	The positive electrode is called the anode. The negative electrode is called the cathode.
<b>Where do the ions go?</b>	<b>Cations Anions</b>	Cations are positive ions and they move to the negative cathode. Anions are negative ions and they move to the positive anode.

Oxidation Is Loss, Reduction Is Gain

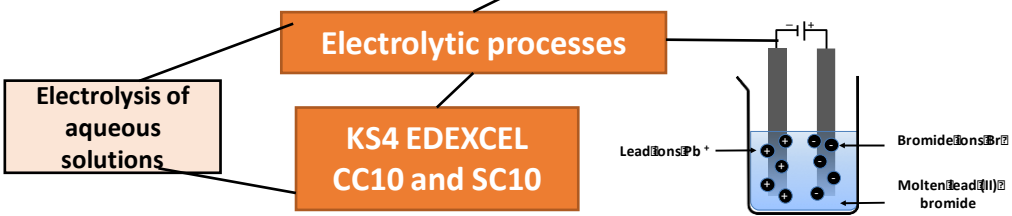
**Extracting metals using electrolysis**

Metals can be extracted from molten compounds using electrolysis.

This process is used when the metal is too reactive to be extracted by reduction with carbon.

The process is expensive due to large amounts of energy needed to produce the electrical current.

Example: aluminium is extracted in this way.



**Higher tier: You can display what is happening at each electrode using half-equations:**

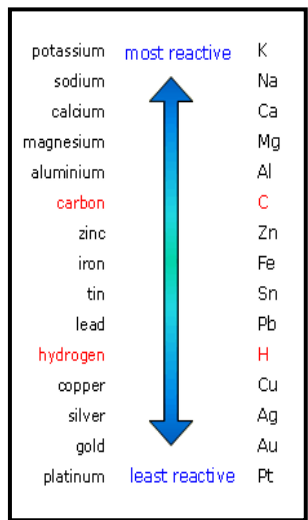
At the cathode:  $Pb^{2+} + 2e^{-} \rightarrow Pb$

At the anode:  $2Br^{-} \rightarrow Br_2 + 2e^{-}$

<b>At the negative electrode</b>	Metal will be produced on the electrode if it is less reactive than hydrogen. Hydrogen will be produced if the metal is more reactive than hydrogen.
<b>At the positive electrode</b>	Oxygen is formed at positive electrode. If you have a halide ion (Cl <sup>-</sup> , I <sup>-</sup> , Br <sup>-</sup> ) then you will get chlorine, bromine or iodine formed at that electrode.

The ions discharged when an aqueous solution is electrolysed using inert electrodes depend on the relative reactivity of the elements involved.

<b>Using copper</b>	<b>Copper is a very good electrical conductor</b>	Much of the copper available isn't pure enough for this use so it is purified using electrolysis.
<b>Copper sulfate solution</b>	<b>The anode is made of impure copper and the cathode is made of pure copper</b>	Both electrodes are placed in copper sulfate solution. Copper ions (Cu <sup>2+</sup> ) leave the anode and are attracted to the cathode.
<b>Electrodes</b>	<b>The cathode of pure copper builds up</b>	The anode decreases in size. The impurities left behind form a sludge.

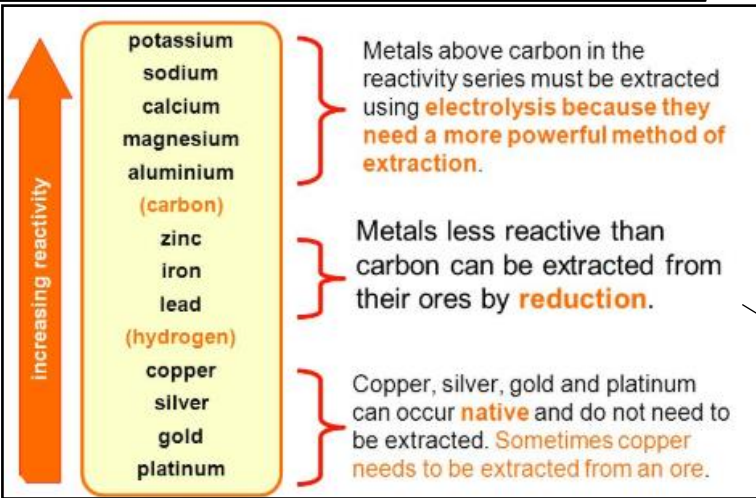


negative ion in solution	element given off at positive electrode
chloride, Cl <sup>-</sup>	chlorine, Cl <sub>2</sub>
bromide, Br <sup>-</sup>	bromine, Br <sub>2</sub>
iodide, I <sup>-</sup>	iodine, I <sub>2</sub>
sulfate, SO <sub>4</sub> <sup>2-</sup>	oxygen, O <sub>2</sub>

# KS4 Chemistry – Obtaining and Using Metals (part 1)

**Oxidation** is **Loss** (of electrons)  
**Reduction** is **Gain** (of electrons)

**HT ONLY:** Reactions between metals and acids are redox reactions as the metal donates electrons to the hydrogen ions. This displaces hydrogen as a gas while the metal ions are left in the solution.



**Extraction using carbon**

Metals less reactive than carbon can be extracted from their oxides by reduction.

For example:  
 $\text{zinc oxide} + \text{carbon} \rightarrow \text{zinc} + \text{carbon dioxide}$

Unreactive metals, such as gold, are found in the Earth as the metal itself. They can be mined from the ground. More reactive metals are obtained by displacement or electrolysis.

## Extraction of metals and reduction

	Reactions with water	Reactions with acid
Group 1 metals	Reactions get more vigorous as you go down the group	Reactions get more vigorous as you go down the group
Group 2 metals	Do not react with water	Observable reactions include fizzing and temperature increases
Zinc, iron and copper	Do not react with water	Zinc and iron react slowly with acid. Copper does not react with acid.

## Reactions of acids and metals

Acids react with some metals to produce salts and hydrogen.

**Reactions with acids**

$\text{metal} + \text{acid} \rightarrow \text{metal salt} + \text{hydrogen}$

magnesium + hydrochloric acid  $\rightarrow$  magnesium chloride + hydrogen

zinc + sulfuric acid  $\rightarrow$  zinc sulfate + hydrogen

## Obtaining and Using Metals CC11 and SC11

## The reactivity series

Metal	Reaction with water	Reaction with dilute acids	Reactivity
Potassium	Violent with cold water	Violent	Most reactive  Least reactive
Sodium			
Calcium	Slow with cold water Rapid with steam	Rapid	
Magnesium			
Aluminium			
Zinc	Usually no reaction	Slow	
Iron	Rusts slowly		
(Hydrogen)			
Copper			
Silver	No reaction	No reaction	
Gold			

Metals form positive ions when they react	The reactivity of a metal is related to its tendency to form positive ions	The reactivity series arranges metals in order of their reactivity (their tendency to form positive ions).
Carbon and hydrogen	Carbon and hydrogen are non-metals but are included in the reactivity series	These two non-metals are included in the reactivity series as they can be used to extract some metals from their ores, depending on their reactivity.
Displacement	A more reactive metal can displace a less reactive metal from a compound.	Silver nitrate + Sodium chloride $\rightarrow$ Sodium nitrate + Silver chloride



# KS4 Chemistry – Obtaining and Using Metals (part 2)

Biological methods of metal extraction		
Metals ores	<i>These resources are limited</i>	Copper ores especially are becoming sparse. New ways of extracting copper from low-grade ores are being developed.
Phytomining	<i>Plants absorb metal compounds</i>	These plants are then harvested and burned; their ash contains the metal compounds.
Bioleaching	<i>Bacteria is used to produce leachate solutions that contain metal compounds</i>	The metal compounds can be processed to obtain the metal from it e.g. copper can be obtained from its compounds by displacement or electrolysis.

Oxidation and reduction in terms of electrons (HT ONLY)		
Metals and oxygen	<i>Metals react with oxygen to form metal oxides</i>	magnesium + oxygen → magnesium oxide $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$
Reduction	<i>This is when oxygen is removed from a compound during a reaction</i>	e.g. metal oxides reacting with hydrogen, extracting low reactivity metals
Oxidation	<i>This is when oxygen is gained by a compound during a reaction</i>	e.g. metals reacting with oxygen, rusting of iron

Ionic half equations (HT only)		
For displacement reactions	<i>Ionic half equations show what happens to each of the reactants during reactions</i>	For example: The ionic equation for the reaction between iron and copper (II) ions is: $\text{Fe} + \text{Cu}^{2+} \rightarrow \text{Fe}^{2+} + \text{Cu}$
		The half-equation for iron (II) is: $\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$
		The half-equation for copper (II) ions is: $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$

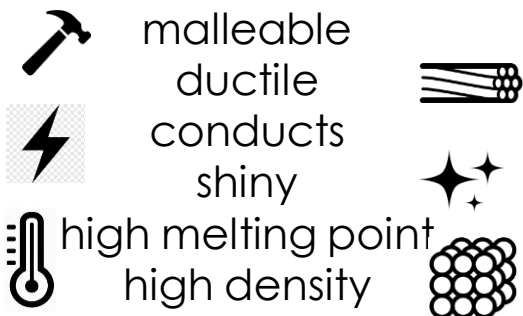
Ways of reducing the use of resources		
Reduce, reuse and recycle	<i>This strategy reduces the use of limited resources</i>	This, therefore, reduces energy sources being used, reduces waste (landfill) and reduces environmental impacts.
Limited raw materials	<i>Used for metals, glass, building materials, plastics and clay ceramics</i>	Most of the energy required for these processes comes from limited resources. Obtaining raw materials from the Earth by quarrying and mining causes environmental impacts.
Reusing and recycling	<i>Metals can be recycled by melting and recasting/reforming</i>	Glass bottles can be reused. They are crushed and melted to make different glass products. Products that cannot be reused are recycled.

Life cycle assessment		
LCAS	<i>Life cycle assessments are carried out to assess the environmental impact of products</i>	They are assessed at these stages: <ul style="list-style-type: none"> <li>- Extraction and processing raw materials</li> <li>- Manufacturing and packaging</li> <li>- Use and operation during lifetime</li> <li>- Disposal</li> </ul>
Values	<i>Allocating numerical values to pollutant effects is difficult</i>	Value judgments are allocated to the effects of pollutants so LCA is not a purely objective process.

Word	Definition
Reactivity series	List of metals in the order of reactivity
Cations	Positive ions
Displacement reactions	When a reactive metal replaces a less reactive metal
Extraction	Taking a metal out of a compound
Native state	Unreactive metals found naturally
Electrolysis	Passing electricity through molten ionic compound to decompose it into its elements
Oxidation	Gain of oxygen by a substance
Reduction	Loss of oxygen by a substance
Redox	Reactions in which oxidation and reduction occurs
Corrosion	When a metal reacts with oxygen and sometimes with water

# KS4 – Chemistry – Transition Metals

## 1. Physical properties



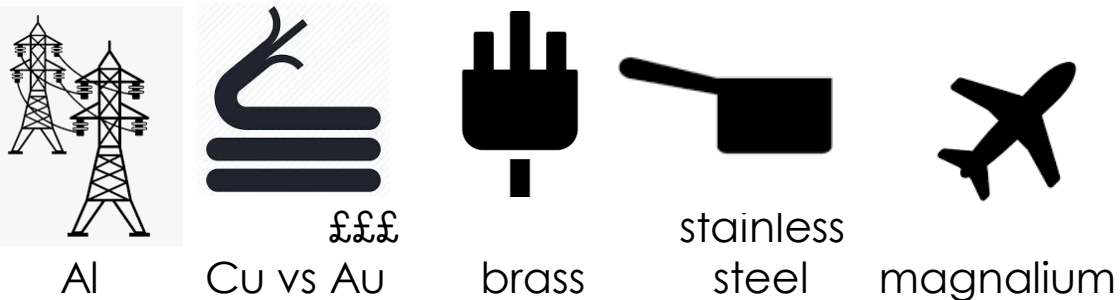
## 2. Chemical properties



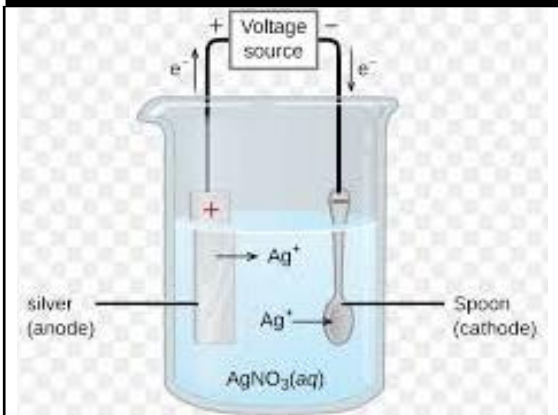
## 3. Corrosion

iron + oxygen → hydrated iron(III) oxide  
+ water

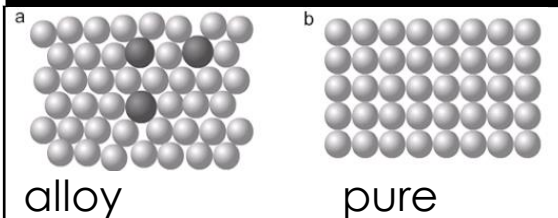
## 6. Uses



## 4. Electroplating



## 5. Alloying



## 7. Keyword

## 8. Definition

<b>alloy</b>	A metal with one or more other metals added to improve its properties.
<b>alloy steel</b>	Iron with other elements added to it. eg high strength steel – has a high carbon content (strong, hard) eg mild steel – has a low carbon content (strong, malleable) eg stainless steel – contains chromium (oxidises to resist rusting) eg tool steel – contains tungsten and molybdenum (strong, tough)
<b>anode</b>	Positive electrode.
<b>catalyst</b>	A substance that speeds up the rate of a reaction without being used up itself.
<b>cathode</b>	Negative electrode.
<b>corrosion</b>	The gradual deterioration of a substance when it reacts with substances in the environment – eg when a metal oxidises.
<b>ductile</b>	A substance that can be stretched out to make a thin wire.
<b>electrolyte</b>	An ionic compound that is molten or dissolved in water.
<b>electroplating</b>	Using electricity to coat one metal with a thin layer of another metal.
<b>galvanising</b>	Coating iron or steel with a thin layer of zinc to improve its resistance to rusting.
<b>malleable</b>	A substance that can be rolled or hammered into shape without shattering.
<b>oxidise</b>	To combine a substance chemically with oxygen.
<b>pure metal</b>	A metal that has a fixed composition with nothing else mixed with it.
<b>rusting</b>	The corrosion of iron or steel – water and oxygen must be present.
<b>sacrificial protection</b>	Using a more reactive metal to protect iron from rusting.
<b>tarnish</b>	A thin layer that forms on a metal due to oxidation.
<b>tin plating</b>	Electroplating steel with tin to protect it from rusting.

# KS4 Chemistry Quantitative Analysis

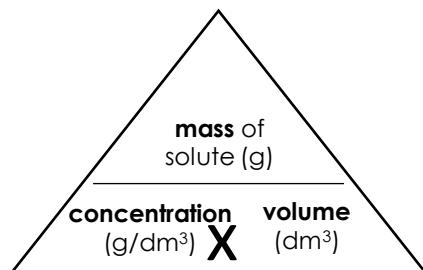
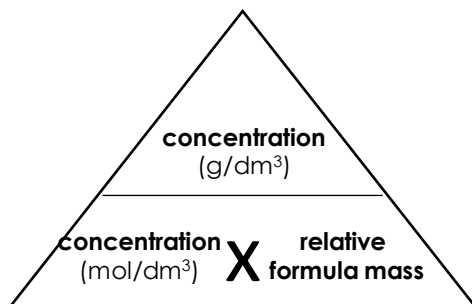
## 1. Percentage yield

- percentage yield =  $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$
- Less than 100% due to:
  - an incomplete reaction
  - side reactions
  - loss of product

## 2. Atom economy

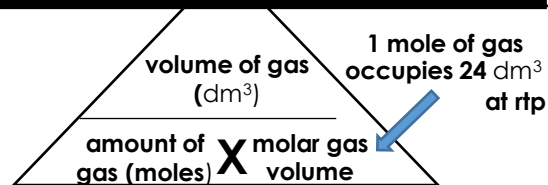
- atom economy =  $\frac{\text{relative formula masses of the useful product}}{\text{sum of relative formula masses of all reactants}} \times 100$
- We want it to be as high as possible
- It can be increased by finding a different way to make the product

## 3. Concentration

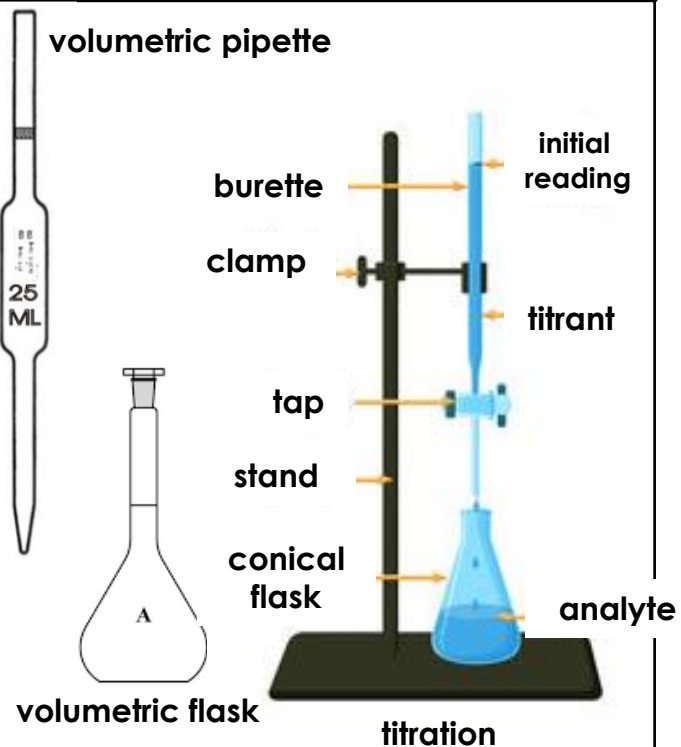


**Converting units:**  
 cm<sup>3</sup> to dm<sup>3</sup> divide by 1000  
 dm<sup>3</sup> to cm<sup>3</sup> multiply by 1000

## 5. Molar volume of gases



## 4. Titrations



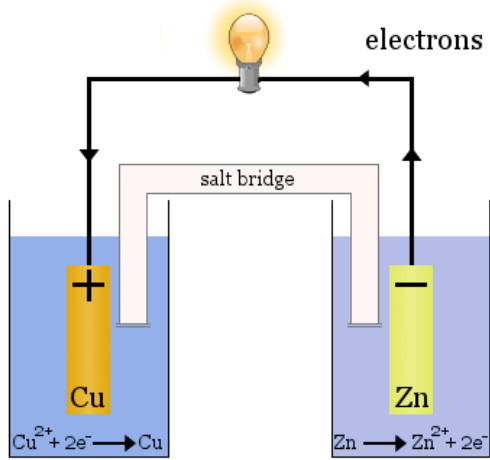
## 6. Keyword

## 7. Definition

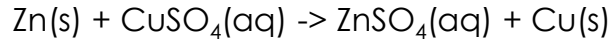
<b>actual yield</b>	The actual amount of product obtained from a chemical reaction.
<b>atom economy</b>	The percentage, by mass, of reactants that are converted into useful products.
<b>Avogadro's law</b>	If the temperature and pressure are the same, equal volumes of different gases contain an equal number of molecules.
<b>burette</b>	A piece of apparatus used to accurately measure the volume of solution that has been added during a titration.
<b>by-product</b>	Substance produced in a chemical reaction in addition to the desired product.
<b>calibrated</b>	Marked with a scale for accurate readings.
<b>concentration</b>	The amount of solute dissolved in a certain volume of solvent.
<b>concordant</b>	Readings that have been taken several times and are identical, or close to each other.
<b>end-point</b>	When just enough solution has been added from the burette to react with all the solution in the flask.
<b>indicator</b>	A substance which changes colour depending on the pH.
<b>molar gas volume</b>	The volume occupied by one mole of any gas. It is 24dm <sup>3</sup> at rtp.
<b>side reactions</b>	A reaction which takes place at the same time as another main reaction.
<b>theoretical yield</b>	The maximum calculated amount of a product that could be formed from a given amount of reactants.
<b>titration</b>	A technique in volumetric analysis that is used to find the exact volumes of solutions which react with each other.
<b>volumetric flask</b>	A flask which is accurately calibrated to hold a given volume of solution.
<b>volumetric pipette</b>	This piece of equipment is calibrated to allow extremely accurate measurement of the volume of a solution.



## Chemical cells



- 2 **different metals**.
- Each metal is in a **solution of its salt**.
- A **salt bridge** to allow ions to move between solutions.
- The further apart the metals are in the **reactivity series**, the bigger the voltage made.
- An **exothermic reaction** which mainly transfers energy as **electricity**.

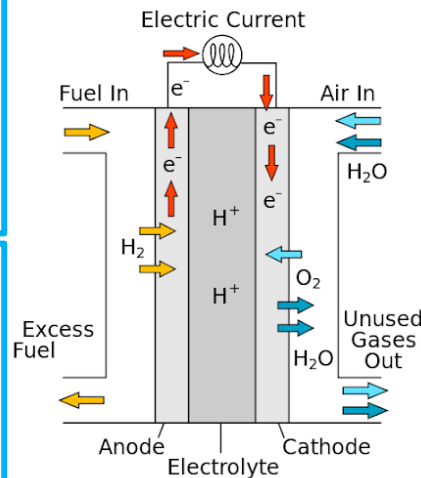


Keyword	Definition
<b>by-product</b>	A substance that is made in addition to the desired product.
<b>chemical cell</b>	A device that produces a voltage due to reactions between the reactants stored inside it, until one of the reactants gets used up (cell goes 'flat').
<b>electrode</b>	A rod made of metal or graphite that carries the current into or out of the electrolyte.
<b>fuel</b>	A substance that releases thermal energy when burned.
<b>fuel cell</b>	A device that produces a voltage due to reactions involving a fuel and oxygen.
<b>greenhouse gas</b>	A gas that helps to trap 'heat' in the atmosphere (eg carbon dioxide, methane, water vapour).
<b>oxidation</b>	A reaction in which oxygen reacts with a chemically joins to a substance. Involves the loss of electrons
<b>reduction</b>	A reaction in which oxygen is removed from a substance. Involves the gain of electrons

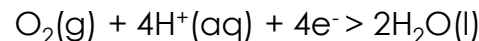
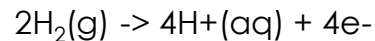
## Fuel Cells – example hydrogen-oxygen cell

- Produces a voltage (electrical energy) by reacting hydrogen with oxygen
- hydrogen + oxygen → water
- $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$
- Hydrogen is oxidised
- Oxygen is reduced

- Need non renewable natural gas to make hydrogen
- Making hydrogen produces carbon dioxide as a by-product
- Hydrogen has to be stored safely (explosive, takes up space)

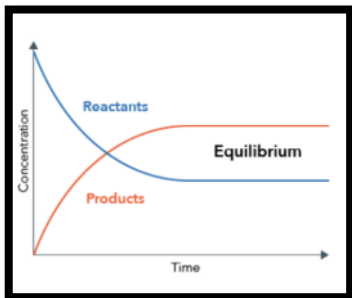


- More efficient than power stations or cells as:
  1. less stages so less heat loss.
  2. no moving parts so no energy lost as friction.
- No need for turbines, generators etc as electricity is generated directly from the reaction.
- Quieter than a petrol or diesel engine.
- Don't produce CO<sub>2</sub>, NO, SO<sub>2</sub>, CO.
- Only by-products are water and heat.



## Reversible Reactions and Equilibria

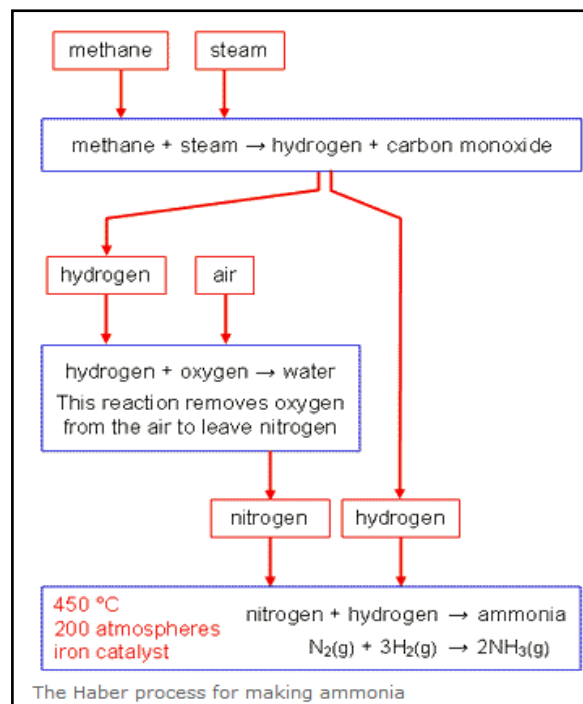
<b>Reversible reactions</b>	In some chemical reactions, the products can react again to re-form the reactants.
<b>Representing reversible reactions</b>	$A + B \rightleftharpoons C + D$
<b>The direction</b>	The direction of reversible reactions can be changed by changing conditions: $A + B \xrightleftharpoons[\text{cool}]{\text{heat}} C + D$



Graph sketch shows in a reversible reaction, the backward reaction gets faster with time, and the forward reaction gets lower with time. When they are occurring at the same rate, dynamic equilibrium has been reached.

<b>Changing concentration</b>	If the concentration of a reactant is increased, more products will be formed. If the concentration of a product is decreased, more reactants will react.
<b>Changing temperature</b>	If the temperature of a system at equilibrium is increased: - Exothermic reaction = products decrease - Endothermic reaction = products increase
<b>Changing pressure (gaseous reactions)</b>	For a gaseous system at equilibrium: - Pressure increase = equilibrium position shifts to side of equation with smaller number of molecules. - Pressure decrease = equilibrium position shifts to side of equation with larger number of molecules.

<b>The Haber process</b>	This process uses nitrogen from the air and hydrogen from natural gas to form ammonia. The reaction is reversible and uses optimum conditions and a catalyst in order to reach dynamic equilibrium.
<b>Optimum temperature</b>	The optimum temperature for the Haber process is 450°C.
<b>Optimum pressure</b>	The optimum pressure for the Haber process is 200 atmospheres.
<b>Optimum conditions</b>	The optimum temperature for the Haber process is 450°C and optimum pressure is 200 atmospheres. These are economically viable conditions as they produce the best yield to cost ratio.
<b>The use of a catalyst</b>	The Haber process uses an iron catalyst. This does not alter the position of the equilibrium but it does increase the rate of the reaction.



Keyword	Definition
Le Chatelier's Principles	States that when a system experiences a disturbance (change in condition), it will respond to restore a new equilibrium state.
Changing concentration	If the concentration of a reactant is increased, more products will be formed. If the concentration of a product is decreased, more reactants will react.
Changing temperature	If the temperature of a system at equilibrium is increased: - Exothermic reaction = products decrease - Endothermic reaction = products increase
Changing pressure (gaseous reactions)	For a gaseous system at equilibrium: - Pressure increase = equilibrium position shifts to side of equation with smaller number of molecules. - Pressure decrease = equilibrium position shifts to side of equation with larger number of molecules.
Equilibrium in reversible reactions	When a reversible reaction occurs in apparatus which prevents the escape of reactants and products, equilibrium is reached when the forward and reverse reactions occur exactly at the same rate.
Equilibrium in reversible reactions	When a reversible reaction occurs in apparatus which prevents the escape of reactants and products, equilibrium is reached when the forward and reverse reactions occur exactly at the same rate.
The Haber Process	This process uses nitrogen from the air and hydrogen from natural gas to form ammonia. The reaction is reversible and uses optimum conditions and a catalyst in order to reach dynamic equilibrium.
NPK fertilisers	Formulations of various salts containing appropriate percentages of the elements.

# KS4 Chemistry Groups in the Periodic Table

Diagram of the periodic table with groups labeled: Alkali metals (1, 2), Transition metals, Halogens (3, 4, 5, 6, 7), Noble gases (0).

H	Transition metals																He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	?	?	?						

Elements arranged in order of atomic number

Elements with similar properties are in columns called groups

Elements in the same group have the same number of outer shell electrons and elements in the same period (row) have the same number of electron shells.

## Group 1

Metal	Reaction with water	Word equation
Lithium	Fizzing	Lithium + water → lithium hydroxide + hydrogen
Sodium	Fizzing more vigorously than lithium	Sodium + water → sodium hydroxide + hydrogen
Potassium	Fizzes and burns with a lilac flame	Potassium + water → potassium hydroxide + hydrogen

Alkali metals	Properties	Electron shells
	Soft and easily cut	Low melting and boiling points.
	Very reactive with oxygen, water and chlorine	Only have one electron in their outer shell. Form +1 ions.
	Reactivity increases down the group	Negative outer electron is further away from the positive nucleus so is more easily lost.

## Group 0

Noble gases	Properties	Reasons
	Unreactive, do not form molecules	This is due to having full outer shells of electrons.
	Boiling points increase down the group	Increasing atomic number.
Helium	Used in balloons	Due to being less dense than air, which means balloons will float.
Neon	Used in signs	Glow when electricity flows through it.
Argon	Used in filament light bulbs	Stops the heated filament reacting with oxygen. Bulbs filled with unreactive argon instead.

## Group 7

Halogens	Properties	Reasons
	Consist of molecules made of a pair of atoms	Have seven electrons in their outer shell. Form -1 ions.
	Melting and boiling points increase down the group (gas → liquid → solid)	Increasing atomic mass number.
	Reactivity decreases down the group	Increasing proton number means an electron is less easily gained as outer shell is further away from nucleus, therefore the attraction force is weaker.

With metals	With hydrogen	With aqueous solution of a halide salt
Forms a metal halide Metal + halogen → metal halide e.g. Sodium + chlorine → sodium chloride	Forms a hydrogen halide Hydrogen + halogen → hydrogen halide e.g. Hydrogen + bromine → hydrogen bromide	A more reactive halogen will displace the less reactive halogen from the salt Chlorine + potassium bromide → potassium chloride + bromine
e.g. NaCl metal atom loses outer shell electrons and halogen gains an outer shell electron	Dissolve in water to form acidic solutions.	(HT) These are redox reactions. The halogen gains electrons and the halide ion from the compound loses electrons.

Keyword	Definition
Reactivity of group 1	The atoms get larger as you go down, so the single electron in the outermost shell (highest energy level) is attracted less strongly to the positive nucleus. The electrostatic attraction with the nucleus gets weaker because the distance between the outer electron and the nucleus increases. Also the outer electron experiences a shielding effect from the inner electrons, reducing the attraction between the oppositely charged outer electron and the nucleus.
Reactivity of group 7	When Group 7 elements react, the atoms gain an electron in their outermost shell. Going down the group, the outermost shell's electrons get further away from the attractive force of the nucleus, so it is harder to attract and gain an extra electron. The outer shell will also be shielded by more inner shells of electrons, again reducing the electrostatic attraction of the nucleus for an incoming electron.
Reactivity of group 0	Elements in Group 0 of the periodic table are called the noble gases. They are unreactive because their atoms have stable arrangements of electrons. The atoms have eight electrons in their outermost shell, apart from helium which has just two but still has a complete outer shell. The stable electronic structure explains why they exist as single atoms; they have no tendency to react to form molecules. The boiling points of the noble gases get higher going down the group. For example, helium boils at -269 °C and radon boils at -62°C.

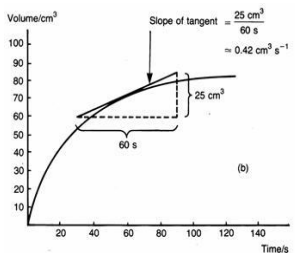
# KS4 Chemistry Rates of Reaction and Energy Changes in Reactions

## Rates of Reaction

Rate of chemical reaction	This can be calculated by measuring the quantity of reactant used or product formed in a given time.	Rate = $\frac{\text{quantity of reactant used}}{\text{time taken}}$ Rate = $\frac{\text{quantity of product formed}}{\text{time taken}}$
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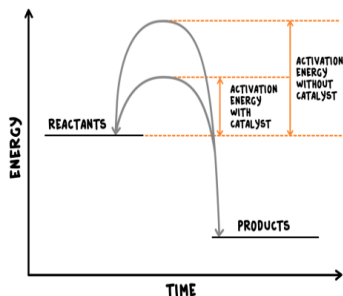
## Factors affecting the rate of reaction

<b>Temperature</b>	The higher the temperature, the quicker the rate of reaction.
<b>Concentration</b>	The higher the concentration, the quicker the rate of reaction.
<b>Surface area</b>	The larger the surface area of a reactant solid, the quicker the rate of reaction.
<b>Pressure (of gases)</b>	When gases react, the higher the pressure upon them, the quicker the rate of reaction.



Quantity	Unit
Mass	Grams (g)
Volume	cm <sup>3</sup>
Rate of reaction	Grams per cm <sup>3</sup> (g/cm <sup>3</sup> ) HT: moles per second (mol/s)

<b>Catalyst</b>	A catalyst changes the rate of a chemical reaction but is not used in the reaction.
<b>Enzymes</b>	These are biological catalysts.
<b>How do they work?</b>	Catalysts provide a different reaction pathway where reactants do not require as much energy to react when they collide.



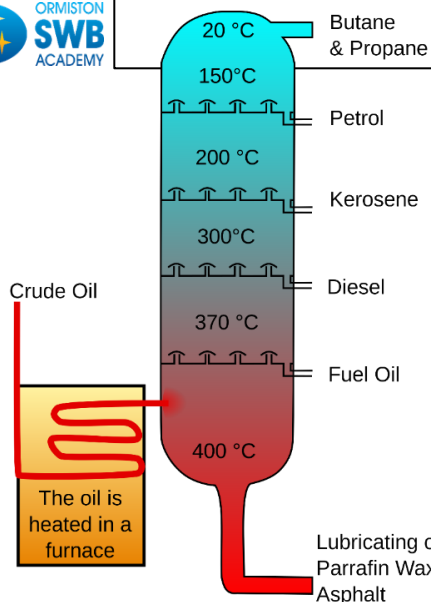
## Energy Changes

<b>Endothermic</b>		Products are at a higher energy level than the reactants. As the reactants form products, energy is transferred from the surroundings to the reaction mixture. The temperature of the surroundings decreases because energy is taken in during the reaction.
<b>Exothermic</b>		Products are at a lower energy level than the reactants. When the reactants form products, energy is transferred to the surroundings. The temperature of the surroundings increases because energy is released during the reaction.

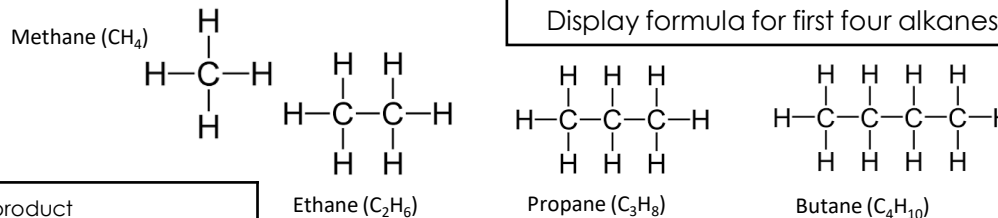
<b>Bond energy calculation</b>	Calculate the overall energy change for the forward reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ Bond energies (in kJ/mol): H-H 436, H-N 391, $\text{N}\equiv\text{N}$ 945
	Bond breaking: $945 + (3 \times 436) = 945 + 1308 = 2253 \text{ kJ/mol}$
	Bond making: $6 \times 391 = 2346 \text{ kJ/mol}$ Overall energy change = $2253 - 2346 = -93 \text{ kJ/mol}$ Therefore reaction is exothermic overall.

Keyword	Definition
Collision theory	Chemical reactions can only occur when reacting particles collide with each other with sufficient energy.
Activation energy	This is the minimum amount of energy colliding particles in a reaction need in order to react.
Heat energy changes	Occur in the following: <ul style="list-style-type: none"> <li>- Salts dissolving in water</li> <li>- Neutralisation reactions</li> <li>- Displacement reactions</li> <li>- Precipitation reactions</li> </ul>
Exothermic reactions	Heat energy is given out as bonds are being formed.
Endothermic reactions	Heat energy is taken in as bonds are being broken.

# KS4 Chemistry Fuels

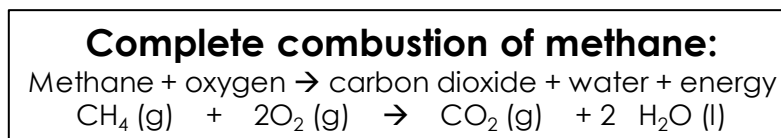


	What happens as the hydrocarbon chain length increases?
<b>Boiling point (temperature at which liquid boils)</b>	↑
<b>Viscosity (how easily it flows)</b>	↑
<b>Flammability (how easily it burns)</b>	↓

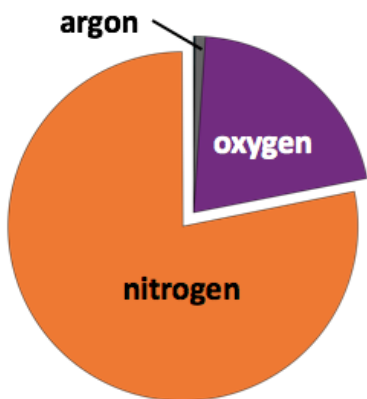


Keyword	Definition
<b>Crude oil</b>	A finite resource. Consisting mainly of plankton that was buried in the mud, crude oil is the remains of ancient biomass.
<b>Hydrocarbons</b>	<ul style="list-style-type: none"> <li>make up the majority of the compounds in crude oil</li> <li>made up of <b>hydrogen and carbon only</b>.</li> </ul>
<b>General formula for alkanes</b>	<b>C<sub>n</sub>H<sub>2n+2</sub></b> for example: C <sub>2</sub> H <sub>6</sub> or C <sub>6</sub> H <sub>14</sub>
<b>Cracking</b>	<ul style="list-style-type: none"> <li>The <b>breaking down</b> of long chain hydrocarbons into <b>smaller, more useful</b> chains.</li> <li>Helps <b>supply</b> meet <b>demand</b>.</li> <li>Can be done by various methods including <b>catalytic cracking and steam cracking</b>.</li> </ul>
<b>Fractions</b>	<ul style="list-style-type: none"> <li>The hydrocarbons in crude oil can be split into fractions.</li> <li>Each fraction contains molecules with a similar number of carbon atoms in them.</li> <li>The process used to do this is called fractional distillation.</li> </ul>
<b>Using fractions</b>	<ul style="list-style-type: none"> <li>Fractions can be processed to produce <b>fuels and feedstock</b> for petrochemical industry.</li> <li>We depend on many of these fuels; <b>petrol, diesel and kerosene</b>.</li> <li>Many useful materials are made by the petrochemical industry; <b>solvents, lubricants and polymers</b>.</li> </ul>

<b>1. Hydrogen fuel</b>	Hydrogen reacts with oxygen in the engine to power the vehicle	<ul style="list-style-type: none"> <li>✓ Water is the product</li> <li>✓ No greenhouse gases released</li> <li>✓ Renewable</li> <li>X Expensive to buy</li> <li>X Difficult to re-fuel</li> </ul>
<b>2. Fossil fuels</b>	Crude oil, natural gas and coal	Petrol, kerosene and diesel oil are non-renewable. Methane is found in natural gas and is also non-renewable.
<b>3. Sulfur dioxide</b>	Released from burning hydrocarbons with sulfur impurities in	Sulfur dioxide dissolves in rain water to form acid rain. This damages plant life and can make water habitats acidic. Acid rain can also erode limestone and sandstone structures.
<b>4. Oxides of nitrogen</b>	Oxygen and nitrogen react under high temperatures to form these.	As pollutants, oxides of nitrogen can damage the ozone layer and are also classified as greenhouse gases. Can cause respiratory problems.
<b>5. Incomplete combustion issues</b>	1. Carbon monoxide is an odourless, toxic gas that can kill	2. Soot (carbon) is also produced that builds up in the atmosphere and can cause global dimming. This reduces the amount of sunlight that reaches the Earth and can alter rainfall patterns.



<b>Complete Combustion</b>	<ul style="list-style-type: none"> <li>The carbon and hydrogen in the fuels are <b>oxidised</b>.</li> <li><b>Carbon dioxide, water and energy</b> are released.</li> </ul>
<b>Incomplete combustion</b>	<ul style="list-style-type: none"> <li>There is <b>not enough oxygen</b> available for complete combustion.</li> <li>The products of the reaction are <b>carbon monoxide, carbon and water</b>.</li> </ul>



Gas	Percentage
Nitrogen	78%
Oxygen	21%
Argon	0.9%
Carbon dioxide	0.04%

Volcano activity 1 <sup>st</sup> Billion years	Billions of years ago there was intense volcanic activity	This released gases (mainly CO <sub>2</sub> ) that formed to early atmosphere and water vapour that condensed to form the oceans.
Other gases	Released from volcanic eruptions	Nitrogen was also released, gradually building up in the atmosphere. Small proportions of ammonia and methane also produced.
Reducing carbon dioxide in the atmosphere	When the water vapour condensed, the oceans formed and the carbon dioxide dissolved into it	This formed carbonate precipitates, forming sediments. This reduced the levels of carbon dioxide in the atmosphere.

Effects of climate change
Rising sea levels
Extreme weather events such as severe storms
Change in amount and distribution of rainfall
Changes to distribution of wildlife species with some becoming extinct

## How oxygen increased

Algae and plants	These produced the oxygen that is now in the atmosphere, through photosynthesis.	carbon dioxide + water → glucose + oxygen $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
Oxygen in the atmosphere	First produced by algae 2.7 billion years ago.	Over the next billion years plants evolved to gradually produce more oxygen. This gradually increased to a level that enabled animals to evolve.

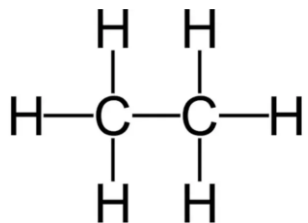
## How carbon dioxide decreased

Reducing carbon dioxide in the atmosphere	Algae and plants	These gradually reduced the carbon dioxide levels in the atmosphere by absorbing it for photosynthesis.
Formation of sedimentary rocks and fossil fuels	These are made out of the remains of biological matter, formed over millions of years	Remains of biological matter falls to the bottom of oceans. Over millions of years layers of sediment settled on top of them and the huge pressures turned them into coal, oil, natural gas and sedimentary rocks. The sedimentary rocks contain carbon dioxide from the biological matter.

## Human activities and greenhouse gases

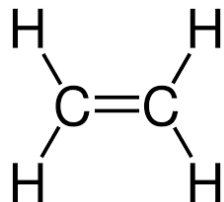
<b>Carbon dioxide</b>	Human activities that increase carbon dioxide levels include burning fossil fuels and deforestation.
<b>Methane</b>	Human activities that increase methane levels include raising livestock (for food) and using landfills (the decay of organic matter released methane).
<b>Climate change</b>	There is evidence to suggest that human activities will cause the Earth's atmospheric temperature to increase and cause climate change.
<b>Carbon dioxide, water vapour and methane</b>	Examples of greenhouse gases that maintain temperatures on Earth in order to support life
<b>The greenhouse effect</b>	Radiation from the Sun enters the Earth's atmosphere and reflects off of the Earth. Some of this radiation is re-radiated back by the atmosphere (including carbon dioxide, methane and water vapour) to the Earth, warming up the global temperature.

## Alkane



e.g. ethane

## Alkene



e.g. ethene

- General formula:  $C_nH_{2n+2}$
- Saturated molecule

- General formula:  $C_nH_{2n}$
- Unsaturated molecule
- C=C functional group

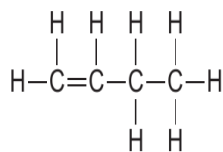
Number of carbons in the chain	Prefix	Alkane	Molecular formula	Structural formula
1	meth-	methane	$CH_4$	
2	eth-	ethane	$C_2H_6$	
3	prop-	propane	$C_3H_8$	
4	but-	butane	$C_4H_{10}$	

B the first four members of the alkane homologous series

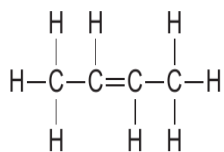
Name	Molecular formula	Structural formula
ethene	$C_2H_4$	
propene	$C_3H_6$	
butene	$C_4H_8$	

C the first three members of the alkene homologous series

## Isomers



but-1-ene



but-2-ene

D The numbers in the butene isomer names show the position of the double bond. The 1 shows that the C=C bond starts at the end of the molecule on the first carbon, the 2 shows that it is in the middle. Carbon atoms are numbered starting from the end closest to the double bond.

## Keyword

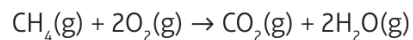
## Definition

<b>Alkane</b>	A hydrocarbon in which all the bonds between the carbon atoms are double bonds.
<b>Alkene</b>	A hydrocarbon in which there are one or more double bonds between carbon atoms.
<b>Homologous series</b>	A family of compounds that have the same general formula and similar properties, but have different numbers of carbon atoms.
<b>Carbon monoxide</b>	A poisonous gas produced from carbon burning without enough oxygen.
<b>Carbon dioxide</b>	A colourless, odourless gas with the molecular formula $CO_2$ .
<b>Saturated</b>	A molecule that contains only single bonds between the carbon atoms in a chain.
<b>Unsaturated</b>	A molecule that contains one or more double bonds between carbon atoms in a chain.
<b>Complete Combustion</b>	Combustion of hydrocarbons with enough oxygen present to convert all the fuel into carbon dioxide and water.
<b>Incomplete Combustion</b>	When a substance reacts only partially with oxygen, such as when carbon burns in air producing carbon monoxide and soot (unburnt carbon).
<b>Isomer</b>	Molecules with the same molecular formula but different arrangements of atoms.
<b>Addition reaction</b>	A reaction in which reactants combine to form one larger product and no other products.
<b>Functional group</b>	An atom or group of atoms in a molecule that is mainly responsible for the molecule's chemical reactions and properties.

## Combustion

### Complete

- Plentiful supply of oxygen
- Products:
  - Carbon dioxide
  - Water
- Blue flame on Bunsen burner
- Example:



### Incomplete

- Poor supply of oxygen
- Products:
  - Carbon monoxide
  - Carbon (soot)
- Yellow flame on Bunsen burner

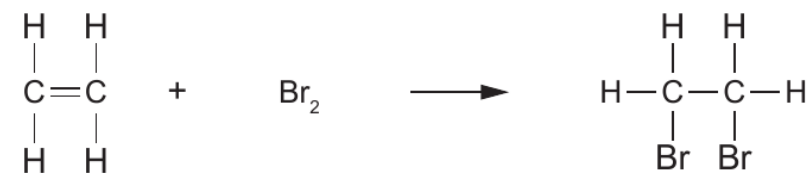
## Addition Reactions

Two reactant molecules add to one another to form just one product molecule.

A reaction in which reactants combine to form one larger product molecule and no other products.

Example:

ethene + bromine  $\longrightarrow$  1,2-dibromoethane



**D** Ethene reacts with bromine to form 1,2-dibromoethane.

## Bromine Water Test

alkane + bromine water

The product retains the colour from the bromine solution.



alkene + bromine water

The product is colourless.

Bromine water is a dilute solution of bromine in water, Br<sub>2</sub> (aq). It has an orange-brown colour.

- Alkenes – react with Br<sub>2</sub>
- Alkanes – do not react with Br<sub>2</sub>

The C=C double bond reacts with the bromine to form a colourless product. The bromine is therefore removed from the solution, which loses its colour.



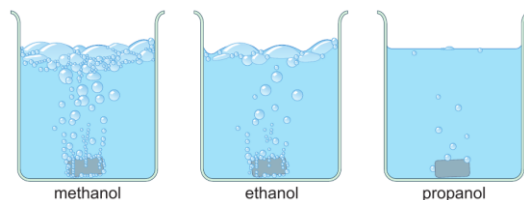
## Alcohols

General formula:  $C_nH_{2n+1}OH$

Name	Molecular formula	Structural formula
methanol	$CH_3OH$	
ethanol	$C_2H_5OH$	
propanol	$C_3H_7OH$	
butanol	$C_4H_9OH$	

**B** The naming of compounds uses a set of rules produced by the International Union of Pure and Applied Chemistry (IUPAC).

- -OH functional group
- Combustion of alcohols:  
alcohol + oxygen  $\rightarrow$  carbon dioxide + water
- Oxidised to form carboxylic acids
- React with reactive metals to form hydrogen gas



**C** Alcohols react with sodium metal but their reactivity depends on carbon chain length.

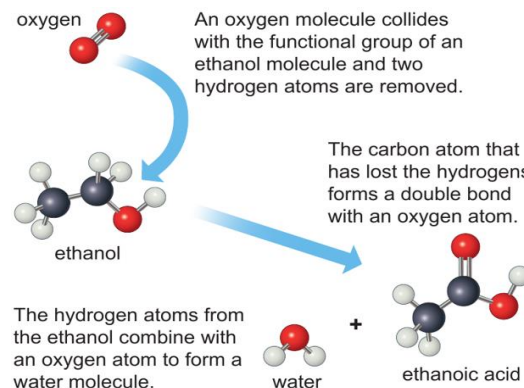
## Carboxylic Acids

Name	Molecular formula	Structural formula
methanoic acid	$HCOOH$	
ethanoic acid	$CH_3COOH$	
propanoic acid	$C_2H_5COOH$	
butanoic acid	$C_3H_7COOH$	

**C** the first four carboxylic acids

The carboxylic acids have similar chemical properties. They all:

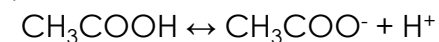
- form solutions with a pH less than 7 (if soluble)
- react with metals to form a salt and hydrogen
- react with bases to form a salt and water
- react with carbonates to form a salt, water and carbon dioxide.



**A** oxidising ethanol

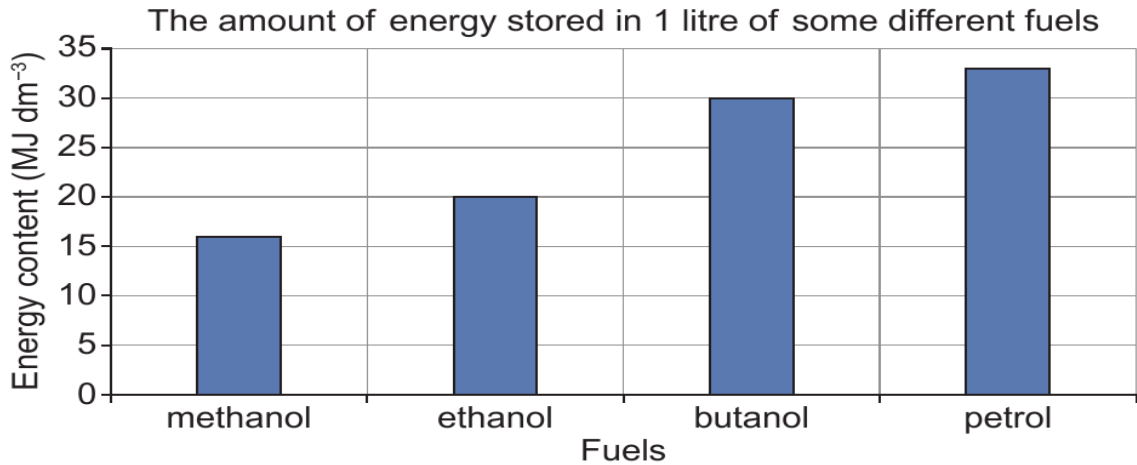
Keyword	Definition
<b>Alcohol</b>	An homologous series of compounds that contain the -OH functional group.
<b>Fractional distillation</b>	In fractional distillation a mixture of several substances, such as crude oil, is distilled and the evaporated components are collected as they condense at different temperatures.
<b>Fraction</b>	In fractional distillation, such as that of crude oil, the different parts of the original mixture are called fractions. The substances in each fraction have similar boiling points to each other.
<b>Organic compound</b>	Chemical compounds that contain carbon. Atoms such as hydrogen, oxygen, nitrogen or chlorine are also common in organic compounds.
<b>Distillate</b>	A distillate will contain the compound that boils at the lowest temperature
<b>Renewable</b>	Energy sources that are replenished and not exhausted, eg solar power.
<b>Homologous series</b>	A family of compounds that have the same general formula and similar properties, but have different numbers of carbon atoms.
<b>Carboxylic acid</b>	An homologous series of compounds that contain the -COOH functional group.
<b>Oxidation</b>	Oxidation occurs when an atom, molecule, or ion loses one or more electrons in a chemical reaction
<b>Oxidising agent</b>	A substance that can oxidise other substances in chemical reactions.
<b>Fermentation</b>	Anaerobic respiration occurring in microorganisms.
<b>Functional group</b>	An atom or group of atoms in a molecule that is mainly responsible for the molecule's chemical reactions and properties.
<b>Sugar</b>	Basic unit of carbohydrates.
<b>Carbohydrates</b>	Food belonging to the food group consisting of sugars, starch and cellulose.
<b>Respiration</b>	Process in living organisms involving the transfer of energy, typically with the intake of oxygen and the release of carbon dioxide from the oxidation of glucose.
<b>Anaerobic</b>	Without oxygen.
<b>Enzymes</b>	A protein which catalyses or speeds up a chemical reaction.

• In solution:

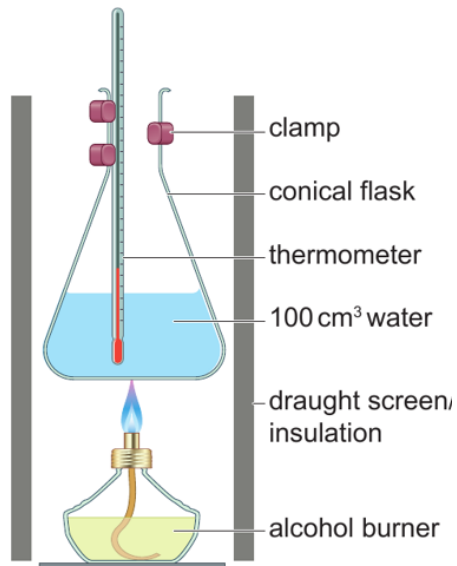


- Carboxylic acid + metal  $\rightarrow$  salt + hydrogen
- Carboxylic acid + base  $\rightarrow$  salt + water

## Combustion of alcohols



**D** Butanol has some advantages over some other alcohols used as fuels.



### Method

Wear eye protection. Do not refill the alcohol burner if there are any naked flames nearby.

- Measure the mass of an alcohol burner and cap. Record the mass and the name of the alcohol.
- Place the alcohol burner in the centre of a heat-resistant mat.
- Use a measuring cylinder to add 100 cm<sup>3</sup> of cold water to a conical flask.
- Measure and record the initial temperature of the water and clamp the flask above the alcohol burner.
- Light the wick of the burner and allow the water to heat up by about 40 °C.
- Replace the cap on the burner and measure and record the final temperature of the water.
- Measure the mass of the alcohol burner and cap again and record the mass.
- Calculate the mass of the alcohol burned to produce a 1 °C rise in temperature.
- Repeat steps A to H using fresh, cold water and a different alcohol.

**B** investigating energy in fuels

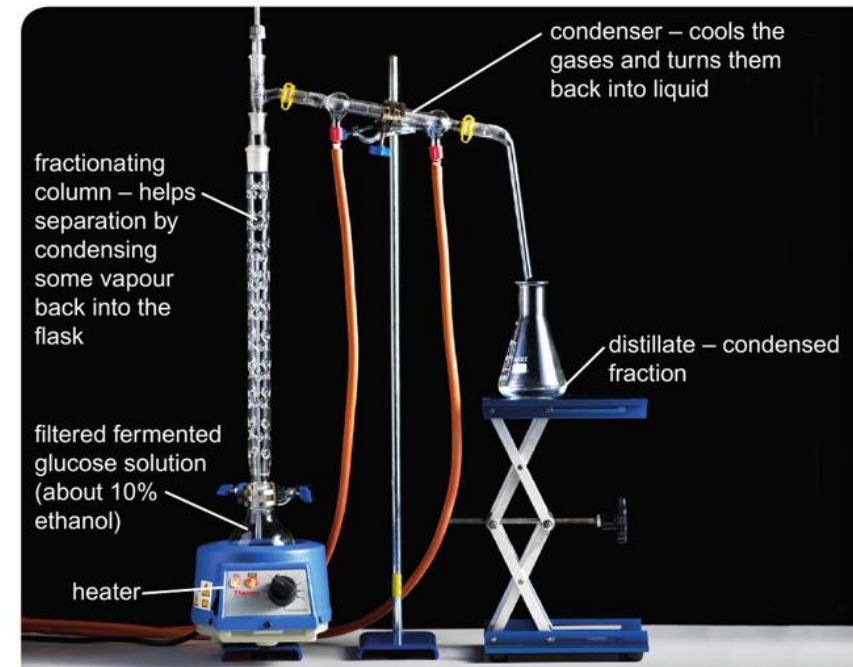
## Ethanol Production (C<sub>2</sub>H<sub>5</sub>OH)

- Sugars mixed with water and yeast
- Fermentation - enzymes in the yeast turn the sugars into ethanol and carbon dioxide
- Temperature and pH must be carefully controlled
- Yeast undergo anaerobic respiration (occurs in absence of oxygen)

Example:



- Fermentation produces alcohol concentrations <15%
- Fractional distillation used to form more concentrated alcohol solutions
- Yeast undergo anaerobic respiration (occurs in absence of oxygen)



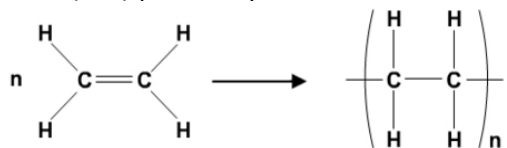
**D** fractional distillation of an ethanol solution

**Polymers** are made from monomers.

**Polymers:** Alkenes can be used to make polymers. Polymers are very large molecules made when many smaller molecules join together, end-to-end. The smaller molecules are called **monomers**.

**Polymers** have a high RMM.

Addition polymer – poly(ethene) from ethene monomers



$n$  = a big number of monomers

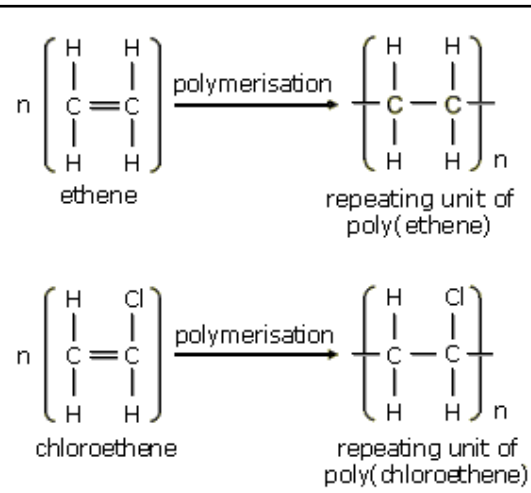
### Displayed formulas of polymers

Polymer molecules are very large compared with most other molecules, so the idea of a repeating unit is used when drawing a displayed formula. When drawing one, starting with the monomer: change the double bond in the monomer to a single bond in the repeating unit add a bond to each end of the repeating unit.

**Synthetic polymers – man made. Manufactured in the laboratory. E.g. poly(ethene)**

**Natural polymers** – DNA, starch, proteins. DNA – made from 4 different monomers called nucleotides. Starch is made from a sugar called glucose. Proteins are polymers made from amino acids.

**Addition polymerisation** – when a double bond in a monomer opens and another monomer molecule is added on.



Key word	Definition
<b>Addition polymerisation</b>	When a double bond in a monomer opens and another monomer molecule is added on.
<b>Biodegradable</b>	Microbes can feed on these types of materials, and break them down.
<b>Condensation polymerisation</b>	Monomers join together, and eliminate a small molecule of water.
<b>Ester links</b>	Functional group in polymers formed when an acid has reacted with an alcohol.
<b>Functional group</b>	Atom or group of atoms that is responsible for the properties and reactions of the compound.
<b>Monomers</b>	Small molecules with a double bond, that can open to form polymers
<b>Non-biodegradable</b>	Microbes cannot feed on these types of materials, and cannot break them down.
<b>Polyester</b>	Polymer made by condensation from a carboxylic acid and an alcohol. Synthetic polymers.
<b>Polymerisation</b>	Monomers (small molecules) join together to form polymers (large molecules)
<b>Polymers</b>	Large molecules made from lots of small molecules, called monomers.
<b>Repeating unit</b>	Shows how the monomer has changed and how it repeats in a polymer.
<b>Synthetic polymers</b>	Man made polymers (plastics)

### H Condensation Polymers:

Condensation polymerisation is a process whereby many small monomer molecules join together to form one large polymer, with water, or some other small molecule formed at the same time. The monomers have more than one functional group.

**H Polyesters:** You can use reaction of alcohols and carboxylic acids to make long chain esters which contain thousands of individual ester molecules joined together,

This is a polyester. The long-chain molecules can be made into fibres, which can be woven into fabrics.

### Problems with polymers:

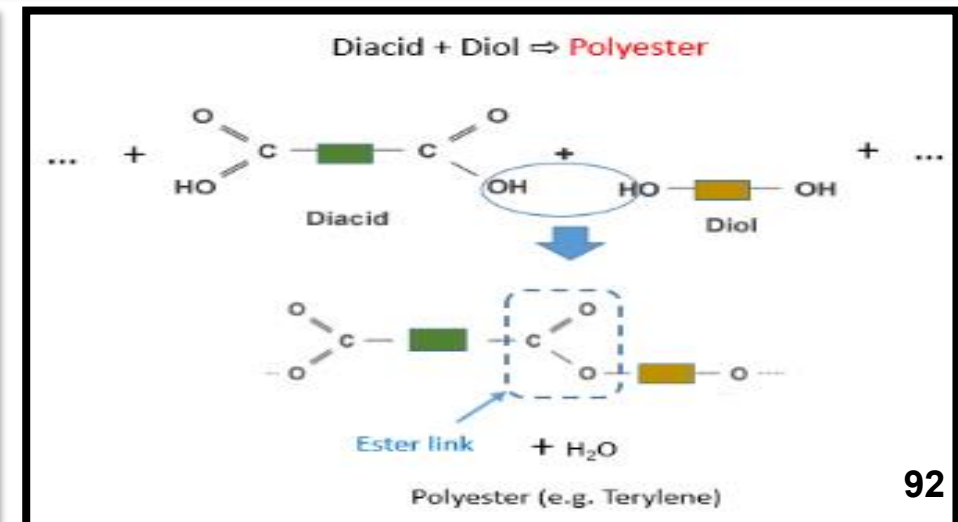
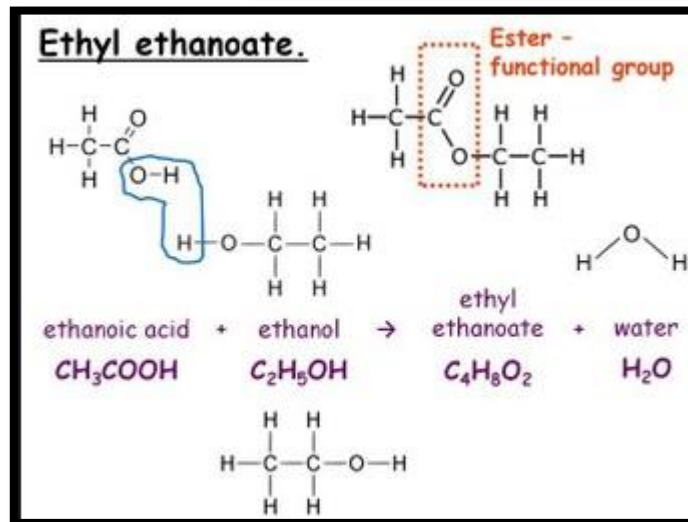
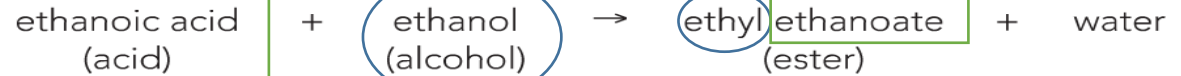
- They are non-biodegradable, causing problems in landfill sites.
- When incinerated, the energy released can be used to generate electricity. However toxic gases are formed.
- Difficult to recycle polymers, as they need to be sorted into different types before they can be made into new objects.

### Recycling symbols on polymers:



Polymer (and common name)	Properties	Uses
poly(ethene) polythene or polyethylene	flexible, cheap, good insulator	plastic bags, plastic bottles, cling film, insulation for electrical wires
poly(propene) polypropene or polypropylene	flexible, shatterproof, high softening point	buckets and bowls
poly(chloroethene) <b>PVC</b>	tough, cheap, long-lasting, good insulator	window frames, gutters, pipes, insulation for electrical wires
poly(tetrafluoroethene) <b>PTFE or Teflon®</b>	tough, slippery, resistant to corrosion, good insulator	non-stick coatings for saucepans, bearings and skis, containers for corrosive substances, stain-proofing carpets, insulation for electrical wires

Esters are made when carboxylic acids (like ethanoic acid) react with alcohols (like ethanol):



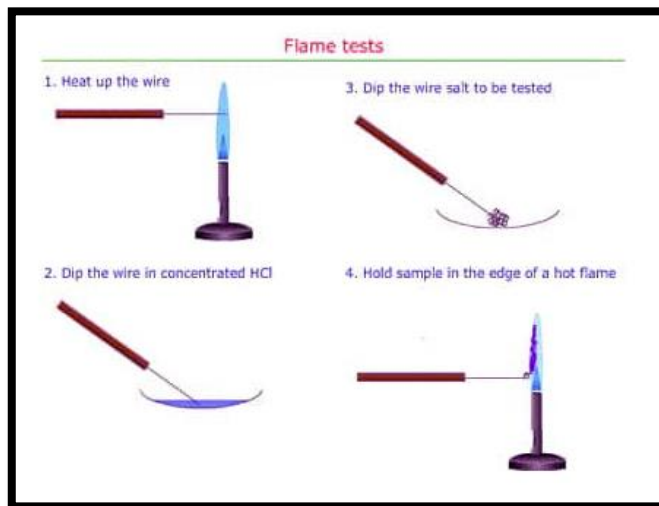
## Types of chemical analysis

**Qualitative analysis** – investigates the type of substance present in a sample.

**Quantitative analysis** – investigates the amount of substance present in a sample.

## Ionic Compounds

...are made up of cations and anions. Cations are positively charged ions formed by the loss of electrons. Anions are negatively charged ions formed by the gain of electrons.



To carry out a flame test on an ionic substance:

- Clean a metal loop in dilute hydrochloric acid.
- Dip it into the sample solution or solid.
- Hold the loop at the edge of a Bunsen burner flame.
- Observe the colour of the flame and use this to determine which metal ion is present.

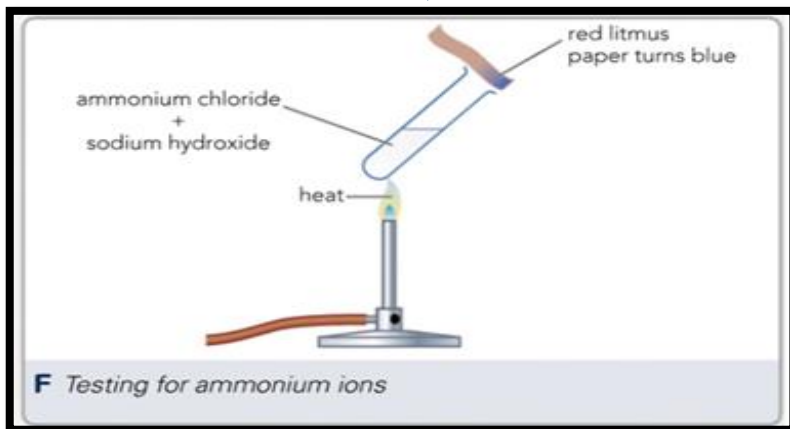
Element	Colour flames
Lithium	Red
Sodium	Yellow
Potassium	Lilac
Calcium	Orange-red
Copper	Blue-green

Key word	Definition
<b>Anions</b>	A negatively charged ion formed from an atom that has gained electrons.
<b>Cations</b>	A positively charged ion formed from an atom that has lost electrons.
<b>Confirmatory test</b>	A chemical test carried out to check the conclusion from the results of another test.
<b>Flame photometer</b>	A machine used to identify metal ions in solution and to determine their concentration.
<b>Halides</b>	A compound formed between a halogen and another element such as a metal or hydrogen.
<b>Halide ions</b>	A negatively-charged ion formed from one of the Group 7 elements.
<b>Standard solutions</b>	A solution containing a known substance.
<b>Precipitates</b>	An insoluble substance that is formed when two soluble substances react together in solution.

<b>Flame photometry</b>	<i>An instrumental method used to analyse metal ions</i>	Analyses the concentration of ions in a dilute solution using a calibration curve. The user compares the results to known data in order to identify the metal ions and their concentration.
Using scientific instruments may improve: sensitivity (detect much smaller amounts), accuracy (give values closer to the true value and speed).		

# KS4 Science – SC25 – Separate Chemistry – Qualitative Analysis (Knowledge Organiser)

<b>Testing for ammonia</b>	<b>Damp red litmus paper</b>	Will turn blue in the presence of ammonia.  Can also be identified by its characteristic smell.
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Test carried out using ...	Ions identified
flame test	Na <sup>+</sup> , K <sup>+</sup> , Ca <sup>2+</sup> , Cu <sup>2+</sup>
dilute acid and lime water	CO <sub>3</sub> <sup>2-</sup>
dilute hydrochloric acid and barium chloride solution	SO <sub>4</sub> <sup>2-</sup>
silver nitrate solution and dilute nitric acid	Cl <sup>-</sup> , Br <sup>-</sup> , I <sup>-</sup>
sodium hydroxide solution and heat	Al <sup>3+</sup> , Ca <sup>2+</sup> , Cu <sup>2+</sup> , Fe <sup>2+</sup> , Fe <sup>3+</sup> , NH <sub>4</sub> <sup>+</sup>

**E** Some of the tests that a forensic chemist might perform on unknown substances.

<b>Sodium hydroxide</b>	<i>Is added to solutions to identify metal ions. These are precipitation reactions.</i>
<b>White precipitates</b>	<i>Aluminium, calcium and magnesium ions form this with sodium hydroxide solution.</i>
<b>Coloured precipitates</b>	<i>Copper (II) = blue-green Iron (II) = green Iron (III) = brown</i>

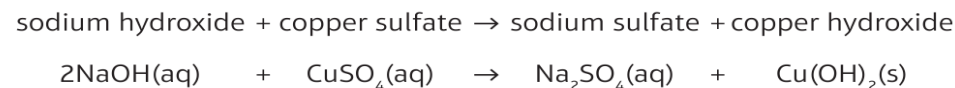
<b>Carbonates</b>	<i>React with dilute acids to form carbon dioxide.</i>
<b>Halide ions</b>	<i>When in a solution, they produce precipitates with silver nitrate solution in the presence of nitric acid.</i>
<b>Sulfate ions</b>	<i>When in a solutions they produce a white precipitate with barium chloride solutions in the presence of hydrochloric acid.</i>



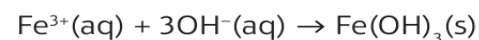
**Halide ion testing**  
Halide ions can be identified by using silver nitrate solution acidified with nitric acid.

Halide ion	Precipitate with silver ions
chloride (Cl <sup>-</sup> )	white
bromide (Br <sup>-</sup> )	cream
iodide (I <sup>-</sup> )	yellow

For example, sodium hydroxide solution reacts with copper sulfate solution to form a blue precipitate:



These precipitation reactions can also be modelled using balanced ionic equations. For example, aqueous iron(III) ions react with aqueous hydroxide ions to form solid iron(III) hydroxide:



## Glass and clay ceramics

**Ceramics** are a range of durable compounds that change very little when heated. They are chemically unreactive, hard and stiff but brittle. They are also poor electrical and thermal conductors, and have high melting points. Ceramic materials consist of giant structures with many strong bonds (covalent or ionic), giving them their typical properties.

Brick, porcelain and china are **clay ceramics**. They are made from clay moulded into the desired shape. When the clay is heated to a very high temperature, tiny crystals form and join together. Bricks are usually decorated by adding a coloured substance to the clay before heating. A pattern may also be moulded into surfaces that will be visible in a finished wall. Porcelain and china are dipped in a 'glaze' and heated strongly again. The glaze forms the hard, waterproof, smooth surface you see on tiles, washbasins and toilet bowls.

**Glass** is made by melting sand, then allowing it to cool and solidify. Glass and clay ceramics have similar properties because they both have giant structures. However, the atoms in glass are not arranged in a regular way to form crystals, so glass is **transparent** rather than **opaque**.

### Polymers

**Polymers** are substances with high average relative formula masses. They are made from **monomers** – smaller molecules that join together to form repeating units. For example, poly(ethene) is made from ethene, and poly(chloroethene) or PVC, is made from chloroethene (see SC24 Polymers).

Polymers can be moulded into complex shapes. The properties of a polymer depend on its structure and chemical composition, but polymers are usually strong and chemically unreactive. They are also poor electrical and thermal conductors. Rigid PVC is useful for underground pipes and window frames. PVC can be made softer by including substances called **plasticisers** in its manufacture. Flexible PVC is useful for indoor water pipes and waterproof flooring.

A **composite material** is a mixture of two or more materials, combined to produce a material with improved properties. The individual materials often have contrasting properties. The individual materials are also usually visible in the composite material, and can often be separated out by physical separation methods. Pykrete consists of ice and about 14% wood pulp. Tiny pieces of wood can be seen in pykrete, and they separate out when the ice melts.

### Reinforcement and matrix

Concrete is made by mixing cement, sand, aggregate (small stones and gravel) and water together. As the concrete sets hard, chemical reactions happen that bond the solid components together. The sand and aggregate form the **reinforcement** of the concrete. The reinforcement is bonded together by cement, which forms the **matrix**.

### Laminates

Wood is a natural composite material consisting of cellulose fibres in a matrix of a polymer called lignin. It is stronger along its grain than it is across its grain. Plywood typically consists of odd numbers of thin sheets of wood, each glued at right angles to the sheet below (see diagram E).

Keyword	Definition
Alloy	An alloy is a mixture of two or more elements, at least one of which is a metal
Brittle	If something is brittle it is easily broken
Composite material	Material made from two or more different materials with contrasting properties
Compressive strength	A measure of how well a material resists being crushed when a force is applied
Density	A measure of compactness and the ratio of mass to volume. It is usually measured in kilograms per metre cubed ( $\text{kg/m}^3$ ) or grams per centimetre cubed ( $\text{g/cm}^3$ )
Ductile	A ductile material is capable of being drawn into thin sheets or wires without breaking
Malleable	Capable of being hammered or pressed into a new shape without being likely to break or return to the original shape
Matrix	The substance that binds the reinforcement together in a composite material
Nanoparticles	Tiny particles which are between 1 and 100 nanometres (nm) in size
Nanoparticulate materials	Useful substances containing nanoparticles
Polymer	A large molecule formed from many identical smaller molecules known as monomers
Reinforcement	Fibres or other material that make up the bulk of a composite material
Resin	Raw plastic, especially when in semi-liquid form
Tensile Strength	The tension a material can withstand without breaking
Tension	Pulling force exerted by each end of an object such as a string or rope

# Physics Knowledge Organisers



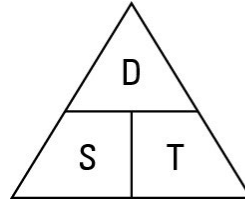
# Motion

Scalar	Vector
Distance	Displacement
Speed	Velocity
Power	Momentum
Mass	Acceleration
Volume	Weight
Temperature	
Force	
Pressure	

## Calculating speed/velocity

$$\text{Speed (m/s)} = \text{distance (m)} \div \text{time (s)}$$

How to remember the equation?  
 "Don't Step on Turtles"



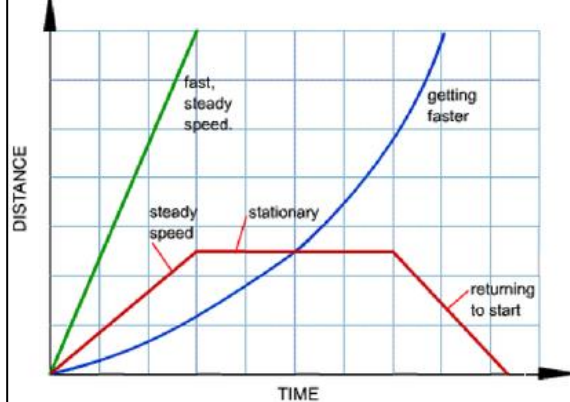
$$D = S \times T$$

$$S = D \div T$$

$$T = D \div S$$

## Distance-time graph

Key features:

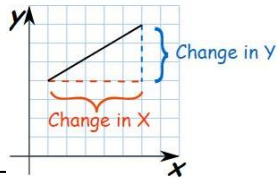


You can calculate speed from this distance-time graph.

Steeper gradient = faster speed.

## Calculating a gradient

$$\text{Gradient} = \frac{\text{Change in } y}{\text{Change in } x}$$



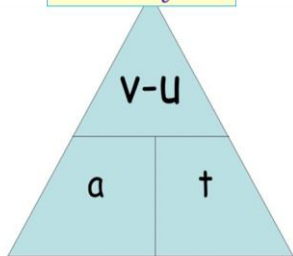
## Calculating acceleration

Acceleration is the rate of change of velocity

$$\text{Acceleration (m/s/s)} = \frac{\text{Change in velocity (m/s)}}{\text{time taken (s)}}$$

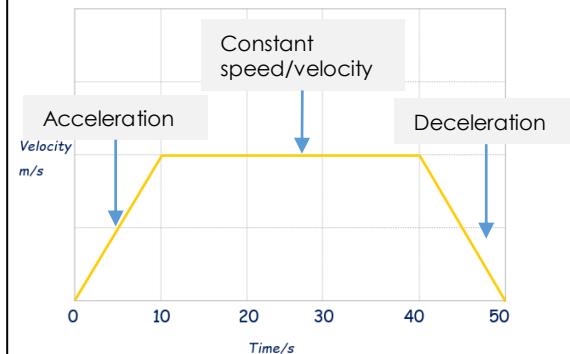
$$a = \frac{v - u}{t}$$

a = acceleration  
 v = final velocity  
 u = initial velocity  
 t = time



## Velocity-time graph

Key features:



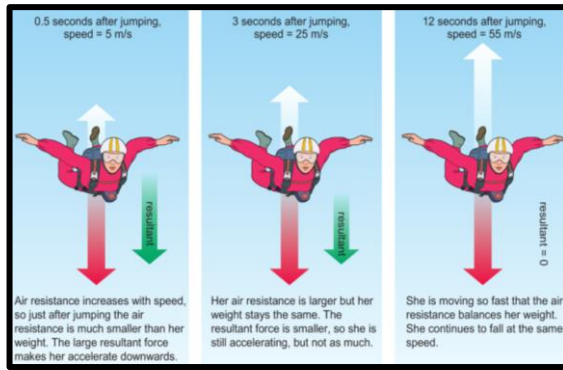
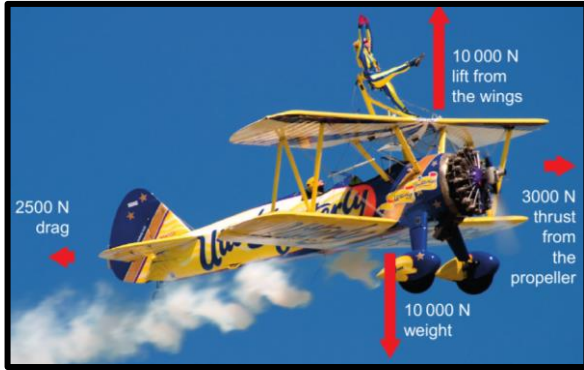
You can calculate acceleration from this velocity-time graph.

Calculating the **area beneath the lines**, is the same as the **overall distance travelled**

Steeper gradient = faster acceleration.

<b>Speed</b>	Scalar measurement that shows how fast an object is moving. Measure in m/s (meters per second).
<b>Velocity</b>	Vector measurement that shows how fast an object is moving in a specific direction. Measured in m/s (meters per second).
<b>Distance</b>	Measurement of how far an object is moving/has moved. Measured in m (meters).
<b>Time</b>	Measurement of time. Measured in s (seconds).
<b>Acceleration</b>	When an objects speed increases over time.
<b>Conversion</b>	Changing a measurement to another form.
<b>Deceleration</b>	When an objects speed decreases over time.
<b>Scalar</b>	A measurement that shows magnitude only.
<b>Vector</b>	A measurement that shows magnitude and direction.
<b>Plateau</b>	A straight horizontal line on a graph.
<b>Gradient</b>	Difference between two values, shown by a incline or decline on a line graph.
<b>Constant</b>	When something does not change. Shown by a straight line on a line graph.
<b>Magnitude</b>	Another term used for size.
<b>Direction</b>	The course which an object is moving. We show North, West, East, South or a combination of two.
<b>Initial</b>	The beginning.
<b>Final</b>	The end.
<b>Displacement</b>	A vector measurement to show the shortest distance to the final place an object ends up.

# KS4 Physics – Forces and Motion



Newton's First Law of motion can be written as:

- a moving object will continue to move at the same speed and direction unless an external force acts on it
- a stationary object will remain at rest unless an external force acts on it.

The acceleration of an object is a measure of how much its velocity changes in a certain time. Sir Isaac Newton's Second Law of Motion describes the factors that affect the acceleration of an object.

The acceleration in the direction of a resultant force depends on:

- the size of the force (for the same mass, the bigger the force the bigger the acceleration)
- the mass of the object (for the same force, the more massive the object the smaller the acceleration).

Newton's Third Law is about the forces on two different objects when they interact with each other. This interaction can happen:

- when objects touch, such as when you sit on a chair
- at a distance, such as the gravitational attraction between the Earth and the Moon.

On Earth the **gravitational field strength** has a value of about 10 newtons per kilogram (N/kg). This means that each kilogram is pulled down with a force of 10 N. The gravitational field strength is different on other planets and moons.

The weight of an object can be calculated using the following equation:

$$\text{weight (N)} = \text{mass (kg)} \times \text{gravitational field strength (N/kg)}$$

This is often written as:  $W = m \times g$

Momentum is calculated using this equation:

$$\text{momentum (kg m/s)} = \text{mass (kg)} \times \text{velocity (m/s)}$$

This can also be written as  $p = m \times v$ , where  $p$  stands for momentum.

**Momentum and acceleration**  
 Table C shows two equations involving acceleration. These can be combined to give:

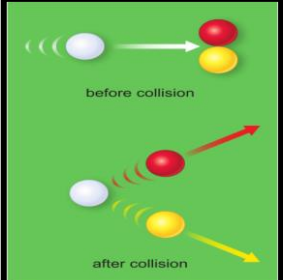
$$\text{force} = \frac{\text{mass} \times \text{change in velocity}}{\text{time}} \quad \text{or} \quad \frac{m(v - u)}{t}$$

where  $v$  is the final velocity and  $u$  is the starting velocity.

As mass  $\times$  velocity is the momentum of an object, this equation can also be written as:

$$\text{force} = \frac{\text{change in momentum}}{\text{time}} \quad \text{or} \quad \frac{mv - mu}{t}$$

**H Momentum and collisions**  
 When moving objects collide the total momentum of both objects is the same before the collision as it is after the collision, as long as there are no external forces acting. This is known as **conservation of momentum**. Remember, momentum is a vector so you need to consider direction when you add the quantities together. If two objects are moving in opposite directions, we give the momentum of one object a positive sign and the other a negative sign.

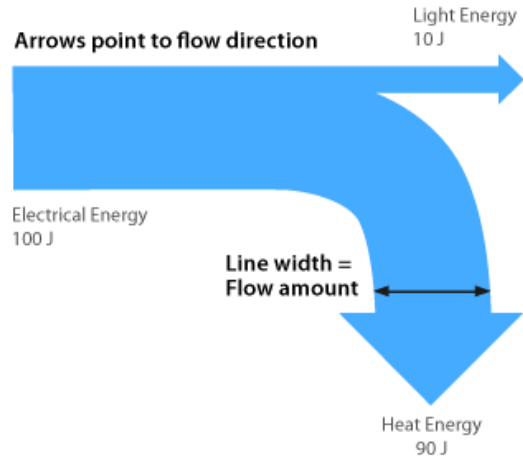


**D** The total momentum of the two coloured balls will be the same as the momentum of the white ball that hit them.

Keyword	Definition
<b>acceleration</b>	A measure of how quickly the velocity of something is changing. It can be positive if the object is speeding up or negative if it is slowing down.
<b>balanced forces</b>	When the forces in opposite directions on an object are the same size so that there is a zero resultant force.
<b>resultant force</b>	The total force that results from two or more forces acting upon a single object. It is found by adding together the forces, taking into account their directions.
<b>scalar quantity</b>	A quantity that has a magnitude (size) but not a direction. Examples include mass, distance, energy and speed.
<b>speed</b>	How fast something is moving. Often measured in metres per second (m/s), miles per hour (mph) or kilometres per hour (km/h).
<b>unbalanced forces</b>	When the forces in opposite directions on an object do not cancel out, to there is a non-zero resultant force.
<b>vector quantity</b>	A quantity that has both a size and a direction. Examples include force, velocity, displacement, momentum and acceleration.
<b>velocity</b>	The speed of an object in a particular direction. Usually measured in metres per second (m/s).
<b>centripetal force</b>	A force that causes objects to follow a circular path. The force acts towards the centre of the circle.
<b>mass</b>	A measure of the amount of material there is in an object. The units are kilograms (kg).
<b>weight</b>	The force pulling an object downwards. It depends upon the mass of the object and the gravitational field strength. The units are newtons (N).
<b>gravitational field strength</b>	A measure of how strong the force of gravity is somewhere. It is the force on a 1 kilogram mass, so the units are newtons per kilogram (N/kg).
<b>inertial mass</b>	The mass of an object found from the ratio of force divided by acceleration. The value is the same as the mass calculated from the weight of an object and gravitational field strength.
<b>action–reaction forces</b>	Pairs of forces on interacting objects. Action–reaction forces are always the same size, in opposite directions, and acting on different objects. They are not the same as balanced forces.
<b>balanced forces</b>	Forces acting on the same object. Balanced forces are always equal, in opposite directions, and always act on the same object. They do not have to be the same type of force. An object acted on by balanced forces will not change the way it is moving.
<b>equilibrium</b>	When a situation is not changing because all the things affecting it balance out.
<b>conservation of momentum</b>	The total momentum of moving objects before a collision is the same as the total momentum afterwards, as long as no external forces are acting.
<b>momentum</b>	The mass of an object multiplied by its velocity. Momentum is a vector quantity, with units kilogram metres per second (kg m/s).
<b>kinetic energy</b>	A name used to describe energy when it is stored in moving things. The amount of energy stored depends on the mass of the object and on its speed (or velocity) squared.
<b>work done</b>	The energy transferred when a force acts through a distance to move an object or change its speed. It is calculated using the size of the force and the distance moved in the direction of the force. The unit for work done is the joule (J).

# Conservation of Energy

Energy Type	Example
Light Energy	Sun, light bulb, torch
Thermal Energy (heat)	Oven, electric fire
Sound Energy	Radio, speakers, TV
Electrical Energy	Electric car, laptop
Nuclear Energy	Nuclear power station, nuclear bomb
Chemical Energy	Food, batteries, coal
Gravitational Potential Energy	Book on a shelf, boulder on a cliff
Elastic Potential Energy	Bow, wind-up toy, stretch spring
Kinetic Energy (movement)	Person running, rolling ball



Energy Efficiency = Useful energy/total energy input

Keyword	Definition
heating	Put more jumpers on and turn off central heating
Hot water	Take showers, only boil the amount of water you need
Electrical appliances	Turn off devices that are on standby
Washing clothes	Air dry clothes, wash on a lower temperature
Heat lost from home	Install insulation – double glazing, loft/floor insulation

Renewable Energy	Quickly replenishes its energy used. Infinite	Wind power, solar power, hydroelectric power, tidal power, geothermal power, biomass
Non-renewable Energy	Is finite (will run out). Does not quickly replace energy used	Fossil fuels – coal, oil and natural gas Nuclear power

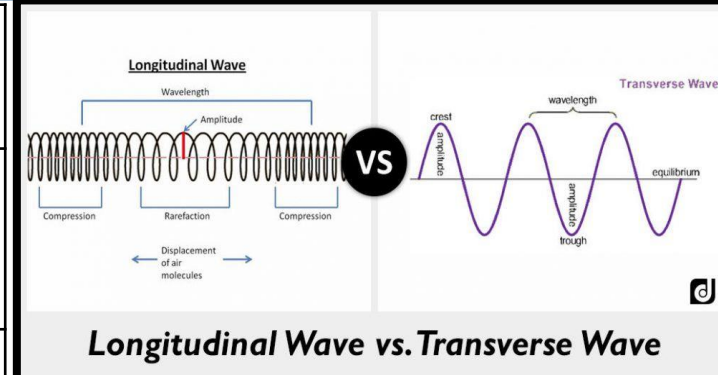
Energy Source	Advantages	Disadvantages
Fossil Fuels	Cheap to set up, power stations already present	Limited (will run out), causes pollution – greenhouse gases and gases that make acid rain, running costs
Nuclear power	Does not produce carbon dioxide or sulphur dioxide	Finite (will run out) danger from radioactive material
Wind power	Infinite, cheap to run, no pollution, cheap to run	Costly to build, only works when windy, noisy and ugly
Tidal power	Good for islands, potential to generate lots of energy, reliable – tide will always go in and out, doesn't release pollution	Costs a lot to build, hard to find suitable locations, could damage environment
Solar power	Infinite, building can have their own power supply, doesn't release pollution, cheap to run	Expensive to set up, only works when sunny
Geothermal power	Doesn't create any pollution, potentially infinite	Expensive to set up, only works in volcanic areas, volcanic activity may stop making station useless
Hydroelectric power	Doesn't create pollution, creates water reserves	Costly to build, can cause flooding, can have major ecological impacts
Biomass	Cheap, if replaced can be sustainable	Burning releases atmospheric pollution, replanting required

Keyword	Definition
Chemical	Energy store that is emptied during chemical reactions when energy is transferred to the surroundings.
Conduction	The transfer of heat by passing on energy (or electrical charge) to nearby particles.
Convection	The process by which heat travels through fluids (gases and liquids).
Elastic potential	An energy store that is filled when a material is stretched or compressed.
Electrical	Energy store resulting from the movement of electrical charge (electrons).
Energy	This is the ability to make something happen when it is transferred.
Gravitational potential	Energy store that is filled when an object is raised.
Joule	Unit of energy, represented by the symbol J.
Kinetic	An energy store filled when a moving object speeds up.
Light	A form of radiation that can transfer energy in a wave.
Non-renewable	An energy resource that will be used up, and not replenished in our lifetime.
Nuclear	An energy store associated with nuclear interactions.
Radiation	Radiation is the transfer of internal energy in the form of electromagnetic waves. This radiation lies in the infrared region of the electromagnetic spectrum. It does not require particles to move, it can travel through a vacuum.
Renewable	An energy resource that can be readily replenished in our lifetime.
Sound	A form of energy transferred by sound waves.
Thermal	An energy store that is filled when an object is heated.
Transformation	Energy transformation is the process of changing one form of energy to another.

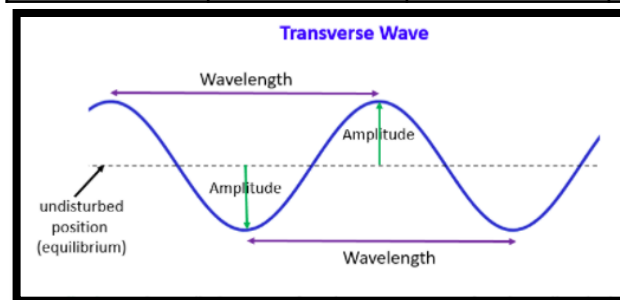
# KS4 Physics – Waves

Wave	Vibrations that transfer energy from place to place.
Transverse	A wave where the vibrations are at right angles to the direction in which the wave is travelling.
Longitudinal	A wave where the vibrations are parallel to the direction in which the wave is travelling.
Frequency	The number of vibrations (or the number of waves) per second, measured in hertz.
Period	The time taken for one complete wave to pass a point. It is measured in seconds.
Wavelength	The distance between a point on one wave and the same point on the next wave.
Amplitude	The size of vibrations or the maximum distance a particle moves away from its resting position when a wave passes.
Refraction	The change in direction when a wave goes from one medium to another.
Normal	An imaginary line drawn at right angles to the surface of a mirror or lens where a ray of light hits it.

Frequency	The number of waves pass a point in a second.	Higher frequency = more energy transferred	Increasing frequency = higher pitch
Amplitude	Maximum disturbance from its undisturbed position.	Increasing amplitude increases energy transferred	Increasing amplitude = increase in volume
Wavelength	The distance between a point on one wave and the same point on the next wave.	Increasing wavelength = decrease energy transferred	



Longitudinal	Transverse
Particles oscillate (vibrate) in the direction of the wave's movement	Particles oscillate (vibrate) at right angles to the direction of the wave movement
Sound waves, ultrasound	Electromagnetic waves (light), water waves



**Wave Formula**

**Wave speed = wavelength x frequency**

Wave speed is measured in meters per second (m/s)	Wavelength is measured in meters (m)	Frequency is measured in Hertz (Hz)
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**Example**

Dylan is standing on the end of a pier. He measures the water waves going past him. The wavelength of each wave is 1.3m. He counts 2 waves every second. Find the wave speed

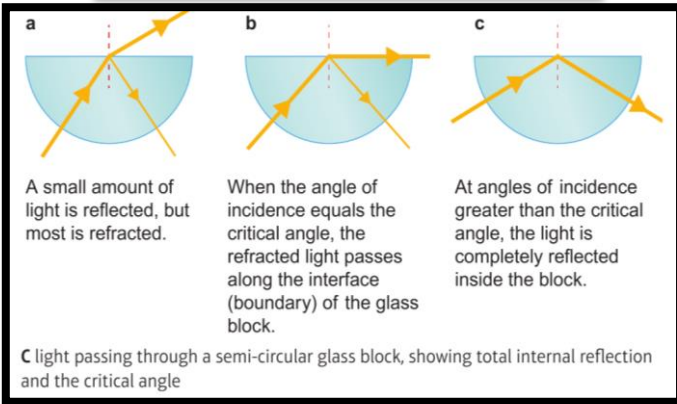
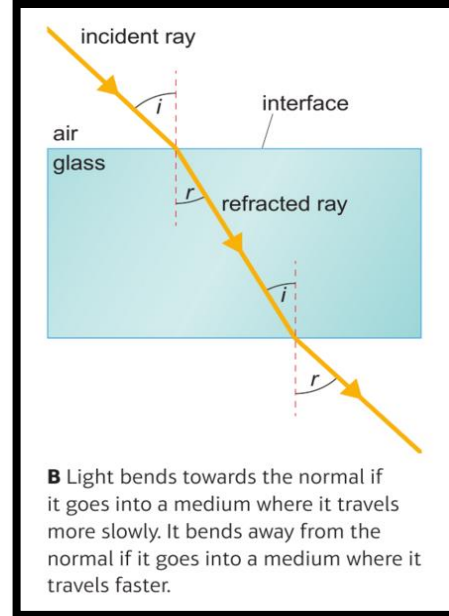
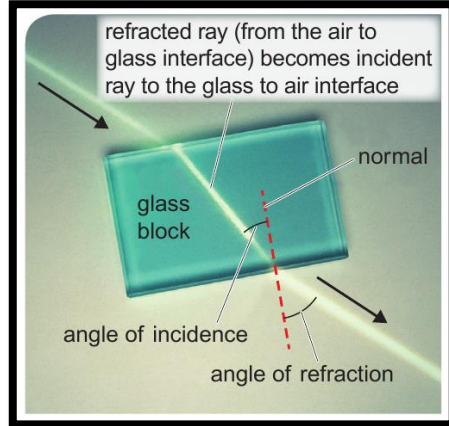
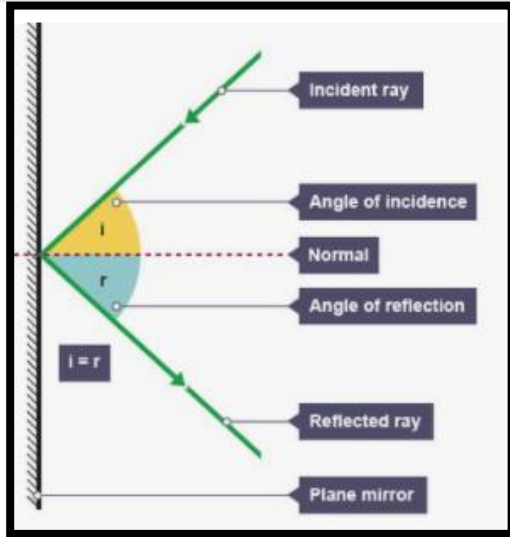
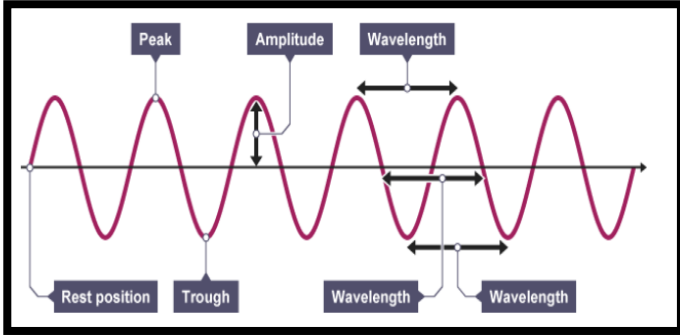
Wave speed = frequency x wavelength

Wave speed = 2 x 1.3

= 2.6 m/s

	Description	Diagram
Reflection = light bouncing off a surface	Light waves reflect from surfaces. When waves reflect, they obey the law of reflection: the angle of incidence equals the angle of reflection.	
Refraction = light bends	Waves change speed when they pass across the boundary between two substances with different densities, such as air and glass. This causes them to change direction and this effect is called refraction.	

# KS4 Physics – Light and EM Spectrum (part 1)

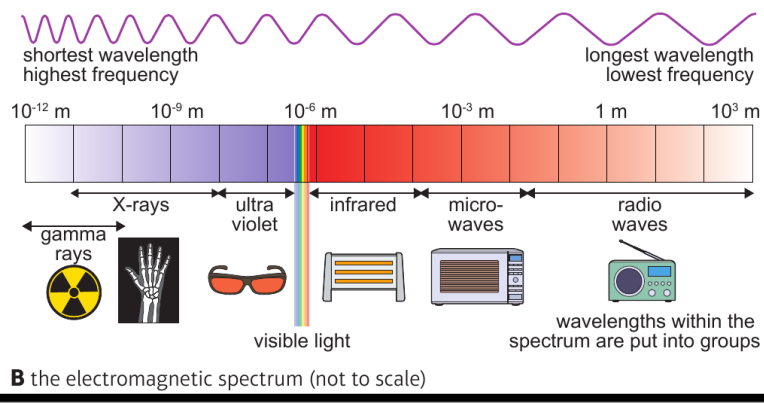
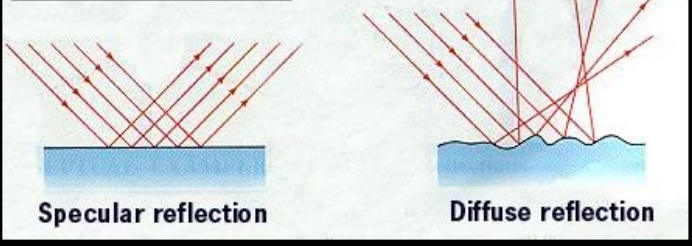


**Separates only.** Total internal reflection and critical angle.

<b>Angle of incidence (i)</b>	The angle between incidence ray and the normal.
<b>Angle of refraction (r)</b>	The angle between normal and the refracted ray.
<b>Separates only - Critical angle</b>	The angle at which total internal reflection happens. In a glass block this is 42°.
<b>Separates only - Diffuse reflection</b>	Reflected light scattered in all directions
<b>Electromagnetic radiation</b>	Form of energy transfer including radio waves, microwaves, infrared, visible light, ultraviolet, x-rays and gamma rays.
<b>Electromagnetic spectrum</b>	The entire frequency range of electromagnetic waves.
<b>Electromagnetic waves</b>	A group of waves that all travel at the same speed in a vacuum, and all are transverse.
<b>Incident ray</b>	The light ray approaching the interface (mirror edge, or edge of a perspex block)
<b>(H) Oscillations</b>	Movement backward and forward
<b>Radiotherapy</b>	Medical technique to kill cancer cells using gamma rays.
<b>Ray diagram</b>	A diagram that models what happens when light is reflected or refracted.
<b>Refracted ray</b>	The light ray that leaves a material like a glass Perspex block. This ray has changed direction.
<b>Separates only - Specular reflection</b>	Light is evenly reflected from smooth surfaces such as a mirror surface.
<b>Separates only – Total internal reflection</b>	When a ray of light is shone into a curved glass block and when the angle (critical angle) has been achieved to allow all the light to be completely reflected inside the glass.
<b>Transverse waves</b>	Vibrations are at right angles to the direction <b>101</b> in which the wave is travelling

# KS4 Physics – Light and EM Spectrum (part 2)

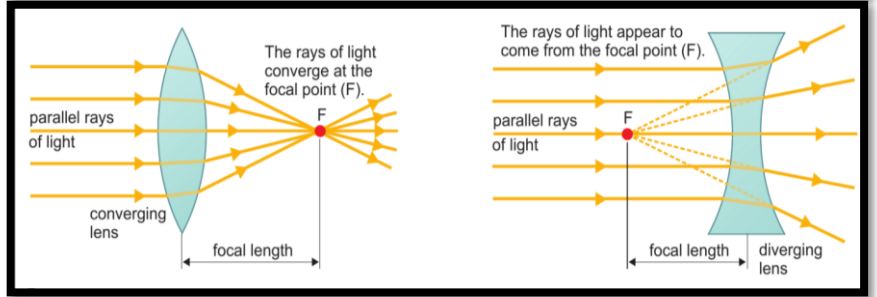
**Separates only.**



**B** the electromagnetic spectrum (not to scale)

**Separates only.**

A **converging lens** is fatter in the middle than at the edges. It makes parallel rays of light converge (come together) at the **focal point**. The **focal length** is the distance between the focal point and the centre of the lens. A **diverging lens** is thinner in the middle than at the edges. The focal point is the point from which the rays seem to be coming after passing through the lens.



Long wavelength, low frequency	Uses	Dangers
Visible light	Light bulbs, our eyes detect it	From a laser can damage the retina in the eye
Infrared	Communication – TV remote, grills, toasters	Felt as heat, and can cause skin to burn
Microwaves	Communications, mobile phones, microwave for food	Can cause internal heating of body tissue
Radio waves	Radio broadcast, communications	Very large doses can cause cancer

**Separates only.**

Heat transfer by radiation - Heat can be transferred by infrared radiation. Unlike conduction and **convection** - which need the vibration or movement of **particles** - **infrared radiation** is a type of electromagnetic radiation. When infrared radiation is absorbed by an object it is heated and its temperature rises.

Short wavelength, high frequency	Uses	Dangers
Ultraviolet	Used to kill microorganisms in water, detecting forge bank notes	Too much exposure can lead to skin cancer
X-rays	Hospitals – to check for broken bones	High frequency, transfer a lot of energy and can penetrate the body. Excessive exposure may cause DNA mutation, possibly leading to cancer.
Gamma rays	Cancer treatment, sterilising hospital equipment	High frequency, transfer a lot of energy and can penetrate the body. Excessive exposure may cause DNA mutation, possibly leading to cancer.

**Separates only.**

- Dark matt surfaces are better at absorbing heat energy than light shiny surfaces.
- Dark matt surfaces are better at radiating heat energy than light shiny surfaces.

**Separates only.**

Surface	Absorption	Emission
Dull, matt or rough	Good absorber of heat radiation	Good emitter of heat radiation
Shiny	Poor absorber of heat radiation	Poor emitter of heat radiation

# KS4 Physics – Radioactivity (part 1)

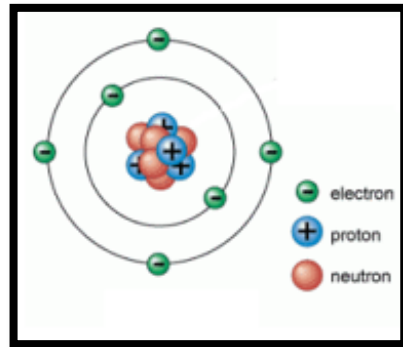
Dalton's model	Plum Pudding - Thomson	Rutherford	Bohr/Chadswick
John Dalton thought that all matter was made of tiny particles called atoms, which he imagined as tiny spheres that could not be divided.	Thomson carried out experiments and discovered the electron. This led him to suggest the plum pudding model of the atom. In this model, the atom is a ball of positive charge with negative electrons embedded in it.	Rutherford suggested a new model for the atom, called the nuclear model. In the nuclear model: the mass of an atom is concentrated at its centre, the nucleus the nucleus is positively charged	Bohr did calculations that led him to suggest that electrons orbit the nucleus in shells. The shells are at certain distances from the nucleus. Chadwick found evidence that the nucleus contains no charged particles called the neutron.

<b>Atomic number (also called proton number)</b>	Number of protons in an atom
<b>Background radiation</b>	Naturally radioactive substances in the environment that produce radiation.
<b>Becquerels (Bq)</b>	Unit to measure radioactivity. One Bq is one nuclear decay each second.
<b>Count rate</b>	Number of clicks on a GM tube when radiation is detected. It is the amount of radiation per second or minute.
<b>Elements</b>	Substances that contain the same type of atoms
<b>Geiger-Muller (GM) tube</b>	An instrument to measure radioactivity.
<b>Half-life</b>	Time taken for half the unstable nuclei in a sample of a radioactive isotope to decay.
<b>Isotopes</b>	Atoms of a single element that have different numbers of neutrons, but same number of protons.
<b>Kinetic theory</b>	Model that helps explain the properties of solids, liquids and gases.
<b>Mass number (also called nucleon number)</b>	Total number of protons and neutrons.
<b>Nucleons</b>	Smaller particles that make up the nucleus.
<b>Neutrons</b>	Sub-atomic particle found in the nucleus, with no charge.
<b>Particle theory</b>	Model that helps explain the properties of solids, liquids and gases.
<b>Protons</b>	Positively charged sub-atomic particle found in the nucleus.
<b>Subatomic particles</b>	Particles smaller than atom, and make up <b>103</b> an atom. Protons, neutrons and electrons.

**Atomic Mass**  
- The number of protons & neutrons in the nucleus.

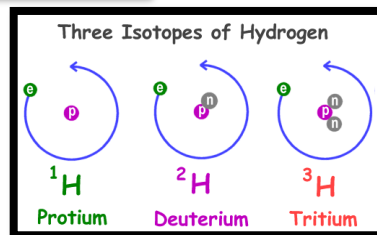
**Atomic Number**  
- The number of just protons in the nucleus.

**Number of protons = number of electrons**



Atomic structure – protons and neutrons found in the nucleus. Electrons orbit the nucleus on electron shells.

Atoms of a single element that have different numbers of neutrons, but same number of protons.



	relative charge	relative mass
proton	+1	1
neutron	0 neutral	1
electron	-1	1 / 1840

These orbits (electron shells) are normally empty in neon atoms.

nucleus

If an atom absorbs energy, an electron can move to a 'higher' orbit.

When an electron returns to a lower orbit the atom emits energy as visible light of a particular wavelength.

Electrons can make all of these different orbit changes. Each different change produces a different wavelength of light.

**B** electronic configuration and energy level changes for neon

nucleus contains 3 protons

charge on nucleus is 3+

**D** ionisation of a lithium atom

**Ionisation**

Sometimes an atom gains so much energy that one or more of the electrons can escape from the atom altogether. An atom that has lost or gained electrons is called an **ion**. Radiation that causes electrons to escape is called **ionising radiation**.

## Type of nuclear radiation

Property	Alpha	Beta	Gamma
What is it?	Nucleus of a helium atom	electron	EM waves
Charge	+2	-1	None
Mass	Relative 4	Relative 0 (1/1840)	None
Range in air	3-5cm	15cm	Long range
Penetration ability	Low, stopped by paper	Increased, stopped by aluminium or lead	Great slowed by concrete, lead
Ionising ability	Highly ionising	Fairly	Least ionising
Effects of a magnetic field	Deflected	Deflected	Unaffected
Effects of an electric field	Attracted to negative electrode	Attracted to positive electrode	Unaffected

Particle	Symbol	
Alpha	$\alpha$	${}^4_2\text{He}$
Beta	$\beta^-$	${}^0_{-1}\text{e}$
Positron	$\beta^+$	${}^0_{+1}\text{e}$
neutron		$n$

Dangers of radioactivity – can damage the DNA inside a cell. This damage is called mutation. Gene mutation that occur in gametes can be passed on to the next generation. Some mutations can cause cancer.

The penetration power of the three types of radiation.

$\alpha$

$\beta$

$\gamma$

Skin or paper stops ALPHA

Thin aluminum stops BETA

Thick lead reduces GAMMA

**Worked example**

In figure D, the activity at 3 minutes is 800 counts per second. After one half-life the count rate will have decreased to 400 counts per second.

This occurs at 9.5 minutes, so the half-life is  $9.5 - 3 = 6.5$  minutes.

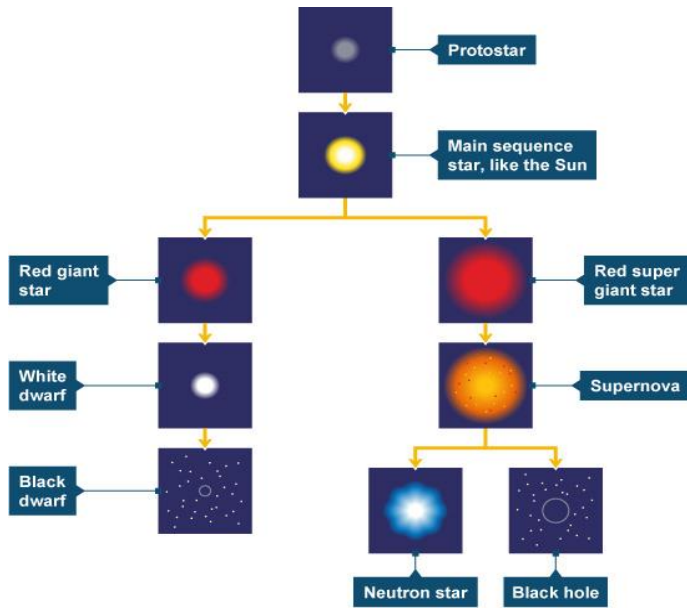
**D** graph of activity against time for a radioactive substance

- [Separates]** Using radioactivity
- Killing microorganisms
  - Radioactive detecting
  - Diagnosing cancer - tracers
  - Treating cancer
  - Checking thickness of paper
  - Smoke alarms – contains a source of alpha particles

- [Separates]** Radioactivity in medicine
- Radioactive materials are used to diagnose medical conditions without having to cut into a patient's body.
  - Tracers that emit positrons – used to detect medical problems.
  - Treating cancer – external radioactivity which uses a beams of gamma rays, x-rays or protons directed at the tumour.



## Life Cycle of Stars:



**Nebula:** Cloud of dust and gas from which stars are made.

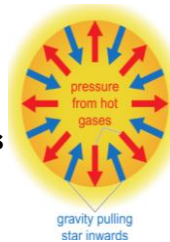
**Gravity and Thermal Pressure:** The two forces that determine whether a star is stable (balanced), shrinking or growing.

### Nuclear Fusion:

- process of nuclei combining that releases energy in a star
- in the main sequence Hydrogen fuses to make Helium
- requires huge pressure from gravity

**Which path does a star evolve along?**

- depends on mass
- stars like our sun become **Red Giants**
- **more massive** stars become **Red Super Giants**.



Keyword	Definition
<b>Solar System</b>	Contains Sun, 8 planets, dwarf planets, comets, asteroids and meteors.
<b>Protostar</b>	A very young star that is still accumulating mass from its main molecular cloud.
<b>Main Sequence Star</b>	A star that merges hydrogen into its core/nucleus and has a stable balance of the external pressure of central nuclear fusion and the gravitational forces that push inward.
<b>Red Giant</b>	A dying star in the later stages of stellar evolution.
<b>White Dwarf</b>	They mark the evolutionary end point of mass stars from low to intermediate like our Sun.
<b>Black Dwarf</b>	All that remains after a white dwarf star burns all its heat but retains its mass.
<b>Red Super Giants</b>	A huge giant star that has consumed its core hydrogen reserve. Helium has accumulated in the nucleus and hydrogen is undergoing nuclear fusion in the outer layers.
<b>Super Nova</b>	The explosion of a star, the largest explosion that takes place in space.
<b>Neutron Star</b>	Created when giant stars die in supernovae, their nucleus collapses, and protons and electrons fuse together to form neutrons.
<b>comet</b>	Balls of ice and dust in elliptical orbits around the Sun.
<b>asteroid</b>	Made of rock and metal in orbit around the Sun between Mars and Jupiter.

## The Solar System and Orbits:

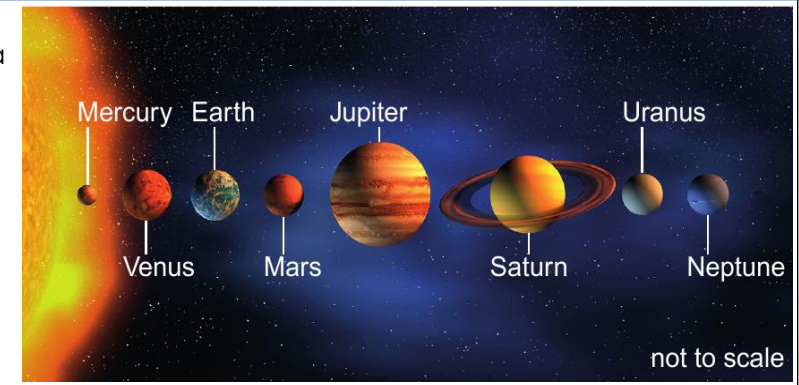
**Dwarf Planet:** too small to be a planet

**Orbit:** A path of one object around another.

**Satellite:** Any object which orbits another.

### Planetary orbits:

- occur because of **gravity** (acts on an object towards the centre of the more massive object).



## Weight and gravity:

- Your weight is a force of gravity acting on you.
- It depends on your mass and the **gravitational field strength (g)** of the earth. ( $g = 9.81 \text{ N/Kg}$ )
- $\text{Weight (N)} = \text{mass (kg)} \times gfs \text{ (N/kg)}$

## Models of Solar System:

### 1. Geocentric model:

- The earth is at the center of everything.

### 2. Heliocentric model:

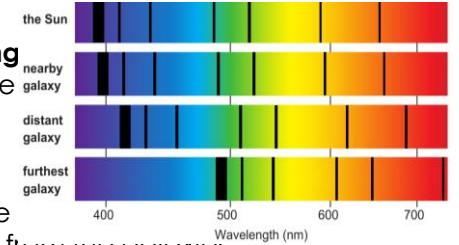
- **Copernicus.**
- The sun at the center of universe.
- Evidence from **Galileo** using **telescopes** to observe **Jupiter's moons.**

### 3. Elliptical orbit:

- Most bodies in the solar system are in elliptical orbits.
- This is the current model.

## Redshift:

- Suggests that the Universe is expanding.
- If a wave source is **moving** relative to an observer, there will be a change in the observed **frequency and wavelength**
- There is an increase in the wavelength of light coming from the galaxies.
- The **further away** the galaxy, the **more redshift**, the **faster** it is moving away.



## Creation of Universe Theories

### 1. Steady State

- The Universe has always existed, and is expanding
- As the universe expands, new matter is being constantly created.

### Evidence:

- **Red shift** because galaxies are moving away from us.

### 2. The Big Bang Theory – accepted theory as there is **more evidence**

- the Universe began as a very tiny point of concentrated energy.
- The expansion is still going on.

### Evidence:

- **Cosmic Microwave Background Radiation:** Left over radiation from the beginning of the Universe.
- **Redshift** because galaxies are moving away from us due to the continual expansion.

## KS4 Physics – Energy – Forces Doing Work

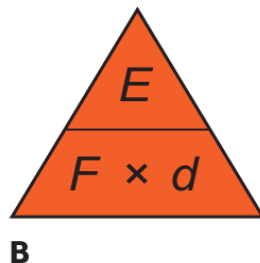
Keyword	Definition	Units of measurement
Work done	The energy transferred by a force	Joules (J)

work done = force × distance moved in the direction of the force  
 (J)                      (N)                      (m)

This can be written as:

$$E = F \times d$$

where  $E$  represents work done  
 $F$  represents force  
 $d$  represents distance.



Keyword	Definition	Units of measurement
Power	The rate at which energy is transferred	<b>Watts (W)</b> or <b>Joules per second (J/s)</b>

power (W) =  $\frac{\text{work done (J)}}{\text{time taken (s)}}$

This can be written as:

$$P = \frac{E}{t}$$

where  $E$  represents work done  
 $P$  represents power  
 $t$  represents time.



### Worked Example

Danny is moving a box weighing 200N. He pulls it 12m along a sloping floor using a force of 150N. Calculate the work done by Danny.

$$\begin{aligned} E &= F \times d \\ &= 150\text{N} \times 12\text{m} \\ &= 1800\text{J} \end{aligned}$$

The force must be in the direction of movement



**Crane A** lifts a weight of 1000N a distance of 6m in 10seconds

**Crane B** lifts the exact same weight the exact same distance, but in **4 seconds**.

We can say that crane B is more powerful as it has done the same amount of work (lifted a force a certain distance), but has done so in less time.

# KS4 Physics – Forces and their Effects

Forces can be placed into two groups. There are forces that act on contact and there are forces that act at a distance.

Contact Forces	Non-Contact Forces
Air Resistance	Gravity
Friction	Magnetism
Tension	Electrical Force
Normal Force	Nuclear Force

Force	A vector quantity	. A push or a pull on an object.
<b>Contact forces</b>	Two objects have to touch for the force to act. Interact at zero distance.	Caused by objects interacting. E.G. Friction, man pushing a wall, a book on a table, Upthrust of water on a boat.
<b>Non-contact forces</b>	Two objects do not have to touch for the force to act. Can interact at a distance.	Caused by interacting fields. E.G. Magnetic forces, electrostatic forces, gravitational forces.

When two children are on a see-saw the see-saw may be balanced and the children will not move. In this case the clockwise moment is balanced by the anti-clockwise moment – so the two moments are equal.

As both the clockwise moment and anti-clockwise moment are balanced:

$$F_c \times x_c = F_a \times x_a$$

Where the subscript denotes the direction (clockwise or anti-clockwise).

Free body force diagrams	A diagram showing all the forces acting on an isolated object or a system	The size and direction of the pairs of forces acting upon an object or system.
Resultant force	Forces acting along the same line	Add together the forces acting in the same direction. Subtract the forces acting in opposite directions.
Vector diagrams	A diagram where forces do not act in the same line. Use scale diagrams to find the resultant force	Draw all the forces acting upon an object. Make sure they are to scale and in the right directions. Draw a joining line from the start of the first force and the end of the last force.

**Moments: A force or a system of forces may cause an object to rotate.**

**Everyday examples of force causing a rotation motion include door handles, steering wheels and see-saws.**

**The turning effect of a force is called the moment of the force. The size of the moment is determined by the equation:**

$$\text{moment of a force (Nm)} = \text{force (N)} \times \text{distance (m)}$$

$$M = F \times x$$

The distance,  $x$ , is normal to the direction of the force

Lever are used to increase the force applied to an object, usually to lift it up from a surface. Levers must have a pivot to rotate around and will work on the principle of moments.



A gear is a wheel that has teeth on it (also known as a cog), as shown in the diagram opposite. For gears to do work you need at least two gears. Gears are used to transmit rotational forces from one place to another.

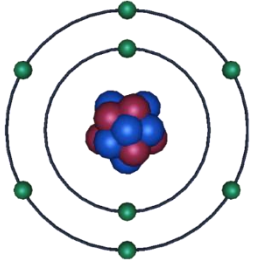


When two cogs are in contact with their teeth interlocking, the driven cog will rotate in the opposite direction to the drive cog. If the drive cog in a gear spins clockwise then the driven cog will spin anti-clockwise.

When a large cog is driving a small cog, then the small cog will rotate faster than the large cog. Halving the number of teeth on the small cog will double the speed of the small cog. Going from a large cog to a smaller cog will increase the speed of rotation.



# KS4 Physics – Electricity

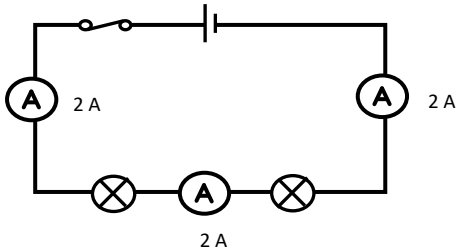


	Mass	Charge	Location
Proton	1	+ (positive)	nucleus
Neutron	1	no charge	nucleus
Electron	1/1835 negligible	- (negative)	shells

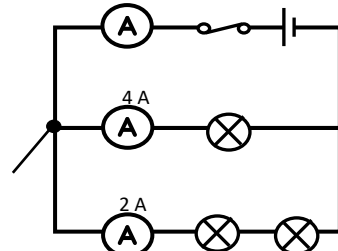
## Useful formulas

- energy transferred (J) = charge moved (C) x potential difference (V)  $E = Q \times V$
- charge (C) = current (A) x time (s)  $Q = I t$
- potential difference = current x resistance
- energy transferred = current x potential difference x time  $E = I \times V \times t$
- electrical power (W) = potential difference (V) x current (A)  $P = V I$
- power = current squared x resistance  $P = I^2 R$

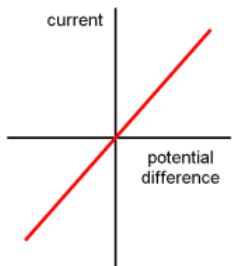
## Current in series and parallel circuits



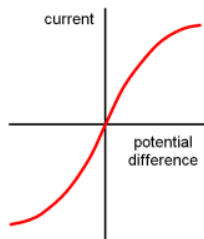
At the junction:  
current in = current out  
 $6 A = 4 A + 2 A$



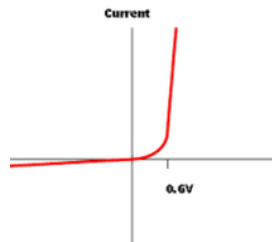
## Ohmic Conductor



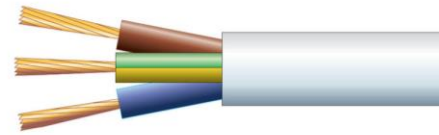
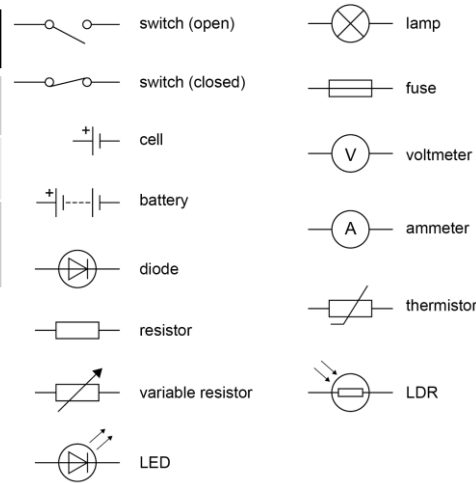
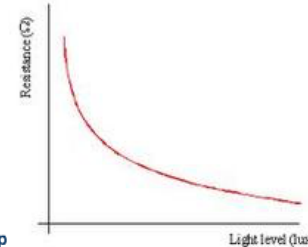
## Non-Ohmic Conductors: Filament Lamp



## Non-Ohmic Conductors: Diodes



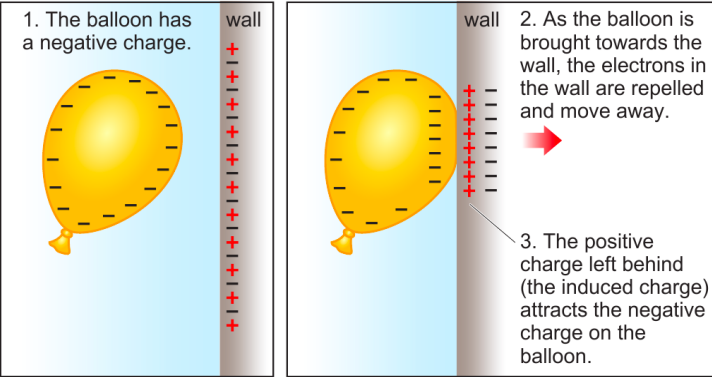
## Non-Ohmic Conductors: Thermistors and LDRs



Name	Colour	Function
live	brown	Carries alternating potential difference from the supply.
neutral	blue	Completes the circuit.
earth	yellow/green	Safety wire to stop appliance becoming live.

Keyword	Definition
Current	The rate of flow of charge in a circuit.
Potential Difference	Also called voltage. The difference in potential between two points of a circuit. Causes a current to flow.
Charge	Charge is the amount of electricity travelling through a circuit.
Resistance	Anything that slows the flow of charge around a circuit. Resistance is usually caused by electrons colliding with ions in a material.
Series Circuit	A circuit with a single loop of wire.
Parallel Circuit	A circuit with two or more loops (branches) of wire.
Variable resistor	A variable resistor is a component where the resistance changes as you slide the connector along it. It can be used to investigate how the resistance of the lamp changes as you change the resistance.
Ohm's Law	the current through an ohmic conductor (at a constant temperature) is directly proportional to the potential difference across the resistor
Ohmic Conductors	Ohmic conductors will produce a straight line I – V graph that goes through the origin.
Non-Ohmic Conductors	The resistance of components such as lamps, diodes, thermistors and LDRs is not constant. It changes with the current through the component.

## Example of Static Electricity



## Dangers of static electricity

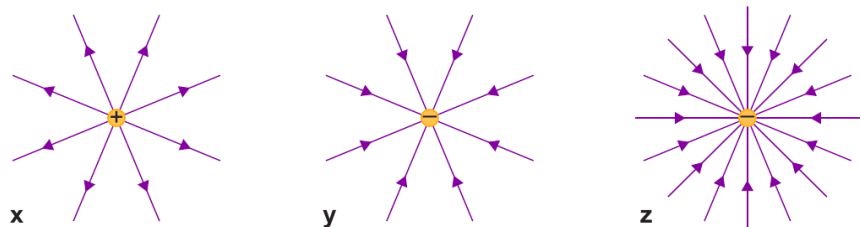
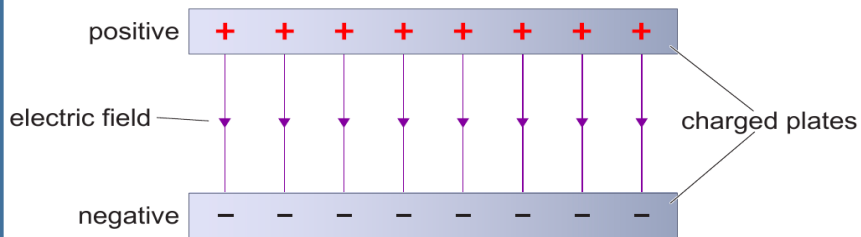
Risk of discharge/sparks. Could lead to fire. Solution and to prevent sparks – earth wire is used to disperse electricity into the ground.

Sparks are a problem when refueling an aircraft, which often becomes charged when flying through the air.



Electric fields – a charged object has a force field around it called an electric field (or electrostatic field)

Field lines 1. Never cross, 2. show where the field is strongest (lines are closest), 3. Show the direction of the force on a charge in the field. 4. Go from positive to negative – if only 1 object they keep going and become more widely dispersed.

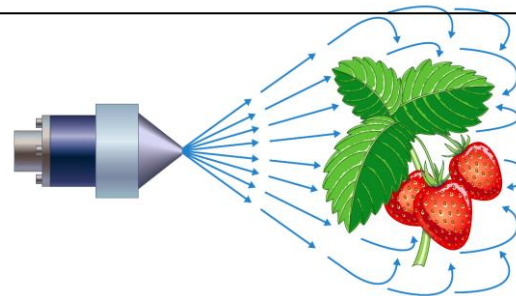


A an electric field around positive and negative point charges

**Separate only**

## Uses of Static Electricity

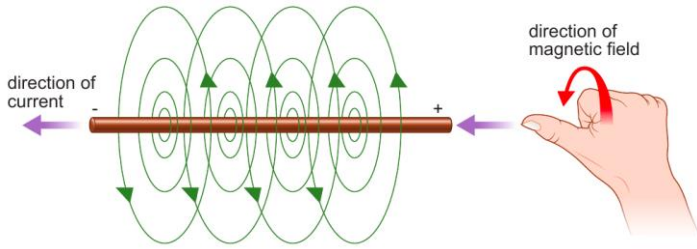
Electrostatic spraying makes use of static electricity. Use of charged particles for painting, applying pesticides. Particles spread out due to repulsion, and are then attracted to a surface via induction.



Keyword	Definition
Static Electricity	Electric charge on insulating materials
Conductor	Material that does conduct electricity.
Insulator	Material that does not conduct electricity.
Electric Charge	Electric charge is a fundamental property of a material that causes a force to be experience when in a magnetic field
Acetate	An insulator that can be used to build up a static charge by friction.
Induction	To create, for example build up of a current in a wire in a magnetic field.
Discharge	Is the release of electricity, commonly via a spark.
Electrostatic	A force of attraction between oppositely charged particles and repulsion between like charges.
Force field	The space around something where a non-contact force affects things, e.g magnetic and gravitational fields.
Field line	The field lines are perpendicular to the surface of the charge. The magnitude of charge and the number of field lines, both are proportional to each other.

## Maxwell's Right Hand Grip rule

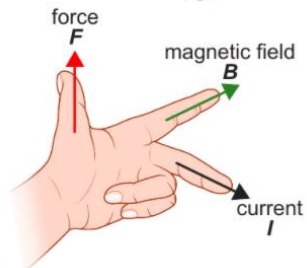
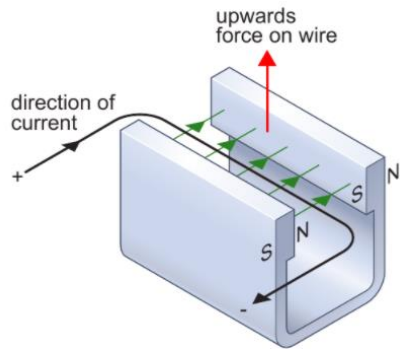
A circular magnetic field forms around a current carrying wire. If you point your right thumb in the direction of the current (+ to -), the magnetic field goes in the direction your fingers are pointing.



A current flowing through a wire causes a magnetic field. Electric motors and other devices depend on the magnetic effect of electric currents.

## Fleming's Left Hand Rule (HT)

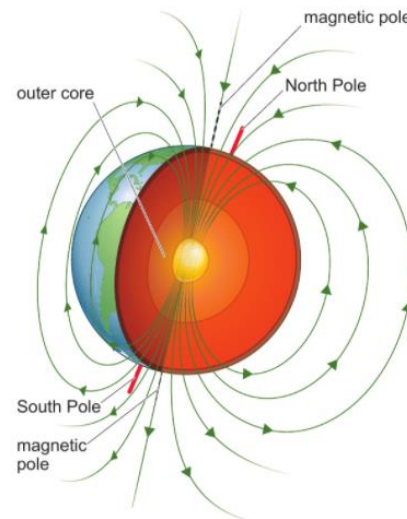
The motor effect describes the force that acts on a current carrying wire in a magnetic field.



## Earth's magnetic field

A plotting compass can also show the Earth's magnetic field.

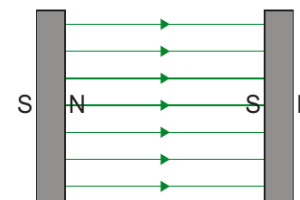
The behaviour of compasses is evidence that the Earth has a magnetic field, which is similar in shape to the magnetic field of a bar magnet.



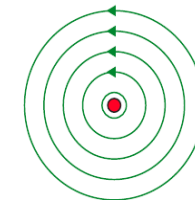
Keyword	Definition
Magnet	An object that has its own magnetic field around it.
Magnetic field	The area around a magnet where it can affect magnetic materials or induce a current.
Permanent magnet	A magnet that is always a magnet such as a bar magnet.
Solenoid	A coil of wire with electricity flowing in it. Also called an electromagnet.
Motor Effect	The force experienced by a wire carrying a current that is placed in a magnetic field.
Magnetic flux density	A way of describing the strength of a magnetic field. Measured in Teslas (T).
Split ring commutator (HT)	This reverses the direction of the current in the coil each half turn. This allows the motor coil to rotate continuously in one direction.

## Magnetic field diagrams (HT)

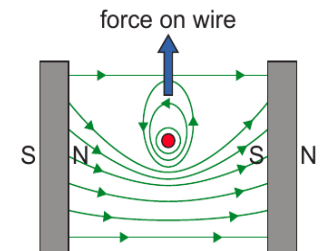
Magnetic field flows from north to south. Also around a current carrying wire.



Two flat magnets produce a uniform magnetic field between them.



A magnetic field goes around a wire carrying a current.



When the wire carrying a current is put between the magnets, the two fields interact to produce a force.

# KS4 Physics – Electromagnetic Induction

## Inducing a potential difference

A potential difference can be induced (created) in a **conductor** when there is movement between the conductor and a magnetic field. This can occur in two different ways:

- a coil of wire is moved in a magnetic field
- a magnet is moved into a coil of wire

This is called **electromagnetic induction** and is often referred to as the **generator effect**.

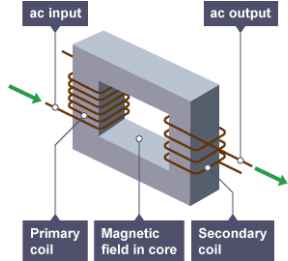
The direction of the induced potential difference or induced current depends on the direction of movement. The current is reversed when:

- The magnet is moved out of the coil
- The other pole of the magnet is moved into the coil

An induced potential difference or induced current will increase if:

- The speed of movement is increased
- The magnetic field strength is increased
- The number of turns on the coil is increased

## Transformers and how they work



1. A primary voltage drives an **alternating current** through the primary coil.
2. The primary coil current produces a magnetic field, which changes as the current changes.
3. The iron core increases the strength of the magnetic field.
4. The magnetic field passes through (or cuts) the secondary coil.
5. The changing magnetic field induces a changing potential difference in the secondary coil.
6. The induced potential difference produces an alternating current in the external circuit.

## Transformer Calculations

The primary coil of a transformer has a current of 0.5A with a potential difference of 100V. The current in the secondary coil is 25A. What is the potential difference across the secondary coil? Use  $V_p \times I_p = V_s \times I_s$

$$100\text{ V} \times 0.5\text{ A} = V_s \times 25\text{ A}$$

$$50 = V_s \times 25$$

$$V_s = \frac{50}{25} = 2\text{ V}$$

A radio runs off the 230V mains supply but only needs 23V. Its transformer has 100 turns of wire in the primary coil. How many turns are needed in the secondary coil?

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$\frac{230\text{ V}}{23\text{ V}} = \frac{100}{N_p}$$

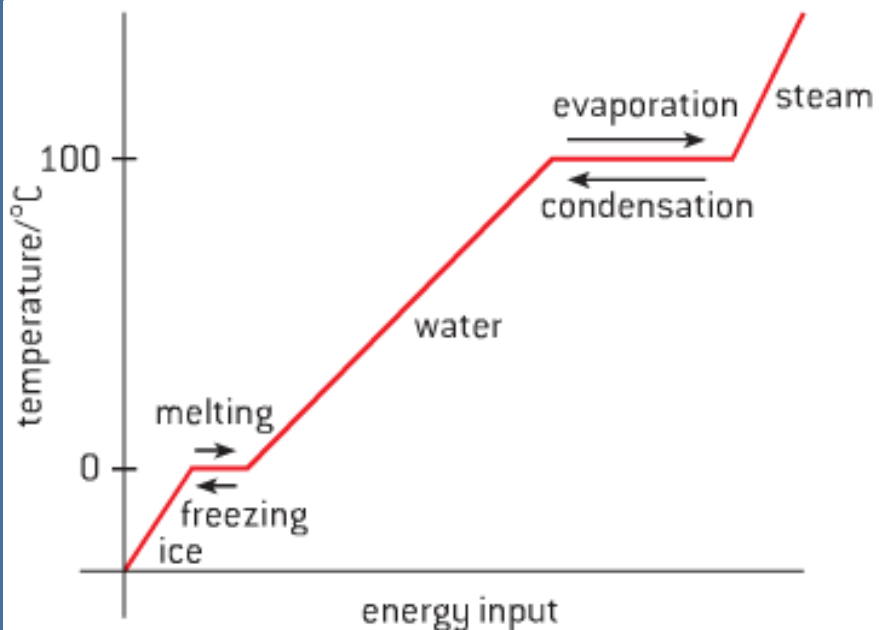
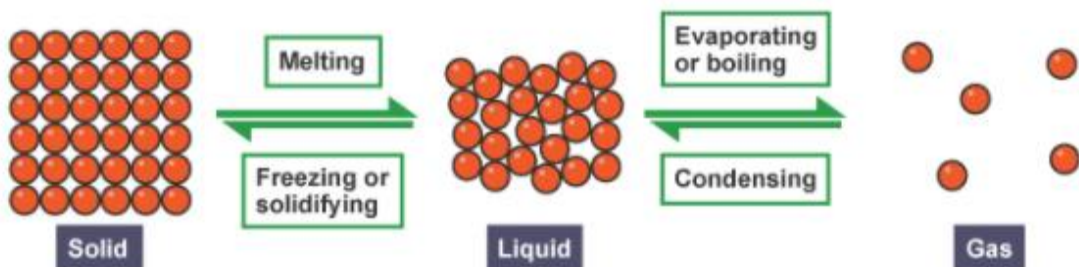
$$10 = \frac{100}{N_p}$$

$$10 \times N_p = 100$$

$$N_p = \frac{100}{10} = 10$$

So the secondary coil must have 10 turns.

Keyword	Definition
A.C	Alternating current, current that flow in both directions
Alternator	An electrical generator which produces alternating current
Conductor	Electrical conductors are materials that have low resistance and allow current to pass through them easily
Dynamo	An electrical generator which produces direct current
Electromagnetic Induction	The production of potential difference (voltage) when a conductor e.g. wire moves through a magnetic field. If the conductor is part an electric current, an induced current will flow
Generator	Device that converts kinetic energy into electrical energy
Generator Effect	When motion between a conductor and a magnetic field creates electricity, i.e. a magnet is moved into a coil of wire.
Magnetic Field	Area surrounding a magnet that can exert a force on magnetic materials
National Grid	The network that connects all of the power stations in the country to make sure that everywhere has access to electricity.
Potential Difference	The potential difference (or voltage) of a supply is a measure of the energy given to the charge carriers in a circuit. Units = volts (V). This is the voltage between two points that makes an electric current flow between them.
Power	The energy transferred each second, measured in watts (W). Power = work done ÷ time taken.
Transformer	An electrical device that increases, or decreases, the potential difference (voltage) of an alternating <b>111</b> current.



### Particles and pressure:

The pressure of a gas is due to the forces on the walls of the container, caused by the moving particles hitting the walls. The faster the particles are moving, the more frequent the collisions will be and the more force they will exert when they collide.

The faster the average speed of the particles in a gas, the higher the temperature of the gas. The higher the temperature, the higher the pressure.

### Worked example

What is the boiling point of water in kelvin?

$$\text{boiling point} = 100^{\circ}\text{C} + 273 = 373 \text{ K}$$

To convert from kelvin to degrees Celsius, subtract 273.

To convert from degrees Celsius to kelvin, add 273.

When a substance undergoes a **change of state** the particles end up in a different arrangement. There are the same number of particles so the mass stays the same (mass is **conserved**). This is a **physical change**, because no new substances are formed and the substance recovers its original properties if the change is reversed. Mass is also conserved in **chemical changes**, but the change in the substances often cannot be reversed.

Key word	Definition
<b>Sublimation</b>	When a solid turns straight into a gas without becoming a liquid first
<b>State of matter</b>	One of three different forms a substance can have: solid, liquid, gas
<b>Change of state</b>	Adding or removing energy to change the arrangement of particles in a material
<b>Physical change</b>	A reversible change in a substance
<b>Chemical change</b>	An irreversible change in a substance
<b>Density</b>	The mass of a certain volume of a substance
<b>Specific heat capacity</b>	The amount of energy it takes to make 1kg of a substance by 1°C
<b>Specific latent heat</b>	The amount of energy it takes to make 1kg of substance change state
<b>kinetic theory</b>	The model that explains the properties of different states of matter in terms of movement of particles
<b>Conserved</b>	A quantity that is kept the same throughout
<b>Joule (J)</b>	A unit for measuring energy
<b>Kelvin (K)</b>	The unit in the Kelvin temperature scale. One kelvin is the same temperature interval as 1° C
<b>Pascals (Pa)</b>	The units for pressure



$$\rho = m / v$$

$$\text{Density (g/cm}^3\text{)} = \frac{\text{mass (g)}}{\text{volume (cm}^3\text{)}}$$

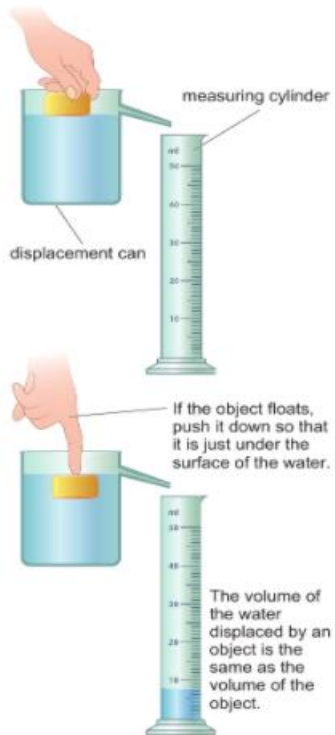
$$\Delta Q = m \times c \times \Delta\theta$$

change in thermal energy (J) = mass (kg) × specific heat capacity (J/kg ° C) × change in temperature (° C)

$$Q = m \times L$$

thermal energy for a change of state (J) = mass (kg) × specific latent heat (J/kg)

**Core Practical:** Investigate the densities of solids and liquids



## Method

### Liquids

- A** Put an empty beaker on a balance, and set the balance to zero.
- B** Use a measuring cylinder to measure 50 cm<sup>3</sup> of a liquid and then pour it into the beaker. Write down the reading on the balance. This is the mass of 50 cm<sup>3</sup> of the liquid.

### Solids

- C** Find the mass of the solid and write it down.
- Diagram B shows how to find the volume of an irregular shape:
- D** Stand a displacement can on the bench with its spout over a bowl. Fill it with water until the water just starts to come out of the spout.
- E** Hold a measuring cylinder under the spout and carefully drop your object into the can. If your object floats, carefully push it down until all of it is under the water. Your finger should not be in the water.
- F** Stand the measuring cylinder on the bench and read the volume of water you have collected. This is the same as the volume of your object. Write it down.

**Core Practical:** Investigate the properties of water by determining the specific heat capacity of water



## Method

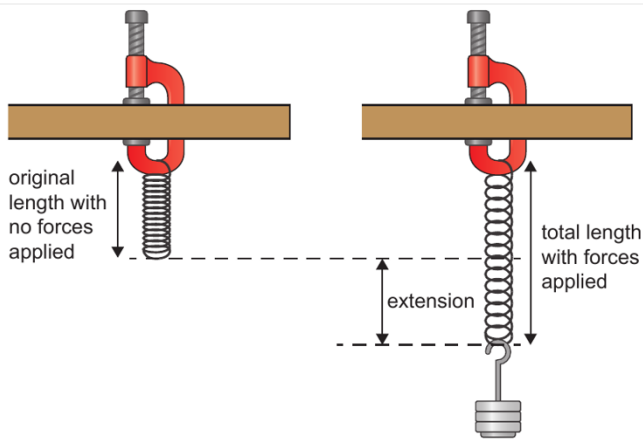
### Melting ice

Wear eye protection.

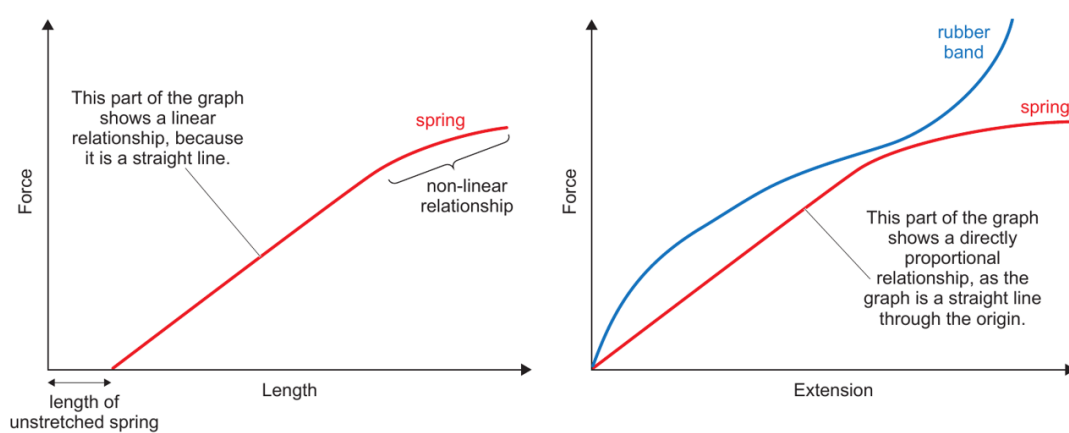
- A** Put a boiling tube full of crushed ice into a Pyrex [or heatproof] beaker. Put a thermometer in the ice and note the temperature.
- B** Put the beaker onto a tripod and gauze. Pour hot water from a kettle into the beaker, and keep it warm using a Bunsen burner.
- C** Measure the temperature of the ice every minute and record your results in a table. Stop taking readings three minutes after all the ice has melted.
- D** Note the times at which the ice starts to melt and when it appears to be completely melted.

### Specific heat capacity

- E** Put a polystyrene cup in a beaker onto a battery-powered balance and zero the balance. Then fill the cup almost to the top with water and write down the mass of the water. Carefully remove the cup from the balance.
- F** Put a thermometer in the water and support it as shown in photo B. Put a 12V electric immersion heater into the water, making sure the heating element is completely below the water level. Connect the immersion heater to a joulemeter.
- G** Record the temperature of the water, and then switch the immersion heater on. Stir the water in the cup gently using the thermometer.
- H** After five minutes record the temperature of the water again and also write down the reading on the joulemeter.



**C** The extension of a spring is not the same as its length.



**D** force and extension relationships for springs and rubber bands

The force needed to extend a spring by 1 metre is called the spring constant. The stiffer the spring, the larger the spring constant.

The spring constant is calculated using the following equation:

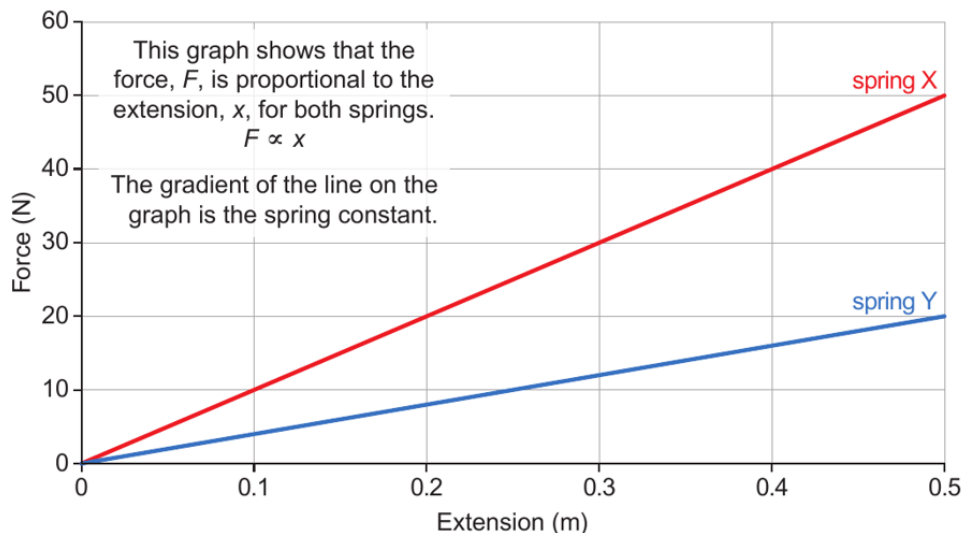
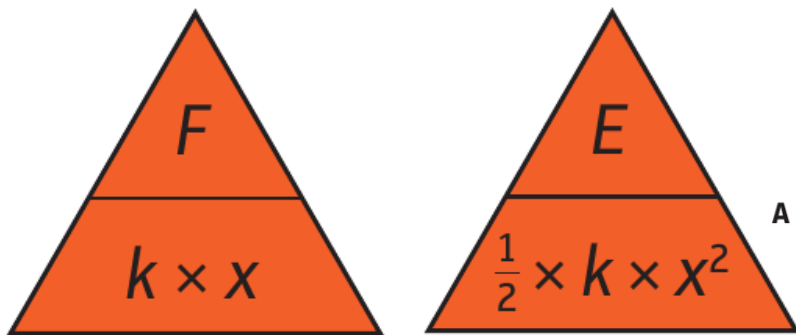
$$\text{spring constant} = \frac{\text{force}}{\text{extension}}$$

(N/m)      (N)      (m)

The work done to stretch a spring is calculated using the following equation:

$$\text{energy transferred in stretching} = \frac{1}{2} \times \text{spring constant} \times (\text{extension})^2$$

(J)                                      (N/m)                                      (m)<sup>2</sup>



**A** Force-extension graph for two springs. The  $\propto$  symbol means 'directly proportional to'.

Key word	Definition
<b>Elastic</b>	An object that can return to its original shape, after forces are removed
<b>Inelastic</b>	An object that cannot return to its original shape, so keeps its new shape, even after forces are removed
<b>Extension</b>	The change in length of an object after forces have been applied
<b>Linear relationship</b>	The graph shows a straight line
<b>Non-linear relationship</b>	The graph does not show a straight line (curve)
<b>Directly proportional</b>	If the value of one variable increase, the other variable also increase by the same percentage
<b>Spring constant</b>	The force needed to produce an extension of 1 metre in a spring
<b>Work done</b>	The energy transferred when a force moves through a distance

# Year 11 Art – GCSE DEVELOPMENT BOARD

- AO1: Developing ideas, artist research.
- AO2: Using resources, testing out ideas and media.
- AO3: Recording ideas, photos and drawings.

## What needs to be included in a GCSE Development Board?

- Drawings /photographs to develop your own ideas tonal and colour. (Linking to your artist's work.)
- X3 small experiments using artist's style/techniques.
- Artist response.
- Developed response..



## How do I develop my ideas inspired by my artist's work?

- Decide what objects might link to your artist's work. Take photographs (Primary)find images on the internet of them (Secondary).
- Draw them in pencil, pen, pencil crayon and paint.



## How do I create experimental pieces?

Take some of your drawings and try out your artist's materials and techniques on them to develop them further.

## What is an artist's response and developed response?

- An **artist's response** is **your own work** developed further using the style/techniques/materials/ideas of your artist.
- A **developed response** makes you look again at what **other** materials and techniques your artist uses to further develop your own ideas.



A **Good development Board** should include drawings using a range of materials and techniques and show a clear journey towards your final piece.

## Expert modelling example...



Development Board.



Response/Developed response

**Wider Thinking:**  
[GCSE Art and Design - BBC Bitesize  
www.studentartguide.com](http://www.studentartguide.com)

**Stretch and Challenge:**  
Use materials and techniques with a high level of skill and control. Record finer surface textures and details.

Keyword	Definition
Tone	Refers to light and dark values.
Texture	Refers to the surface quality in a work of art. (How things look and feel.)
Colour	Colour has the strongest effect on our emotions. It is the element we use to create the mood or atmosphere of an artwork.
Record	To capture visual elements like proportion and form. For recording your ideas. It is important to observe your sources closely.
Artist Response	Your own work developed using your artist's work as inspiration.
Contextual	Connections made to the work of other artists from different and similar times, places and cultures.
Composition	Ways of arranging, organising and laying out elements in a piece of art and design.
Develop	Bring out potential.
Explore	Try out the qualities of materials, techniques or processes through practical investigation.
Imaginative	Develop ideas and concepts in new, engaging and inventive ways.
Refine	Improve initial work taking into account feedback and aims.



## AO1 DEVELOP

**DEVELOP** ideas through investigations informed by **ARTISTS** and other sources, showing analytical and cultural **UNDERSTANDING**

## AO2 EXPERIMENT

**REFINE** ideas through **EXPERIMENTING** and **SELECTING** appropriate resources, media, techniques and processes

## AO3 RECORD

**RECORD** ideas, observation and insights **RELEVANT** to your **INTENTIONS**

## AO4 PRESENT

Present a **PERSONAL** response, showing analytical understanding and realising **INTENTIONS** for your project, making connections in your work

### How do I identify the formal elements of my major project: Cakes, Biscuits & Sweets?

- Artist's information/Inspiration
- What specific theme/genre are you going to study.
- Name a well known artist to take influence from within your chosen genre.
- Define Form/shape/pattern/experiment.
- Apply numerous techniques during development.

### How do I create a response to chosen Artists work?

- Use the ideas behind an artists work to inspire your own designs.
- Watch a demonstration by your teacher.
- Use decorative/dyeing/printing/experimental Textiles techniques with skill and control.
- Create a response to your chosen artists work using influence from their work.

### What needs to be included to ensure a successful final piece?

- Commit to design throughout project.
- Use shape, scale and proportion accurately.
- Make your work as detailed as possible using the Textiles techniques explored.
- Take inspiration from your chosen artist and show clear development in response to their work.
- Create a mock-up of a final product.
- Create final product signifying the conclusion to the journey you have created throughout your sketchbook.

<u>Keyword</u>	<u>Definition</u>
<b>Observation</b>	The action or process of closely observing or monitoring something or someone.
<b>Silk Printing</b>	A design is cut out of paper or another thin, strong material and then printed by rubbing, rolling, or spraying paint or ink through the cut out areas.
<b>Fabric Manipulation</b>	Experimenting with the <b>fabric</b> to change its appearance, drape or shape.
<b>Influence</b>	Something or someone that influences a person or thing, then, has an influence on that person or thing.
<b>Moodboard</b>	An arrangement of images, materials, pieces of text, etc. intended to evoke or project a particular style or concept.
<b>Batik</b>	A method (originally used in Java) of producing coloured designs on textiles by dyeing them, having first applied wax to the parts to be left undyed.
<b>Applique</b>	Layering pieces of fabric that are sewn or stuck on to a larger piece to form a picture or pattern.
<b>Toile</b>	An early version of a finished garment made up in cheap material so that the design can be tested and perfected.



Digital Art



### Artist Response

**Responding** to the work of other **artists** is a great way to generate ideas. ... Starting with a direct **response** showing their understanding of the ideas and aesthetic of an **artist**.



**LEARNING OUTCOME 2:** Be able to plan a pitch for a proposal

- **Learning Aim 1.2 :** Plan a pitch

**Knowledge Organiser – RO66**

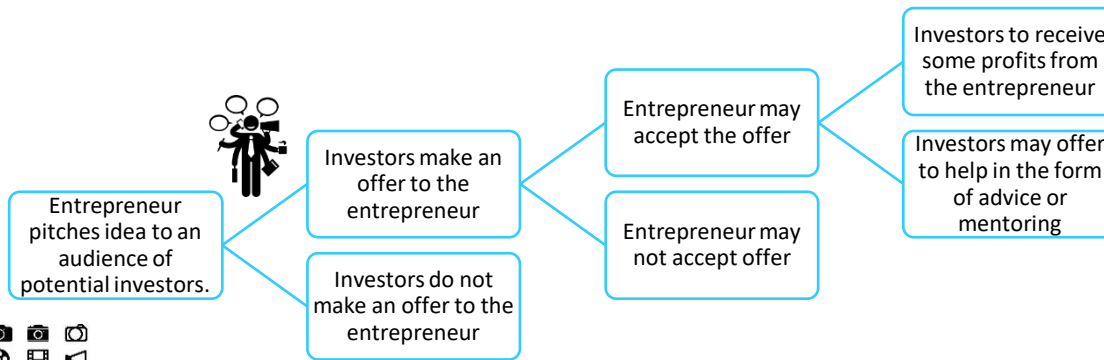
**A Pitch**

A pitch is a short communication that tells an audience about a business proposal with the objective of trying to gain support for the idea. Entrepreneurs often use this method to communicate to potential investors.



**Consider audience**

- Find out more about the audiences business background, organisations they have worked in before and their hobbies and interest.
- Make the content accessible
- Convince other of the likeliness of success.



**Identify appropriate media**

When completing any communication, the presenter may want some pre-prepared resources.

**PowerPoint presentations** – this can contain information on different slides. Visually it can be adapted to create more of an impact on the audience through colours and pictures.

**Handouts** – information that is relevant can be given to the audience, they can be referred to during the presentation. Creates opportunities for discussion.

**Verbal prompts** – notes and prompts can be used to remind the presenter what to say and discuss. However it is important not to read a script.

**Structure of a pitch**

**Introduction** – the presenter introduces themselves and clearly state what the business proposal is.

**Main content and visual aids** – go through, in detail each area of the business

**Conclusion** – This is the time in which the presenter sums up the main points.

**Anticipate potential questions** – thinking of some of the questions that may be asked, this will help when it comes to answering the audience.

**What to wear** – look professional to portray confidence.



**Key Terms**

**Investor:** a wealthy individual listening to a pitch

**Objective of a pitch**

When planning a pitch a business must establish what it is they are trying to achieve.

**To inform** – a business's chance to explain the proposal to the audience, including: design, promotion, cost and break-even

**To persuade** – potential investors need to be convinced that the idea is going to work. The pitch must stand out from the rest and persuade the audience using the presenter's personality, skills and business knowledge.

**Timeframes** – you have a designated amount of time and the pitch must be practiced so it is delivered within the timeframe.

**Communicate effectively** – when communicating, it is important to establish a 'presence' and engage the audience into the presenter's way of thinking. This can be done with the right pacing and volume.

**Venue** – if the business is able to select the venue where the pitch will happen, they need to ensure it is convenient for the audience to reach, check the room layout and ensure they have access to the correct equipment.

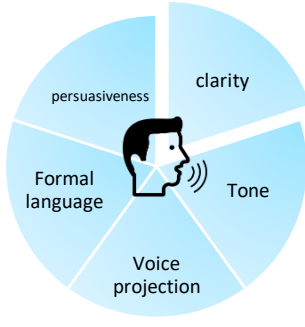
**LEARNING OUTCOME 3 + 4:** Be able to pitch and review a proposal to an audience

- **Learning Aim 3.1+3.2+3.3+3.4+4.1+4.2:** feedback, delivering and reviewing a pitch.

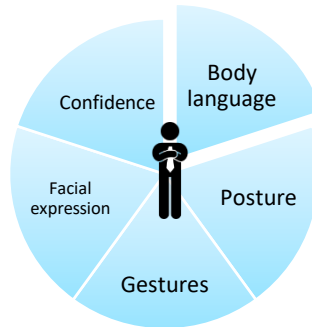
**Use and develop personal presentation skills**

Personal presentation – it is important to create the right impression. You want to show your best attributes and demonstrate that you have taken the time to present yourself in the best way

**Verbal skills**



**Non-Verbal skills**



**Support peers – feedback**

**Constructive feedback** –giving your opinion and in a polite manner make suggestions.

**Feedback sandwich** – two slices of 'bread' represent two positive comments and then the 'filling' is one constructive criticism.

**Phasing feedback** – be sensitive to the persons feelings.

**Sharing opinion** – everyone has their own opinions, listen to everyone and be respectful.

**Encouragement** – encourage others by focusing on the positives of their work.



**Review a practice pitch**

Practicing a pitch allows you the opportunity to gain feedback and make improvements prior to the professional pitch.



**Deliver the pitch.**

To deliver a pitch businesses should consider the following: the business idea, customer profile, market research, product design, costing and risks

**Reviewing a pitch**



**Self assessment**

- When you individually assess different aspects of your work, it is a useful method of reviewing but you need to be honest with yourself.

**Feedback from others**

- Using different types of feedback can help you gain several different views on your pitch

**Lessons learned from practice pitch**

- Focus on the changes that need to be made and documents them to provide you with a source of review.

**Lessons learned from professional pitch**

- Verbal feedback from the audience can be recorded so that it can be reviewed later on.

**Compare the outcomes with the objectives**

A business will often complete a review and will focus on the positive aspects and on things that could be improved. This could be in the form of a meeting and participants will be asked to consider:

- What went well
- What could have been improved
- The format and content of the pitch
  - Visual aids
  - Timings
- Anticipation and preparation of responses to potential questions



**Key Terms**



**Professionalism:** consistently displaying appearance and conduct of the highest quality and is associated with the impression that is given to others when working in a business

**Future developments**



When any kind of project or business has been completed or launched, it is a good idea to think about how the idea can be developed further. Always look to improve or develop your new products (product development)

**Reviewing a business proposal**



Businesses will need to ensure that their staff have the right knowledge and skills when reviewing any new business idea. A business will put together a plan of what information is required.

**Product proposal** – a description of the product and its unique selling point, etc.

**Pricing strategy** – the pricing methods that they intent to adopt to try and obtain sales.

**Brand** – the brand personality, identity and image which is individual to the pitch.

**Promotional plan** – the different promotional methods that were created to sell the product.

**Relevant and appeal to the customer** – research that shows why customers will want to purchase the product.



**Export of e-waste**



## Possible Careers

- Legal Consultant (Lawyers)
- Data analyst
- Environmental officer
- Teaching

## Environmental impact of computer science

E.g. smartphones

- Companies make these with a limited life – bring out new brands
- When we make devices we use up natural resources
- e.g. plastics that come from crude oil, precious metals like gold, silver copper, mercury
- Extracting these materials take a lot of energy, creates pollution and uses natural resources
- E-waste – when we throw away devices we create this
- Not always disposed of safely
- Much of our e-waste goes to 3<sup>rd</sup> world countries
- Landfills – precious and poisonous metals and toxins from waste leak in to land and water
- This impacts on 3<sup>rd</sup> world countries environment and health of people e.g. children rummaging through landfill sites looking for food.
- WEEE – Waste electric and electronic Equipment – company that helps dispose of E waste safely and promotes recycling of devices.

## Cultural implications

- Shaped our lives – lead to digital divide – some people have greater access to tech than others. This can lead to others being disadvantaged
- Why? Some have more money to buy new devices, urban areas have better network coverage than rural, some don't know how to use the technology e.g. older people haven't grown up with computers so don't know how to use them
- People in richer countries have better access = better opportunities for these people
- Changes in business – streaming media- cheaper – music shops such as HMV closing stores. Cheaper services like Airbnb use internet to rent out rooms – can be cheaper but also risky – safety regulations, insurance might not be in place as if you book through a hotel it would be.
- Shaped our culture – selfies, attention seeking and self obsessed behaviour. Things going viral – easily spread can have positive but a negative impact on peoples lives.

**Ethical** - what is CONSIDERED to be right and wrong by society

**Legal** - what is ACTUALLY right and wrong in the eyes of the law

**Cultural** – how groups of people with certain beliefs, practices or languages may be affected e.g. religions, ethnic groups

**Environmental** – how we impact the environment

**Privacy** - keeping data secure and accurate

**Stakeholders – Individuals or groups of people who have an INTEREST in or are AFFECTED by decisions a company makes**

- **Owners**
- **Employees**
- **Customers**
- **Shops it sells goods to**
- **Suppliers to the company**
- **Local Community**

## Legal

- **Data Protection Act**
  - Keep Personal data secure
  - Keep Personal data Accurate
  - Keep Personal data for a specific purpose
- **Computer Misuse Act**
  - Illegal to access computer material without permission,
  - Illegal to access computer material without permission and with intent to commit criminal offences,
  - Illegal to alter computer **data** without permission

### Copyright designs and patents act

- Illegal to copy someone else's work, design eg, novel, music, picture, software, designs etc
- Permission is needed from the copyright holder if you want to use anything – may have a small cost
- Difficult to control with internet in play and not easy to police e.g. streaming videos, music illegally

### Creative Commons Licensing

- Allow you to legally share media and software online without having to ask for permission first.
- Usually take and build upon the work in the public domain that can be shared again

### Freedom of information act (2000)

- allows members of public to access information held by a public organisation about that organisation's activities
- Covers data files, email, printed documents
- e.g. NHS, armed forces, Police, Schools
- The act makes these organisations publish data on a regular basis so the public have access to it
- Public can also request certain information
- e.g. school results data, Hospital waiting lists, crime stats etc



## Open source software PROS

- free and openly available to everyone. **No licence needed.**
- The code is published and allow others to use and **modify it.**
- Open source products are usually **tested in public by online contributors.**
- **Wide pool of innovative creators – very reliable and secure**

## Open source software CONS

- Might not get regular updates
- **May have security holes**
- **May be Limited user documentation**
- **No warranties or customer support**
- **No one to take ownership if something goes wrong**

OPEN SOURCE SETUP	PROPRIETARY SETUP
<p><b>Back Office</b></p>	<p><b>Back Office</b></p>
<p><b>Website</b></p> <p>CMS integrated with:                      - Tessitura Ticketing System                      - Facebook API                      - Virtue Mart shopping cart</p>	<p><b>Website</b></p> <p>Proprietary or custom-built Content Management System, linked to commercial Client Relationship Management system</p>
<p><b>Software</b></p>	<p><b>Software</b></p>

## Proprietary software PROS

- **legally remains the property of the organisation, group, or individual** who created it.
- Source code not usually published
- Has help and customer support
- Well tested and tried
- A special licence key needs to be purchased to use it.

## Proprietary software CONS

- **Can be expensive**
- **Might not exactly fit users needs**
- **Ma not maintain older versions and warranties will expire – as the companies wills want people to buy the latest versions.**

OPEN SOURCE	PROPRIETARY
Linux,Ubuntu, Open Office	Microsoft windows, word, Pumori
Purchased with source code	Purchased with out source code
User can modify software	User can not modify software.
Free of Charge	Must pay to use.
Can install freely	License required
No one is responsible for support	Full support from vendor if any problem occurs.

# Year 11 – iMedia – R084

## Target Audience

You need to know your target audience: Who are they? What kind of things do they do? What products do they use? How old are they? What are they interested in? The answers to these questions and many more will help you better understand the people you are designing for. Getting an understanding of these individuals helps you create with ease and make something you know will relate to them.

## Assets Table

An asset table is a list of all of the assets, images and information you have collected for the project - listing where you got it from and describing any legal issues with using it.

## Legislation

You will need to write a couple of paragraphs focusing on Copyright Law. You need to include the following:

Copyright law in education – The law does not apply.

Copyright in Business – a company can be fined and asked to remove the material in question.

## Client Requirements

They will be working for. They will tell you what to plan, design or create for them. The Client will set out requirements that they want you to follow when you plan the project - eg: Purpose, Theme, Style, Genre, Content.



## Scenario



## Export Options

They can be saved in different formats for different purposes :  
Printing and distributing  
Online – cyberbully website  
Check the client brief!



## The purpose, creation and characters of existing multipage comic strips

You need to investigate comic strip:  
genres  
origins  
history  
target audiences  
characters and their physical and non-physical characteristics.

## Software to create comics

Comic Life  
Storyboard that  
Publisher  
Canva.com

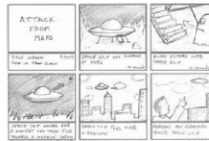
## Features in comics

Speech Bubble  
Captions  
Thought Bubbles  
Comic Panels  
Titles

## Storyboard

A storyboard is a visual diagram which will show the following:

- panel layout
- focal points within panels
- characters
- storyline
- communication
- locations



## What resources will be needed to make your comic strip?

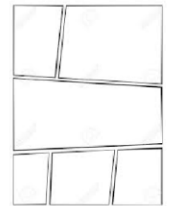
Digital Camera  
Internet  
Computer System  
Comic Life  
Pencil and Paper  
Microsoft Word  
Microsoft PowerPoint  
Microsoft Excel



## Tools & Techniques

You need to show evidence of the tools and techniques you have used:

- Panel placement
- Focal points



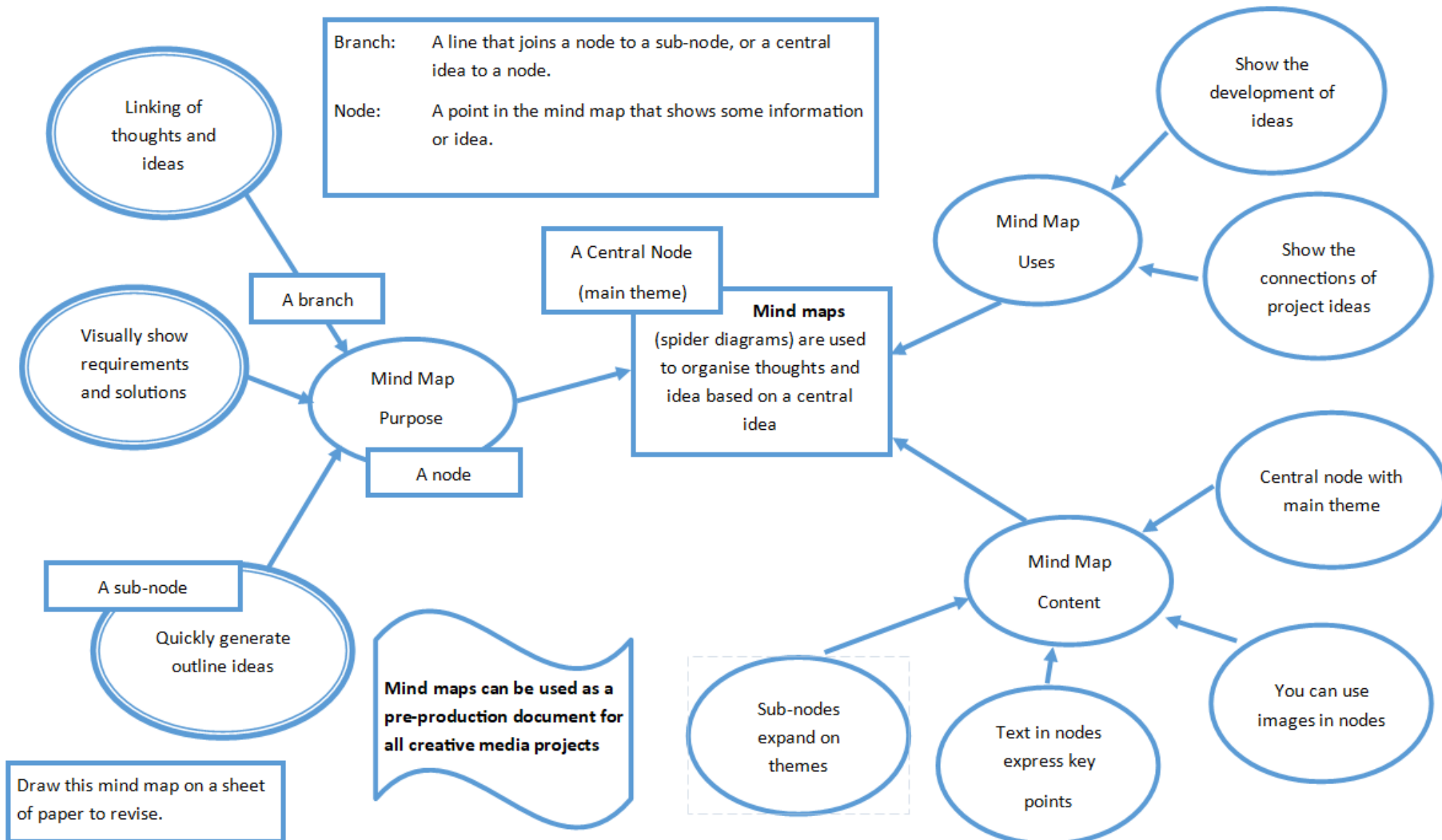
## Technical Compatibility

Your final image must meet the technical specification set by the client.

Two page comic with at least 6 panels on each page  
Exported suitable for printing (PDF)  
Exported suitable for online

# Year 11 – iMedia – R084

You must be able to understand the purpose and use the content of different pre-production documents



# Year 11 – iMedia – R084

You must be able to understand the purpose and use the content of different pre-production documents

## Mood Boards



A mood board is a collection of sample materials and products. They can be created using paper/cards on a notice board or with software.

### Purpose:

- ⇒ Help with creativity in the design stage to establish a style
- ⇒ Save time by ensuring the design ideas work well before production begins
- ⇒ Checks there is a clear creative direction for the project (show the client)
- ⇒ The client can be involved at an early stage to give their feedback
- ⇒ Shows concepts that are difficult to describe in words



## Colours

Mood boards can be used to explore several possible colour schemes based on client preferences or your ideas.



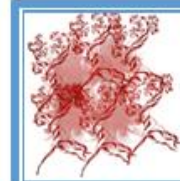
## Inspiration

Explore ideas to see how assets work well together. What is the mood created by the design?



## Textures

Establish which texture designs work well together to add to the overall theme of the project



## Photography (images)

Do client photos fit with the mood? Do you need other images, if so, what are the limitations of using other people's images?



# Year 11 – iMedia – R084

You must be able to identify a wide range of multimedia products, where they are used and give details of their design principles

Multimedia Elements	Design principles.
<b>Colour Scheme</b>	Colour scheme must be chosen to suit the purpose for the target audience. The choice of colours cannot be accidental and there should be serious consideration of the reasons that a specific range of colours have been chosen. A consideration of combination of colours in a multimedia product must also be considered should be chosen to meet the purpose of the multimedia product. All choices must be compatible with the scenario and the users needs are the important considerations for choosing the colour scheme.
<b>House Style</b>	The house style is a consistent use of multimedia elements throughout the whole multimedia product. House styles maintain a common layout, colours and fonts. A house style is typically maintained by creating a template. An organisation will wish to maintain the house style across all their documentation and multimedia products so for their customers can immediately recognise it.
<b>Layout</b>	Layout is how the design of certain multimedia elements are positioned within a multimedia product. The position of headings, images, font size, colours and other multimedia elements have been decided after planning using visualisation drawings to assess the most appropriate layout. The layout will be completed after taking into consideration users needs and the target audience. The layout must operate for every platform the users access the multimedia product, e.g. PC, tablet or smartphone.
<b>GUI</b>	Graphical User Interface must be easy to use by everyone who access the multimedia product, whether it is a DVD interface, kiosk interface, touchscreen or mouse controlled user interface. The GUI will have a layout that the user finds accessible and easy to navigate. A GUI design will be assessed with visualisation diagram to determine where navigation the best button size and placement or if hyperlinks are used.
<b>Accessibility</b>	Accessibility is about making a multimedia product available to a wide range of the community through good design. A range of multimedia elements come together to improve accessibility; such as, colour scheme, size of fonts, GUI design, layout. The multimedia product, such as a website or DVD, might be able to display the content in different languages to make it available to a wider community.
<b>Navigation methods</b>	The choice of navigation method is important to enable the user to be able to use the multimedia product. This could be using different forms of input technology such as voice control, hand gesture, touch screen, keyboard or mouse. It is also about how the multimedia product interacts with the users input to enable the user to be able to easily use the multimedia product.

# Year 11 – iMedia – R084

You must be able to identify a wide range of multimedia products, where they are used and give details of their design principles

Multimedia Products	Design principles.
<b>Websites</b>	<p>Websites are an interactive multimedia product that can be access by users who have a connection to the internet. Websites are built using a wide range of multimedia elements (see previous page). A computing device that is able to run a web browser with an internet connection is required. Navigation is either thorough touchscreen or mouse control. Performance is related to the speed of the internet connection and the quantity and size of the multimedia elements built into the web page.</p> <p>Websites are used extensively for on desktop and mobile computers to access a wide range of multimedia elements. Websites can provide audio streams (e.g. Spotify) and video (e.g. YouTube and iPlayer). Generally the more multimedia elements that are present requires higher speed internet connections to make their operation smoother.</p>
<b>Information Kiosks</b>	<p>Information kiosks are a wide range of multimedia products such as bank ATMs, supermarket self service checkouts, hospitality kiosks, airport check in kiosks, tourist information kiosks, railway ticket machines and fast-food order points. These multimedia products are usually single purpose machines that need special hardware and software to make them operate. Generally they have a large touch screen and some have audio capabilities. They can also have peripheral technologies printers for tickets, and cameras or small keypads. Information kiosks are usually limited by being positioned in a fixed location and wired to a network connection to provide information from a database system.</p>
<b>Mobile phone applications</b>	<p>Smartphones are able to support a wide range of multimedia elements. With high performance touchscreens, WiFi, Bluetooth, motion sensors, speakers, microphones, they provide smartphone applications a wide range of possibilities . The majority of smartphone applications rely on an internet connection and use the touchscreen to operate the software. The GUI can use buttons or hyperlinks as well as other integrated sensors. The hardware is usually fixed at purchase with the exception of some allowing the addition of memory cards. Smartphones are able to produce a range of multimedia elements, such as audio, video and still images. Smartphone applications can have a different layouts, GUIs and do not always have the same appearance. Touchscreen technology makes accessibility difficult with visual impairments.</p>
<b>E-learning products</b>	<p>E-Learning products will use a wide range of multimedia elements such as video, audio. E-Learning can be provided on DVD, where the user navigates by selecting the content and viewing a video or some software that is included on the DVD disk. The user is limited to using a computer with a DVD drive to see the video content and to run any software. More recently , e-Learning is also provided through websites which can be accessed from a wider range of devices.</p>

You must be able to understand the purpose and use the content of different pre-production documents

Camera, Lighting and Sound

BOP206 / 2011

	<b>"This is the Place"</b>
<b>1. TITP GRAPHIC</b> _____ /	<b>TITLES / GRAMS</b>
<b>2. CAM 3</b> _____ / M.L. 2-SH PRES 2 L.O.F. PRES 1 R.O.F.	<b>PRESENTER 1:</b> Hello and welcome to "This is the Place".  <b>PRESENTER 2:</b> This is the show where each week we visit a productive location of interest and today we are here at Ravensbourne – a media college and 'digital destination' just opposite the O2 in North Greenwich, London.  <b>PRES 1:</b> Ravensbourne sports a Faculty of Fashion and offers studies to MA level but this afternoon we are focusing on Communication Media - more usually called Broadcasting.  And we start our walkabout in this the jewel of Broadcasting, the Ravensbourne TV studio. (TURNS) This brand new facility is fully equipped with 5 HD cameras and is State-of-the-Art - in both the specification of its installed kit and the suitability of its building design.  In fact without detailed planning in sound insulation for instance, no studio would be able to co-exist in this an otherwise quiet college of study.  So, let's look at the studio fundamentals. The studio's lighting 'grid' is way up there at over 4 metres high - that's over 13 feet and here you'll find numerous
<b>3. CAM 2</b> _____ / W.S. PRESENTERS R.O.F. AT TOP OF SHOT PAN LEFT TO INCLUDE CAMERA 1 WITH PRESENTER'S WALK	
<b>4. CAM 1</b> _____ / STUDIO WALL DETAIL AS DIR.	
<b>5. CAM 2</b> _____ / M.S. PRES	
<b>6. CAM 4</b> _____ / W.S. STUDIO GRID/LIGHTS	

Page 1 of 11

## Scripts

A script is a piece of written work that can be for a movie, audio, audio-visual product or screenplay. It is often that starting point for any of these products and includes information about the media product in a style and format that follows some layout conventions. It is often used by a number of different people involved in the actual production, who will analyse the script and break it down into sections with information that is needed.



Screenplay scripts are created by the writer and presented in a standard format.

They are distributed by agencies or producers to attract talent and finance for production projects. Alternatively, a writer might be employed to adapt an existing novel or event into a screenplay or stage play script.

# Year 11 – iMedia – R084

You must be able to understand the purpose and use the content of different pre-production documents

## Purpose:

- ⇒ To identify the location where the action takes place
- ⇒ To identify who will be in the scene, e.g. actors, narrative
- ⇒ To provide stage direction for actors and production crew
- ⇒ To provide dialogue (i.e. speech) for the actors and other characters

## Uses:

- ⇒ Any moving product with dialogue (spoken words), actions and a timeline, for example:
  - ◇ Video products, e.g. advertisements, films
  - ◇ Audio products, e.g. advertisements, jingles, radio plays
  - ◇ Animation products, e.g. short films
  - ◇ Computer game with short story-telling scene or interactions between game characters

## Content:

- ⇒ Set or locations where the action takes place
- ⇒ Scene descriptions
- ⇒ Scene/stage directions, i.e. what happens in the scene
- ⇒ Camera shot types
- ⇒ Sounds and sound effects
- ⇒ Names of actors or characters
- ⇒ Dialogue, e.g. speech and how it is spoken

## Keywords:

**Narrator:** A person that tells the story verbally. The narrator voice will be heard over the action, but the narrator does not appear in the scenes or take part in the acting. Typically a narrator is employed in a screenplay or an audio-visual product.

**Dialogue:** The combination of what is spoken by a character in the scene together with how they say it, that is, identifying any emotion, factual expression, e.t.c.

**Voiceover:** The words spoken by an unseen person to accompany an audio or audio-visual product. Often used in radio adverts and jingles.

## SCRIPT EXAMPLE



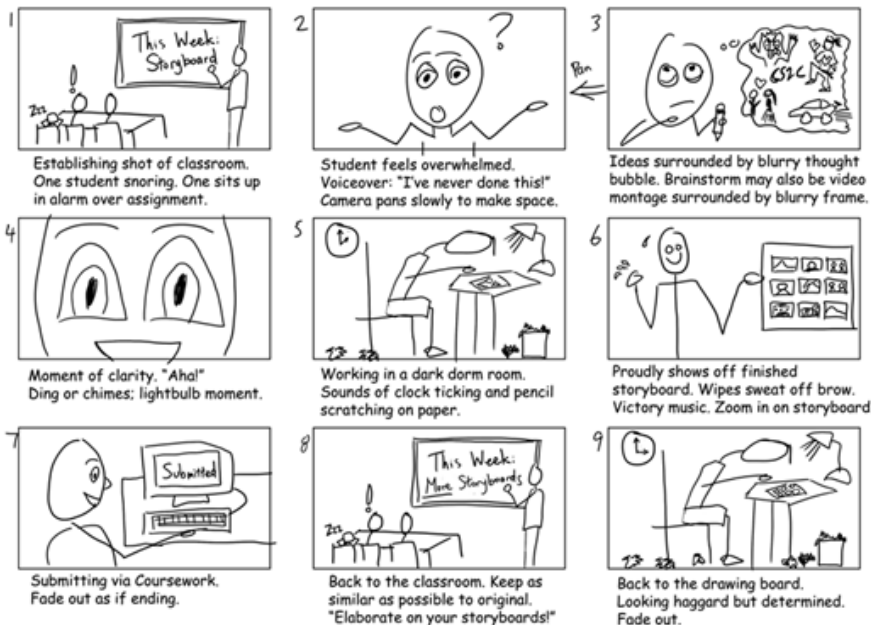


# Year 11 – iMedia – R084

You must be able to understand the purpose and use the content of different pre-production documents

## Storyboards

- ⇒ A storyboard is used by many people to illustrate a sequence of **moving** images.
- ⇒ A storyboard shows the flow of scenes that occur in a timeline, a succession of events.
- ⇒ This is different to a visualisation diagram which are used for a single of events.
- ⇒ Each scene of the story is placed in chronological order (in the order



## Why use storyboards?

### Best way to share your vision for the project

- ⇒ A visual aid makes it much easier for you to share and explain your vision for your video with others.
- ⇒ When you have a storyboard, you can show people exactly how your video is going to be mapped out and what it will look like. This makes it much easier for other people to understand your idea.

### Makes production much easier

- ⇒ When you storyboard a video you're setting up a plan for production, including all the shots you'll need, the order that they'll be laid out, and how the visuals will interact with the script.
- ⇒ The storyboard is a starting point or suggested storyline around which you can plan your story (all the angles you will shoot of a scene). This really comes in handy when you're making your video, as it ensures you won't forget any scenes and helps you piece together the video according to your vision.

### Saves you time

- ⇒ While it may take you a little while to put your storyboard together, in the long run it will save you time in revisions later.
- ⇒ Not only will it help you explain your vision to your team, it will also make the creation process go more smoothly.

You must be able to understand the purpose and use the content of different pre-production documents

## Storyboard and camera angles

- ⇒ The storyboard could be used by several people who could be involved in the production process.
- ⇒ Camera shots and angles are important aspects to a storyboard
- ⇒ The camera operator or animator will use the storyboard to decide how to create each scene.
- ⇒ Each scene is usually defined by changes to the camera use for each shot.



Establishing Shot



Full Shot



Medium Shot



Close Shot



Extreme Close Shot



Up Shot



Down Shot



Over The Shoulder



Two-Shot



POV shot

wiki How to Draw Storyboards

### Purpose of a storyboard

- ⇒ To provide a visual representation of how a media project will look along a timeline
- ⇒ To provide a graphical representation of what a sequence of movements will look like
- ⇒ To provide guidance on what scenes to film or create
- ⇒ To provide guidance on how to edit the scenes into a story

### Uses of a storyboard

- ⇒ Any project where movement or a sequence is required, especially along a timeline, for example
  - ◇ Video projects
  - ◇ Digital animations
  - ◇ Comic books to illustrate the story
  - ◇ Computer games, to illustrate game flow, narrative or story
  - ◇ Multimedia projects, to illustrate the sequence between scenes

### Content of a storyboard

- ⇒ Images, for content of each scene
- ⇒ Locations
- ⇒ Camera shot type and angles
- ⇒ Cameral movement
- ⇒ Shot length and timings

# Year 11 – iMedia – R084

You must be able to understand the purpose and use the content of different pre-production documents

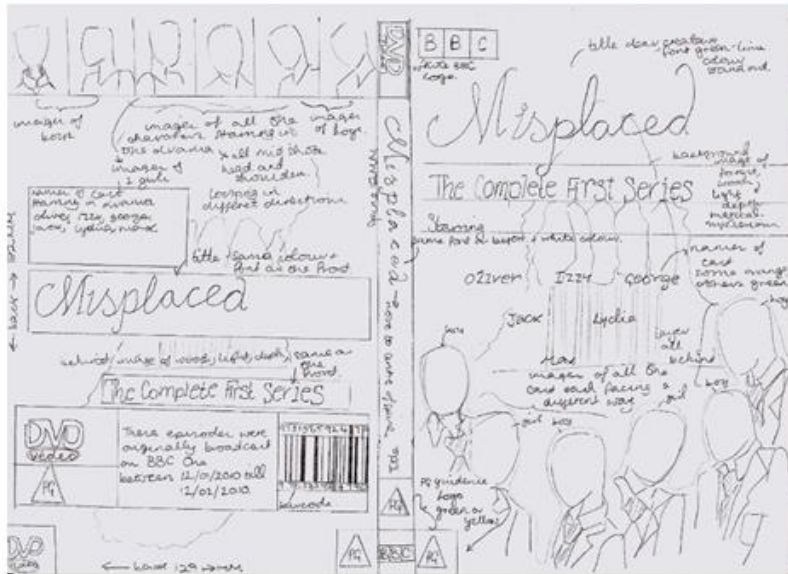
## Visualisation Diagrams

Visualisation diagrams are a rough drawing or sketch of what the final static image product is intended to look like. They will have annotations to describe the design ideas. Typically, a visualisation diagram is hand drawn, but it does not need any artistic skills to communicate ideas.

It is intended to demonstrate the layout and content of the product that is being illustrated

You might produce several drafts to demonstrate ideas to your client. Your client might choose the draft they like the most. There must be sufficient information in the visualisation diagram for the client to make a decision about their preferred design.

Visualisation diagrams are valid for static designs, that is an image that does not move. It is, therefore, relevant for designs such as a magazine cover, a DVD cover, or an image for a website. It would not be suitable for a video or an animation.



Look closely at the detail in the example visualisation diagram. Compare the concepts in the visualisation diagram and compare them to the final product that was produced. Do you notice the similarities and the differences.

Notice how the visualisation diagram was not modified as ideas developed in the pro-

### Purpose:

- ⇒ Plan the layout of a static or still image in a visual manner
- ⇒ To show how a finished item might look like

### Uses :

- ⇒ CD/DVD cover design
- ⇒ Poster, such as for a film, event, leaflet or advertisement
- ⇒ A single game scene or display of a single scene

- ⇒ Comic book page layout
- ⇒ Web page layout
- ⇒ Magazine front cover

### Content:

- ⇒ Multiple images, layout and positions of items.
- ⇒ Colours and colour schemes
- ⇒ Position and styles of text
- ⇒ Fonts, font colours and size
- ⇒ Notes as annotations which provide

# Year 11– iMedia(ICT) – R085

## Target Audience:

You need to know your target audience. Who are they? What kind of things do they do? What are their likes and dislikes? What are they interested in? Getting an understanding of these individuals helps you create with ease and make something you know will relate to them.

## Planning:

Create a work plan which lists all of the tasks involved in the whole project. Estimate how long each task will take and create a chart or diary to record how long they REALLY take to complete. Build in some contingency time in case things go wrong!

Create a site map to show the pages of the website and how they will be linked together with navigation features.

Create a visualisation diagram to plan the content and layout of the individual web pages.

## Test Plans:

There are a range of elements that all need work to produce a successful product. Create a test plan to check these functions:

- Navigation
- Links to take the user to the correct page
- Display of images and content
- Playback of video and audio

## Asset Table:

Create an asset table to show the range of audio, video and images you will be using. This will include listing where you got the assets from and describing any legal issues with using them.

## Methods of internet connection:

- Wired broadband
- Wi-Fi
- 3G, 4G and 5G wireless broadband

# Year 11– iMedia(ICT) – R085

## Devices used to access webpages:

- Laptops and personal computers
- Tablets
- Mobile devices and smartphones
- Game consoles and digital television
- Smart Speaker
- Smart Watch

## Purposes of websites:

- Education
- Online retail
- Information
- Services
- Advertising
- Promotion
- Entertainment

## How does the appearance of websites differ on different devices?

The screen resolution used can change the look of a site  
Operating system used can change the look of a site  
Fewer images may be used on mobile versions  
The web browser may change things  
The orientation can change

## Client Requirements:

Your client is the person you will be working for. They will tell you what to plan, design or create for them. The client will set out requirements that they want you to follow when you plan the project.

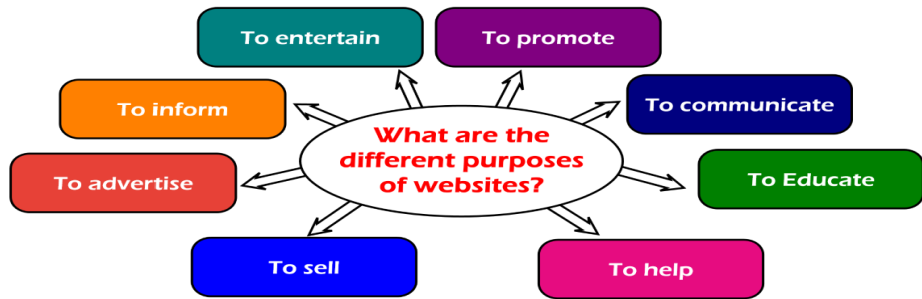
## Features of websites:

House style  
Navigation features  
Hyperlinks  
Search facility  
Website footer  
Images/image gallery  
Ordering forms  
Downloadable content  
Logo/Title  
Page Titles  
Email links  
Links to social media  
Internal links  
Shopping basket

## Interactive features

- Rollovers
- Animations
- Adverts
- Surveys
- Forums
- Quizzes
- Comment boxes
- Audio/video files

# Year 11– iMedia(ICT) – R085



## How does the appearance of websites change on different devices?

1. The screen resolution you are using can change the look of a site.
2. The operating system used can change the look of a site.
3. Fewer images may be used on mobile versions.
4. The web browser used may change things.
5. The orientation can change.

## Advantages and disadvantages of using the Internet

Advantages	Disadvantages
1. Easy communication across the world	1. Viruses
2. 24/7 access to information	2. Cyber-bullying / Trolling
3. Entertainment	3. Viruses
4. Online Banking	4. Exposure to inappropriate material
5. Online Shopping	5. Identity theft
6. Learning Resources and information availability	6. Leakage of private information



## What are the common features of websites?



## Which different ways can be used to connect to the Internet?

1. ADSL Broadband over existing phone lines.
2. Cable Broadband - through cables shared by the TV service
3. Fibre Broadband.- High speed fibre optic cables
4. Ethernet - a cable running from a router / network point
5. Wi-fi - wireless signal from a wireless router
6. Mobile Data 3G and 4G

Interactive elements: e.g. rollovers, animations, games, adverts, surveys, forums, quizzes, comment boxes, audio files

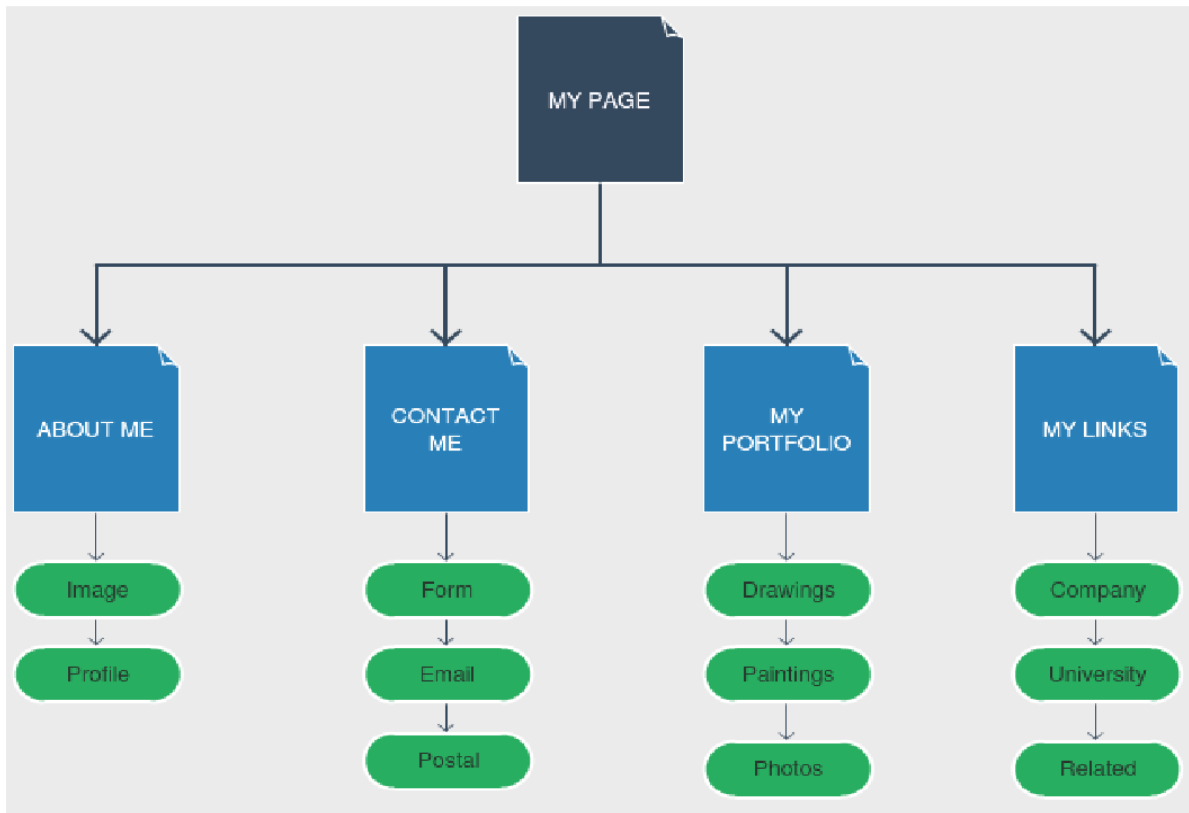
# Year 11– iMedia(ICT) – R085

Research	Plan	Create	Review
<p>▸ Refer to client specification</p> <p>▸ Target Audience</p> <p>▸ Identify existing solutions.</p> <p>▸ Is the project achievable</p> <p>▸ Target audience</p> <p>▸ Technology needed to complete the project</p>	<p>▸ Layout</p> <p>▸ Colours</p> <p>▸ Fonts</p> <p>▸ Media</p> <p>▸ Content</p> <p>▸ User needs</p> <p>▸ House Style</p> <p>▸ Charts</p> <p>▸ Equipment</p>	<p>▸ Assets</p> <p>▸ Templates</p> <p>▸ Images</p> <p>▸ Logos</p> <p>▸ Text</p> <p>▸ Media</p> <p>▸ Hyperlinks</p> <p>▸ Forms</p> <p>▸ Testing plan</p>	<p>Quality</p> <p>▸ Testing</p> <p>▸ Fix errors</p> <p>▸ Obtain feedback</p> <p>▸ Check fit for purpose</p> <p>▸ Improvement</p> <p>▸ Meets client requirements</p> <p>▸ Use target audience and client feedback</p>

Keywords	
Word	Meaning/Description
Website	A collection of web pages linked together.
Webpage	A document which can be displayed in a web browser such as Firefox, Google Chrome, Microsoft Internet Explorer or Edge, or Apple's Safari.
Navigation Bar	A navigation bar is a user interface element within a webpage that contains links to other sections of the website.
Rollover Image	Allows you to have two images and when the pointer hovers over one, it changes to another image.
Hyperlink	A button, text or image that allows you to move around a website.
Hotspots	An area on a computer screen which can be clicked to activate a function, especially an image or piece of text acting as a hyperlink.

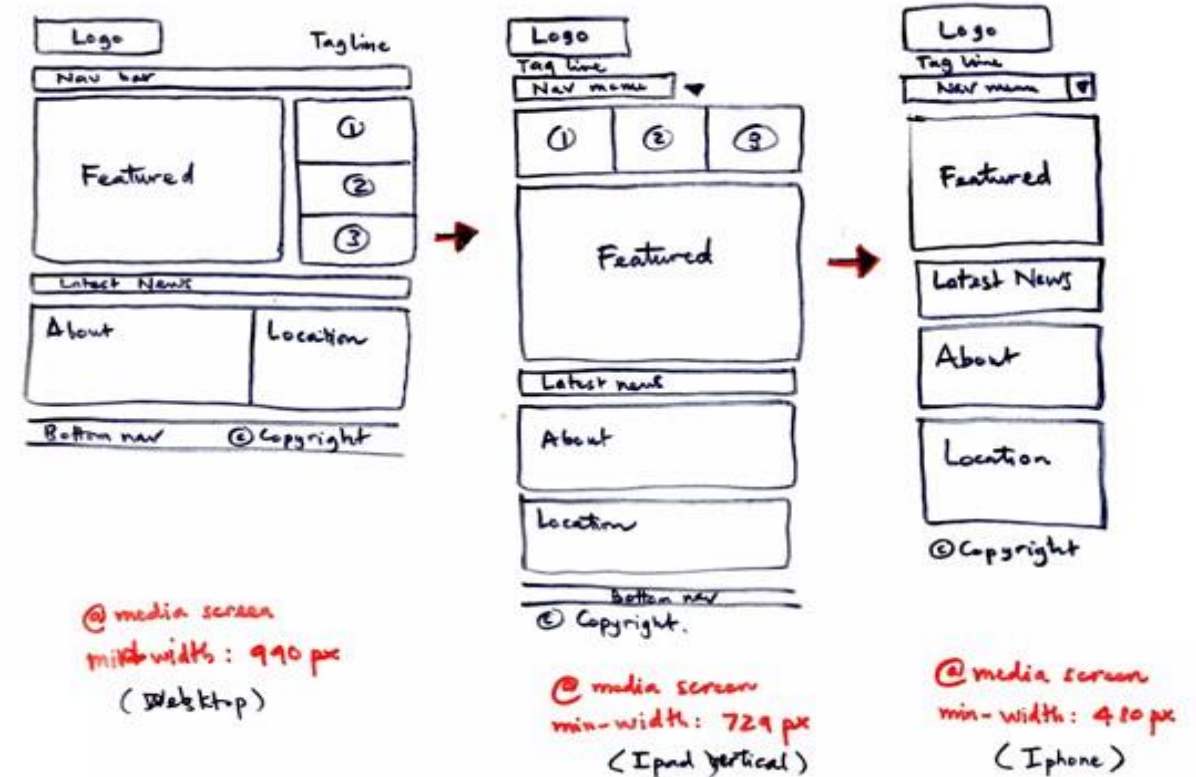
Required Evidence	Examples of evidence
Written and presentation files	<ul style="list-style-type: none"> <li>• Electronic files/evidence</li> <li>• Written report/presentation</li> </ul>
Client requirements	<ul style="list-style-type: none"> <li>• Written report, presentation, audio commentary</li> </ul>
Planning Documents	<ul style="list-style-type: none"> <li>• Work plan, asset table, visualisation diagram and test plan</li> </ul>
Finished product	<ul style="list-style-type: none"> <li>• An website product.</li> </ul>
Review	<ul style="list-style-type: none"> <li>• Written report, presentation or recording.</li> </ul>

# Year 11– iMedia(ICT) – R085



Using the planning techniques should enable you to be able to produce a visualisation diagram or sitemap of the website that is in your client brief.

It should represent the full consideration of the client brief.



**Visualisation diagrams** and storyboards are always produced prior to creating the multimedia project. They assist in the development of the project ensuring that all the client's requirements have been fulfilled before the expressive task of creating the media begins. Sitemaps and visualisation diagrams are never edited once the multimedia product has been completed, so some differences are expected to be seen.

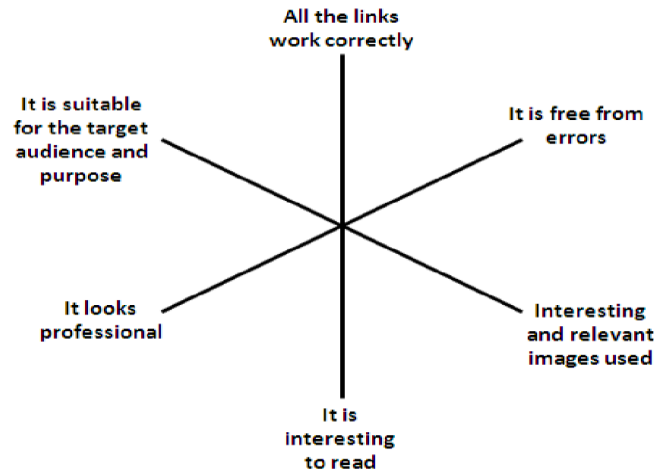
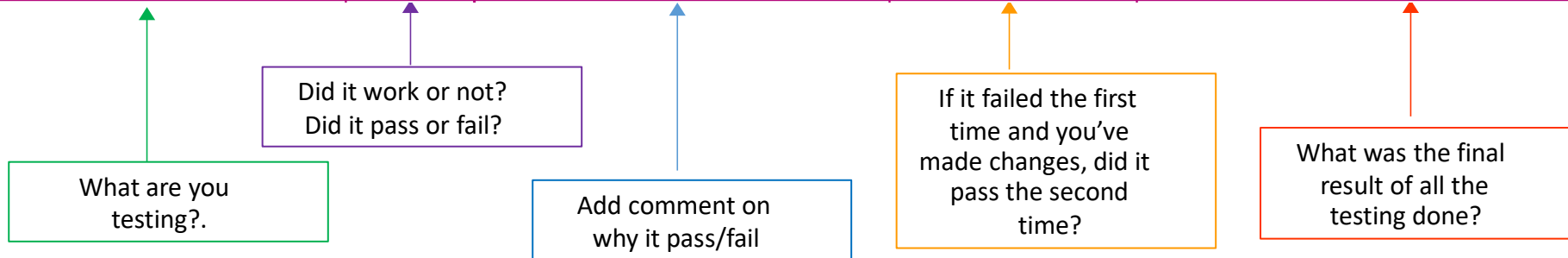


# Year 11– iMedia(ICT) – R085

What is a test plan and where will I use it?

Example of a test plan

Test	Pass/Fail	Comments	Re-test	Result



**Think about the following when you test your product :**

- Checking if all links work correctly.
- Checking for errors.
- Whether interesting and relevant images were used.
- Whether it looks professional.
- If it suits their target audience.

# Year 11– iMedia(ICT) – R085

## Copyright Protection

- Copyright protection starts as soon as a work is created .
- Once your copyright has expired, anyone can use or copy your work .
- The length of copyright depends on the type of work .

Type of Work	How long Copyright Lasts
Written, dramatic, musical and artistic work	70 years from when it's first published
Films	70 years after the death of the director, screenplay author and composer
Broadcasts	50 years from when it's first broadcast
Layout of published editions of written, dramatic or musical works	25 years from when it's first published

## Copyright Infringement

Copyright is infringed when any of the following acts are done **without permission** , whether directly or indirectly and whether the whole or a substantial part of a work is used:

- copying the work in any way
  - issuing copies of the work to the public
  - renting or lending copies of the work to the public
  - performing, showing or playing the work in public
  - broadcasting the work or other communication to the public by electronic transmission
  - making an adaptation of the work .
- Conviction in the magistrates' court the maximum term of incarceration in the UK for copyright infringement is 6 months and/or a fine of up to £50,000.
  - Conviction in the Crown Court the maximum term of incarceration in the UK for copyright infringement is 10 years and/or an "unlimited" fine .

### Creative Commons Marks



Some creators **Creative Commons** to release and enable free distribution of work that would otherwise be regarded as eligible for copyright protection.

There are sometimes conditions (additional logos) associated with the creative commons licences (see table.)

Icon	Right	Description
	Attribution (BY)	You may copy, distribute, display and perform the work and make derivative works and remixes based on it only if they give the author or licensor the credits ( <a href="#">attributio n</a> ).
	Share -alike (SA )	You may distribute derivative works only if it is not modified.
	Non -commercial (NC)	You may copy, distribute, display, and perform the work and make derivative works and remixes based on it only for non -commercial purposes.
	No Derivative Works (ND)	Your may copy, distribute, display and perform only verbatim copies of the work, not derivative works and remixes based on it.

### Creative Commons Marks



Creative commons **Zero Mark** is a way to release as many copyright restrictions possible to anyone internationally.



The creative commons **Public Domain Mark** indicates works that is already released for public use and is free of any known copyright restrictions.

# Year 11– iMedia(ICT) – R085

What types of sources/assets can be collected to use in website design?

Example of an assets table – this is how you can keep a record of all the assets you have collected or created to use while creating your website.

Asset	Properties	Source	Legal issues	Use

Name of the assets  
That you have  
Used/Created.

Tell the moderator a  
Bit more about the  
Properties of the  
Assets. This can  
Include size, type,  
Format etc

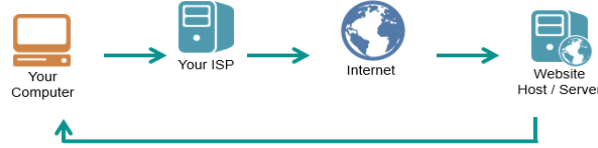
This can either be a  
Primary source or a  
Secondary source.  
Primary source is  
Something you have  
Created or took  
Yourself. Secondary  
Is when this is a  
Source that belongs  
To someone else e.g  
News article, video  
Or logo.

For secondary  
Sources, is it  
Copyright protected?  
Do you have?  
Permission to use  
This asset?

Where have you  
Used this asset?  
Example is  
“Animated banned  
Used on all web  
Pages” or “image of  
Street food used on  
The Culture”  
Webpage.

# Year 11– iMedia(ICT) – R085

## The Internet



### Possible Careers:

- Web designer
- Data Analyst
- Programmer

The Internet also known as WWW which stands for **World Wide Web** is a network of online content formatted in a code called HTML. These are interlinked HTML pages that can be accessed over the Internet.

It provides space for a wide range of information like documents, content and videos



**(1)**When connecting a computer to a website, the user needs to have an internet service provider which is also known as an ISP.

**(2)** The ISPs are responsible for making sure you can access the Internet, routing Internet traffic, resolving domain names, and maintaining the network infrastructure.

**(3)** The website host server stores the webpages for individuals and organisations. Websites are **hosted**, or stored, on special computers called **servers**

## Hyperlinks



A **hyperlink**, or simply a link, is a link from a document to another document or part of the document that the user can follow by clicking or tapping on.



Keywords	Definition
Tag/s	are the hidden keywords within a web page that define how your web browser must be formatted and displayed e.g. <b>&lt;title&gt;</b>
Html	Stands for <b>Hypertext Markup Language</b> is the standard markup language for documents designed to be displayed in a web browser
Http	transfers web pages from web servers to the client. All web page addresses start with http
Code	Is the set of instructions forming a computer program which is executed by a computer
CSS	<b>Cascading style sheets</b> are used to format the layout of Web pages
Webpage	are HTML documents that present images, sound and text accessed through a web browser

# Year 11– iMedia(ICT) – R085

```

<!DOCTYPE html>
<html>
<head>
<title>My First Webpage</title>
</head>
<body>
<h1>My First Heading</h1>
<p>My first paragraph.</p>
</body>
</html>
    
```



CSS Script	Definition – What does it do?
Colour	Font colour
Text-align	Horizontal alignment
Background – Colour	Changes background colour
Background – Image	Change background image
Background - Repeat	Changes the background to stay in place or move when scrolled

HTML TAG	Definition – What does it do?
<html>	Root of a HTML document
<body>	Content of the page
<head>	Information about a page
<title>	Tab title/ defines title
<h1>, <h2>, <h3>	Headings
<p>	Paragraphs
<img>	Image
<a>	Anchor (used in hyperlinks with href)
<ol>/<ul>	Ordered/unordered list
<li>	List item
<table>	Creates and defines tables
<tr>	Table row
<td>	Table data
<div>	Divider





**Year 11 Child Development KO - Component 3 Learning Aim A: Investigating individual circumstances that may impact learning and development**

**Key Terminology**

Restricted gross motor skills	A child is unable to control the large muscles in their bodies compared to other children their age	Care/educational providers	Settings that provide formal care or education for children
Restricted fine motor skills	A child is unable to control the small muscles in their hands and fingers compared to other children their age	Family structure	The way in which a family is organised
Delayed gross motor skills	The large movements of a child's body are not progressing as quickly as other children their age	Expected milestones	Development that is expected at a particular age
Delayed fine motor skills	The small movements of a child's hands are not progressing as quickly as other children their age	Initiate play	To start play
Poor concentration levels	When children find it difficult to focus on what they are doing	Navigate	Move with planned direction
Delayed literacy skills	When a child's reading and writing skills are not progressing as quickly as other children the same age	Preferences	Things that children prefer to do
EAL	English as an additional language	Lack of responsiveness	Not responding to people
Negative role model	Someone who does not set a good example	Emotional resilience	A person's ability to adapt to stressful situations
Social norms and values	Attitudes and behaviours that are considered normal in society	Positive relationships	A relationship between two people that makes them happy
Disruptive behaviour	Unwanted behaviour that disturbs and interrupts activities	Expression	The action of making known <u>ones</u> thoughts and feelings
Transition	A change in a child's life	Routine	A sequence of actions that is regularly followed







**Circumstances that may impact on a child's learning**










**How they may affect learning**







Physical circumstances		These may include sensory impairments, restricted fine and gross motor skills, and delayed gross and fine motor skills.	A child may not be able to access learning at varying levels, grasp and manipulate small objects and to navigate play areas. Children may also tire easily and not be able to sustain involvement in activities.
Cognitive circumstances		These may include poor concentration levels and delayed literacy skills	A child may not be able to understand the rules of play.
Communication and language circumstances		These may include English as an additional language and a child who has a language and communication delay	A child may have difficulty communicating preferences and choices, and play with others may be limited due to lack of responsiveness
Social and emotional circumstances		These may include negative role models, difficulty forming friendships with other children, disruptive behaviour and transitions such as death of a loved one, birth of a new sibling and moving house.	A child may have poor emotional resilience, may isolate themselves, refuse to join in play with others and may have low self-esteem. A child may also have limited expression of thoughts and feelings and find it difficult to build positive relationships with others.

## Year 11 Child Development KO - Component 3 Learning Aim C: Adapt Play to promote inclusive learning and development

Key Terminology	
Inclusive	Including everyone
Right to learn	A moral or legal entitlement to have an education and learn
Desired behaviours	The way in which we want children to behave
Additional needs	A term used to indicate that a child requires extra support or services to enable them to participate fully in activities
Positive behaviours	Behaviours that are good and desired
Communication methods	The different ways in which we can communicate with each other
Sensory needs	Difficulty seeing or hearing
Contrasting colour schemes	The change of appearance of a <u>colours</u> surrounded by another colour
Social inclusion	The process of joining in with others
Alternative communication	Forms of communication used instead of or along with talking
Picture exchange communication system (PECS)	A form of alternative communication which allows children with little or no communication abilities to communicate using pictures
Makaton	A language programme using signs and symbols to help children to communicate
Identification of words	To establish what <u>words</u> mean

Adapting activities/resources to support a child with physical needs	
 Make <u>adjustments to</u> the environment	 Choose <u>age appropriate</u> resources
 Select resources that ALL children can hold and grasp	 Secure moveable objects with tape etc..
 Adjust the level of desks and chairs etc	 Provide materials for sensory needs <u>e.g.</u> contrasting colours

Adapting activities/resources to support a child with cognitive/intellectual or communication and language needs		
 Allow children to play together and share ideas and promote social inclusion	 Shorten activities to suit a child's concentration span	 Use Makaton or PECS
 Use peers or other adults to model activities	 Break tasks down into smaller steps	 Label equipment with pictures
 Modify toys to suit needs <u>e.g.</u> less parts etc.	 Use digital resources where appropriate	 Display routines as pictures




Adapting activities/resources to support a child with social and emotional and language needs	
 Promote <u>self resilience</u>	 Provide a structured approach to activities
 Choose activities that focus on a child's interests	 Promote choice to allow the child control over resources to complete an activity
 Allow expression of thought	 Promote group activities to build confidence

**Year 11 Child Development KO - Component 3 Learning Aim B: Creating safe environments to support play, learning and development in children aged 0 – 5 years**







**Key Terminology**

Risk	Likelihood of an environment, activity or resource causing harm
Hazard	Potential for an environment, activity or resource to cause harm
Risk assessment	A process of evaluating what might cause harm to people and making sure things are in place to manage the risk
Positive risk taking	Balancing the potential risk of harm against the benefit of children participating in activities
Adult to child ratio	The number of adults to the number of children
Stimulation	Giving something interest, <u>enthusiasm</u> or excitement
Role model	A person looked to by others as an example to be imitated
Intrusive	Causing disruption or annoyance through being unwelcome
Smart device	Allows us to connect different devices or networks
Parental controls	Software and tools that can be installed on internet enabled devices
Personal information	Private details about someone <u>e.g.</u> date of birth, full name, address
Inappropriate content	Information online that could upset a child, including violence and bad language
Trip hazard	Objects on the floor that cause someone to trip and fall
Toileting needs	The need to use the toilet
Accessibility	How easy it is for an area to be reached






**Ensuring Children are safe**

Manage risks and hazards		An adult must consider the hazards and risks when planning an activity. Children should also be taught how to explore and take risks in a positive way, learning how to judge risks for themselves. Adults should use safety features such as the BSI kite mark, <u>age</u> advice symbols and the CE mark to ensure the suitability of resources.
The role for the adult		Adults have a responsibility to plan play activities, ensure the correct adult to child ratio and model appropriate behaviours. Adults must be available but not intrusive and ensure the play is age appropriate.
Internet enabled technology		Adults need to teach children how to be safe online, including not sharing personal information or befriending strangers. Controls must be put in place by adults, <u>and also</u> talk to children about internet safety.

**Health and safety considerations of inside environments**

 Layout of furniture	 Width of doorways and corridors
 Types of flooring and floor coverings	 Layout of furniture
 How resources are organised	 Use of specific areas for play

**Health and safety considerations of outside environments**

 Appropriate clothing	 Planning ahead for hunger, thirst, toilet breaks etc.	
 Accessibility – how children may enter and exit buildings	 Choice of outdoor play resources	 Noisy or quiet play spaces – use of signs and maps














## Component 2 Learning Aim A – Health Services. Illnesses & Barriers to Access

### SERVICES

<b>Primary care</b>	<b>Healthcare provided in the community for all individuals. The individual makes the initial approach to a medical professional.</b>
<b>General Practitioners (GP)</b>	Treat all common medical conditions and refer patients to hospitals and other medical services for urgent and specialist treatment
<b>Nurse</b>	Practice nurses provide nursing and health care support, duties include vaccinations, new patient assessments and monitoring patients with long term conditions
<b>Dentist</b>	Dentists run daily clinics to diagnose and treat dental issues. Tasks <u>include</u> : advice, clean teeth, perform minor surgeries.
<b>Optician</b>	Examine eyes for vision problems, diagnose and treat eye disease, prescribing glass & lens if needed.
<b>Pharmacist</b>	Give advice on minor conditions, recommend <u>medication</u> and dispense prescriptions.
<b>Walk in Centres</b>	Provide routine and urgent treatment for minor injuries. No appointment needed.
<b>Secondary care</b>	<b>Primary care professional refers you to a specialist, you are then in secondary care.</b>
<b>Cardiologist</b>	Specialises in diagnosing and treating diseases of the heart. they may carry out tests, and they may some do procedures and surgeries.
<b>Psychologist</b>	Assess, <u>diagnose</u> and treat individuals suffering from mental distress and mental illness
<b>Physiotherapist</b>	Treats people who have mobility, breathing and neurological problems
<b>Orthopaedics</b>	Specialise in disorders of eye movements and diagnostic procedures related to disorders of the eye and visual system.
<b>Tertiary Care</b>	<b>Patient needs higher level of care within the hospital. Tertiary care requires highly specialised equipment and expertise.</b>
<b>Dermatology</b>	Dermatologist specialises in treating skin, <u>nail</u> and hair disorders.
<b>Psychiatry,</b>	They make a diagnosis and work with you to develop a management plan for your treatment and recovery for mental illnesses.
<b>Allied Professionals</b>	<b>Professionals who may not be medically trained but use their knowledge to support peoples health.</b>
<b>Podiatrist</b>	Provides essential foot care for individuals with diabetes, circulatory and nerve damage.
<b>Art therapist,</b>	Helps people who have behavioural and emotional problems by using drawing, <u>painting</u> and other art.
<b>Dietician,</b>	Uses their expert knowledge about the science of food to advise and support individuals in their dietary needs.
<b>Social worker</b>	Provide advice, support and resources to individuals and families to help them solve their problem
<b>Youth Worker</b>	Personal and social <u>development support</u> for young people between 11-25.

### ILLNESSES

<b>Asthma</b>		Your <b>airways are sensitive</b> and become inflamed and tighten when they breathe if anything irritates them. This can cause <b>tightness</b> and <b>wheezing</b> and make it hard to breathe
<b>Diabetes Type 2</b>		A condition that causes <b>high levels of glucose</b> in your blood because you have a problem with producing insulin. This means the glucose stays in the blood stream and can't be used to give you energy.
<b>Dementia</b>		<b>Memory loss</b> can be a problem. Risk increases with age
<b>High Blood Pressure</b>		When your <b>blood pressure</b> , the force of your <b>blood</b> pushing against the walls of your <b>blood</b> vessels, is consistently too <b>high</b> .
<b>Autism</b>		A disorder affecting brain development. It may affect the way a person relates to their environment. Some people find interacting more difficult than others.
<b>Hearing Impairment</b>		Is a <b>partial or total inability to hear</b>
<b>Speech Impairment</b>		A condition in which the ability to produce <b>speech</b> sounds that are necessary to communicate with others is <b>impaired</b> .
<b>Mobility</b>		<u>Mobility refers</u> to whether you can move an injured body part, like a joint or a limb.
<b>Skin Conditions</b>		<b>Acne, eczema, seborrheic dermatitis, skin cancer and psoriasis</b> are the five most common skin disorder
<b>Gum Disease</b>		<b>Swelling</b> of the soft <u>tissue</u> and abnormal loss of bone that surrounds the teeth and holds them in place.
<b>Incontinent</b>		Any <b>accidental or involuntary loss of urine</b> from the bladder or bowel motion, <u>faeces</u> or wind from the bowel

### Physical Barriers

Physical barriers are the structural difficulties that may limit service users' access. Includes- doors not being wide enough, uneven surfaces, lifts not working, no ramps etc.

**Overcome** - planning access before travel, amendments made to building to support equal access, consideration and careful planning of the services which need to be accessed.



### Sensory Barriers

Sensory barriers are when an individual has an impairment which impacts their senses. Includes vision loss or hearing loss which may make process more difficult for them and cause them distress.

**Overcome** - by amending environments to support them or providing them with adaptive equipment to make their access easier.



### Social, cultural and psychological barriers

**Social Barriers** - linked to stigmas within the community; this could be stereotypes, addiction or opening hours of services.

**Cultural barriers**- may be limitations linked with their traditions, religion or beliefs. This may include: Gender of professionals or belief in treatments being offered.

**Psychological barrier**- may be fear, anxiety, mental illness, self-diagnosis or negative experiences that limit access.

**Overcome** - taking individual's preference's into consideration when offering services, making reasonable adjustments and, having a wider variety of professionals available to support.



### Language barriers

Language barriers are when verbal communication struggles to be corresponded between two people or a group. This may be due to not speaking the native language, learning difficulty which impacts speech, use of improper English etc.

**Overcome** - by having translators in place to support the transition to a common language, use of alternative communication methods such as images and interpreters.



### Geographical Barriers

Geographical barriers are when services cannot be effectively utilised due to their location. This may be due to fuel prices, public transport, and distance to the service.

**Overcome** - by voluntary services supporting with transport, having mobile units to provide treatment, or refunding fuel and car parking charges for long term health patients.



### Intellectual Barriers

People with intellectual disabilities may be due to genetic conditions, childhood illnesses, or they may be uneducated and struggle to learn.

**Overcome** - breaking down information to the ability of the service user and reiterate key points, avoid noisy areas so information is clear, involve a family member or advocate as someone who can also be aware to repeat the information when required.



### Resource Barriers

Resource barriers are when services struggle to provide adequate equipment, treatments and building to support the growing needs of service users. Also, having a lack of staff can affect how the services are provided and the quality of care people receive.

**Overcome** - government can redistribute funding to meet the needs of all, organising skills and equipment to make the most of what is available, reducing waste and amending ideas to stretch the availability of resources.




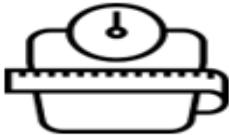






### Financial Barriers

Financial barriers links to the use of money. This may be travel expenses, paying for services, or not having any disposable income to pay for preventative services.

**Overcome** - by the NHS having financial exemptions for vulnerable people, having services free at point of contact and also to refund expenses to ensure that services users are not missing out services due to their income.



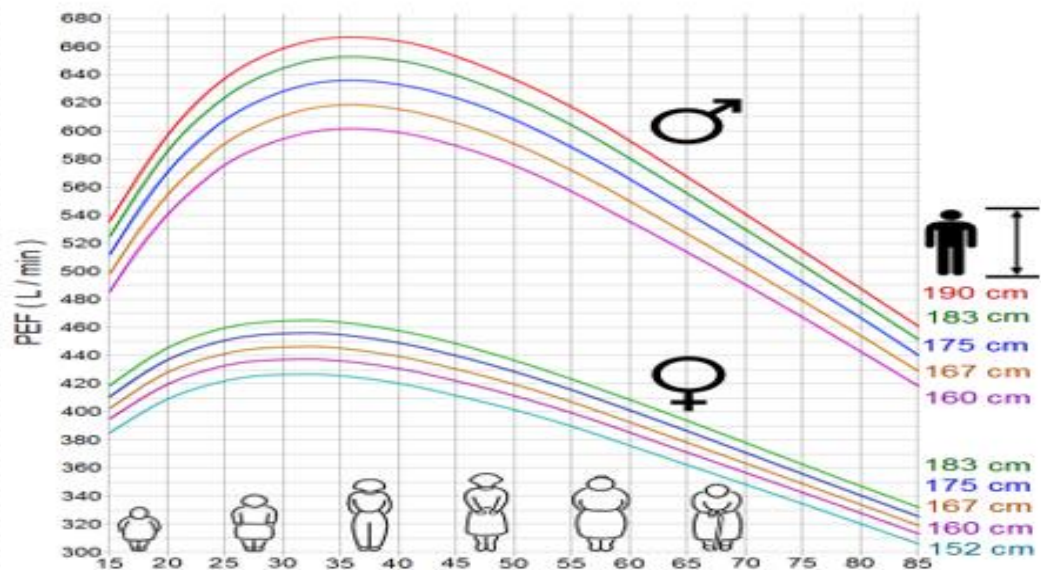
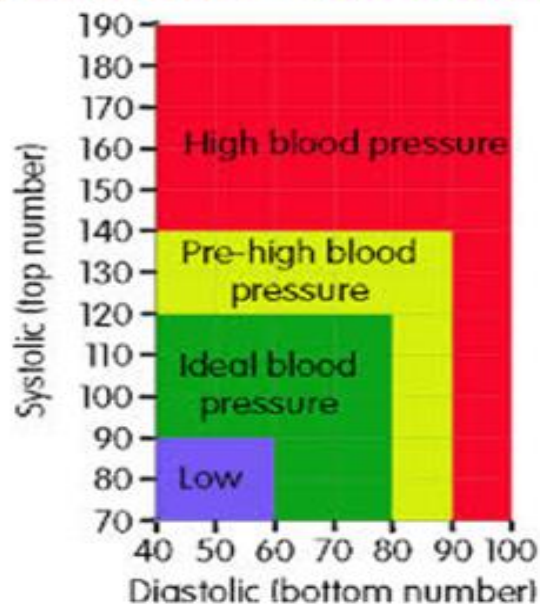
## Year 11 - BTEC Health & Social Care Learning Aim B – Health Indicators

Health Indicators to discuss		What?	Abnormal Reading?	Risks	Causes		
Physiological		<b>BLOOD PRESSURE</b>	Pressure exerted by the blood against the artery walls.	High Blood Pressure is 140/90 mm Hg Low Blood Pressure is 90/60 mm Hg or lower A Blood pressure chart is used to interpret measurements	Hypertension Heart Disease Stroke Kidney Disease Dementia	Lifestyle Diet Genetic Lack of Exercise Stress Overweight	
		<b>BODY MASS INDEX</b>	<ul style="list-style-type: none"> <li>A way of measuring the amount of body fat.</li> <li>Based on height and weight and can be found on a published chart.</li> <li>Normal Reading 18.5-24.9</li> </ul>	Underweight = <18.5 Overweight = 25-29.9 Obese = 30-34.9 Severely Obese= 35>	Underweight – Anaemia, Weak immune system, osteoporosis Overweight – Heart Disease, stroke, diabetes, arthritis	Poor diet (too many calories, too much fat) Lack of exercise Alcohol intake	
		<b>PEAK FLOW</b>	<ul style="list-style-type: none"> <li>Measures the speed a person can expel air from their lungs</li> <li>Assesses health of lungs</li> </ul>	<ul style="list-style-type: none"> <li>Low readings could indicate problems</li> <li>People readings will depend on sex and <u>height</u> and you need to use a peak flow chart to assess</li> </ul>	<ul style="list-style-type: none"> <li>Asthma</li> <li>Emphysema</li> <li>Bronchitis</li> <li>Cystic Fibrosis</li> <li>Lung Cancers</li> </ul>	Any lung condition that decreases air flow will result in abnormal readings.	
		<b>PULSE RATE</b>	Measures how fast the heart beats per minute (bpm) Indicates the level of a person's health & physical fitness.	Average is between 60-100bpm for an adult  High than 100bpm at rest is abnormal	Dizziness Heart Attack Stroke High Blood Pressure	Lack of exercise Overweight High stress levels Smoking	
Lifestyle	<b>SMOKING</b> 		<b>ALCOHOL INTAKE</b> 		<b>DIET</b> 		<b>LEVEL OF EXERCISE</b> 

Need to be able to use these charts to understand people's current physical health

# BMI Chart

WEIGHT lbs	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215			
kg	45.5	47.7	50.0	52.3	54.5	56.8	59.1	61.4	63.6	65.9	68.2	70.5	72.7	75.0	77.3	79.5	81.8	84.1	86.4	88.6	90.9	93.2	95.5	97.7			
HEIGHT in/cm	Underweight			Healthy			Overweight			Obese			Extremely obese														
5'0" - 152.4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42			
5'1" - 154.9	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41			
5'2" - 157.4	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41			
5'3" - 160.0	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40			
5'4" - 162.5	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40			
5'5" - 165.1	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39			
5'6" - 167.6	16	17	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38			
5'7" - 170.1	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38			
5'8" - 172.7	15	16	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37			
5'9" - 175.2	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37			
5'10" - 177.8	14	15	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
5'11" - 180.3	14	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
6'0" - 182.8	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
6'1" - 185.4	13	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35			
6'2" - 187.9	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35			
6'3" - 190.5	12	13	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34			
6'4" - 193.0	12	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34			



# Resting Heart Rate Chart

## Men (beats per minute)

Age	18 - 25	26 - 35	36 - 45	46 - 55	56 - 65	65 +
<b>Athlete</b>	49 - 55	49 - 54	50 - 56	50 - 57	51 - 56	50 - 55
<b>Excellent</b>	56 - 61	55 - 61	57 - 62	58 - 63	57 - 61	56 - 61
<b>Great</b>	62 - 65	62 - 65	63 - 66	64 - 67	62 - 67	62 - 65
<b>Good</b>	66 - 69	66 - 70	67 - 70	68 - 71	68 - 71	66 - 69
<b>Average</b>	70 - 73	71 - 74	71 - 75	72 - 76	72 - 75	70 - 73
<b>Below Average</b>	74 - 81	75 - 81	76 - 82	77 - 83	76 - 81	74 - 79
<b>Poor</b>	82 +	82 +	83 +	84 +	82 +	80 +

## Women (beats per minute)

Age	18 - 25	26 - 35	36 - 45	46 - 55	56 - 65	65 +
<b>Athlete</b>	54 - 60	54 - 59	54 - 59	54 - 60	54 - 59	54 - 59
<b>Excellent</b>	61 - 65	60 - 64	60 - 64	61 - 65	60 - 64	60 - 64
<b>Great</b>	66 - 69	65 - 68	65 - 69	66 - 69	65 - 68	65 - 68
<b>Good</b>	70 - 73	69 - 72	70 - 73	70 - 73	69 - 73	69 - 72
<b>Average</b>	74 - 78	73 - 76	74 - 78	74 - 77	74 - 77	73 - 76
<b>Below Average</b>	79 - 84	77 - 82	79 - 84	78 - 83	78 - 83	77 - 84
<b>Poor</b>	85 +	83 +	85 +	84 +	84 +	85 +

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## Year 11 Health & Social Care Component 3 Learning Aim C

### HEALTH & WELLBEING IMPROVEMENT PLANS

#### Health Improvement Plans

- Health Improvement plans should be based on the individuals physiological and lifestyle indicators.
- Should be person centered and include goals, actions, targets and identify support
- Person Centered Approach** - Puts the individual at the heart of their health improvement plan. Takes into account the individual's **needs, circumstance and wishes**
  - Needs** = PIES
  - Wishes** = Likes, dislikes, choices, desires
  - Circumstances** = Illnesses, accesses to facilities, time, commitments, experience

#### When creating improvement plans follow these steps:

1. Identify the health issue & goal



2. Recommended actions to take



3. Set Targets for health improvement



4. Identify support needed



5. Identify possible obstacles and ways to overcome

#### Sections of an Improvement Plan

#### Definitions

#### Improvement Plan Examples

Sections of an Improvement Plan	Definitions	Improvement Plan Examples		
<b>Goals</b>	From the case study you will be about to <b>identify goals for health improvement</b>	Reduced BMI	Stop smoking	Improve mobility
<b>Recommended Actions</b>	For each goal you need to suggest an <b>action</b>	Eat a healthier diet and exercise more	Use nicotine substitutes	Start an exercise routine
<b>Targets</b>	Challenges to help a person complete the action.  SMART Targets are more likely to be successful. These are: <u>Specific</u> = an exact goal, clearly explained <u>Measurable</u> = so that progress can be assessed <u>Achievable</u> = possible for the person <u>Realistic</u> = suitable for the needs and circumstances <u>Time-related</u> = has a deadline  <u>Short Term Targets</u> = less than 6 months <u>Long Term Targets</u> = 6 months to a year	<b>Short Term</b> = Within 6 weeks exercise twice a week and stop snacking in-between meals  <b>Long Term</b> = Within 6 months exercise 3 times a week and eat less than 1800 calories a day.	<b>Short Term</b> = Cuts down to 5 cigarettes a day within 1 month  <b>Long Term</b> = Shorts completely within 10 months.	<b>Short Term</b> = Within 6 weeks walk for 20 mins every other day.  <b>Long Term</b> = Join a gym and attend regularly within 6 months

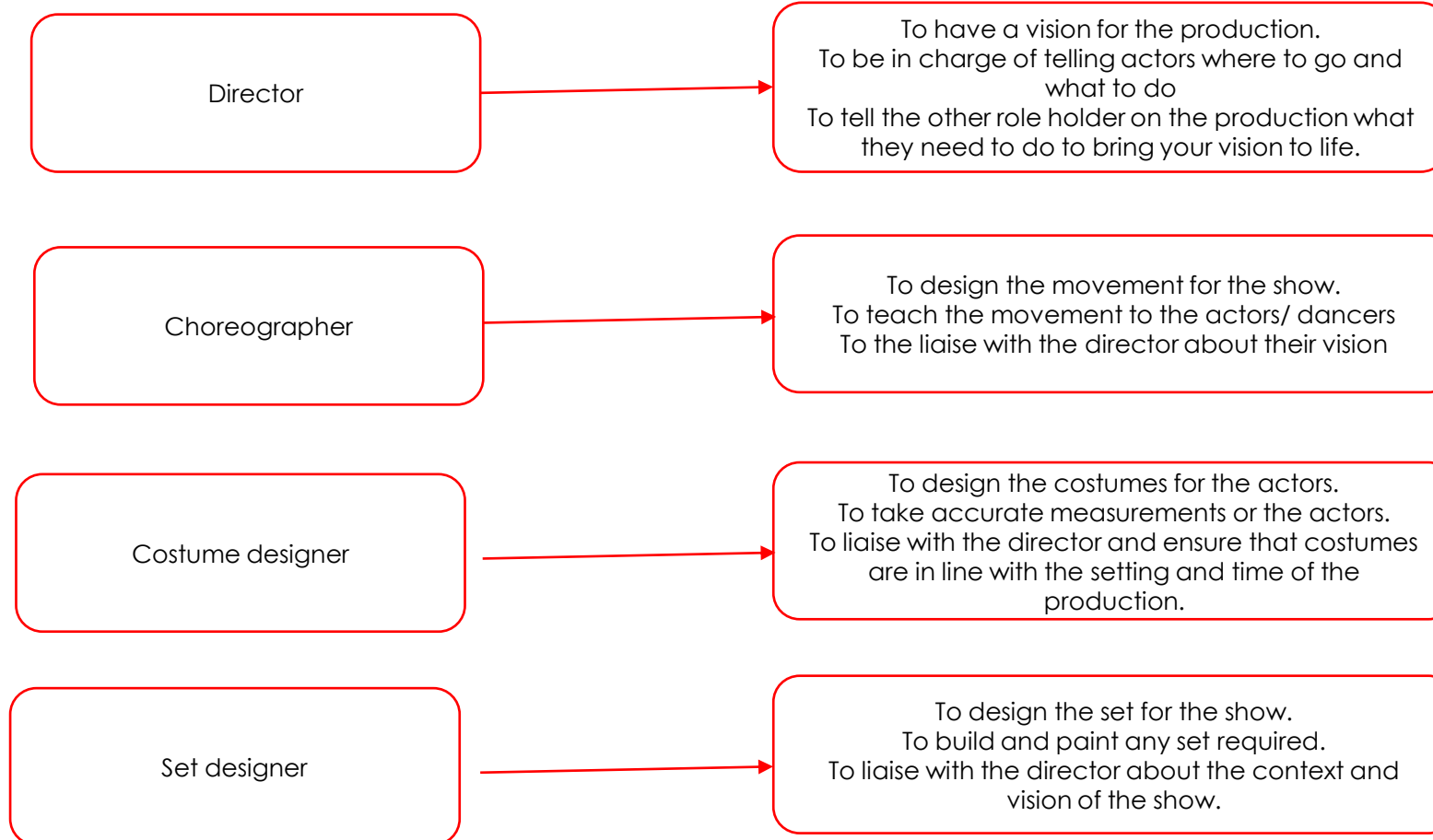
Practitioner	Style	Key Stylistic Features
Bertolt Brecht	Epic Theatre	<p><b>Alienation:</b> Using sing, placards, pitch and pace to make the audience distance from the action on stage.</p> <p><b>Gestus:</b> To give a character a clear and over exaggerated gesture they must use when they come on stage</p> <p><b>Political themes:</b> Brecht wanted the audience to think about the corruption of the world they live in.</p>
Frantic Assembly	Physical theatre	<p><b>Chair Duets:</b> Using two chairs create a continuous string of movements. Add emotion. Add pace to speed up or slow down sections.</p> <p><b>Hymn Hands:</b> Use hands to mirror what your partner is doing– or grab the hands or shoulders for effect.</p> <p><b>Round-by-through:</b> Moving around the body. Go through another actors' arms to create a spiral effect.</p>
Jerome Robbins	Book Musical	<p><b>Allegory for Romeo and Juliet:</b> based on this story- however focusses on the love of a Jew and a Catholic</p> <p><b>Theme of Love:</b> The love Tony felt for Maria and Romeo for Juliet made them defy their families, their friends and their social world. Their love is strong and forceful, so much so that it made them revolt against the very world they revolved in and, sometimes, even against themselves</p> <p><b>Theme of Society:</b> <b>Racial inequality</b> Jets Vs Sharks= Jews vs Catholics <b>Gender Roles</b> in the song "America" we see how men and women view America very differently.</p>



Keyword	Definition
Book Musical	A musical where the music, lyrics and script follow a well thought out narrative.
Creative Intentions	The theme, issues within a play or the style. Why did the director choose each of these?
Epic Theatre	A form of didactic theatre where the scenes are episodic and follow no narrative. Often political.
Focus	Not laughing while you are on stage and staying in character.
Genre	The style of a theatre.
Physical Theatre	a form of theatre which emphasizes the use of physical movement, as in dance and mime, for expression.
Practitioner	A person who pioneered a style of theatre.
Purpose	The reason a piece of theatre exists. Example: to put across a political message.

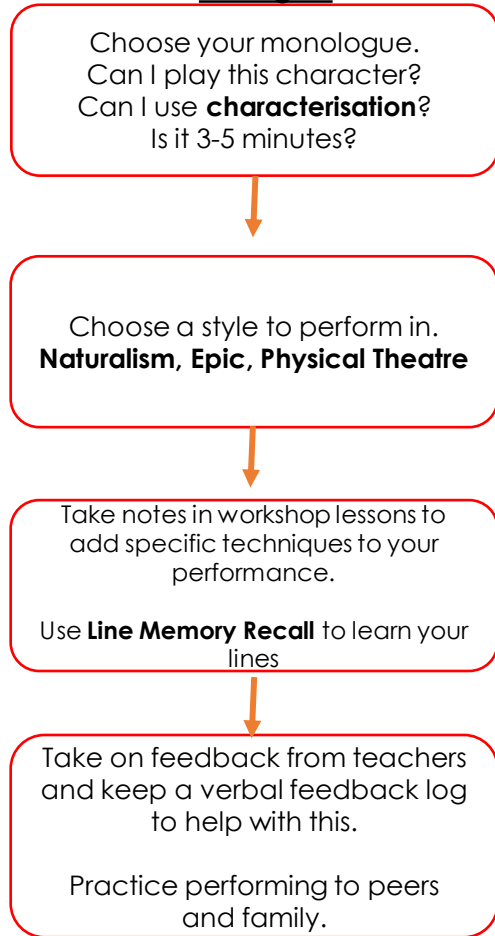
## Year 11 – BTEC Performing Arts – Component 1 – Exploring the Performing Arts- Learning Aim B

Keyword	Definition
Responsibilities	What someone in the theatre is required to do. Director- have a vision and tell the actors what to do on stage.
Role	A job role within theatre: director, actor, stage manager, lighting designer etc.

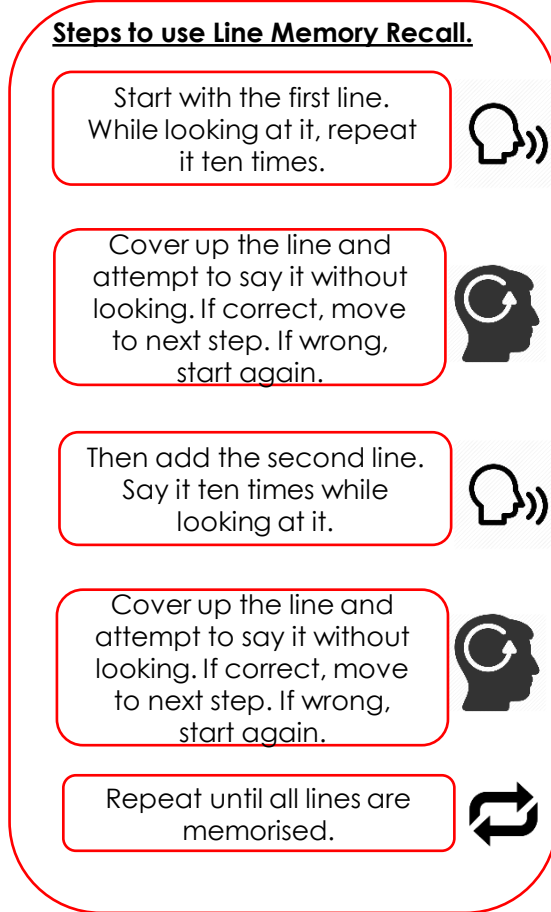


# Year 11 – BTEC Performing Arts – Component 2 – Developing Skills and Techniques in the Performing Arts

## Steps to a good monologue or duologue.



## Steps to use Line Memory Recall.



Keyword	Definition
Articulation	Pronouncing the consonants and vowels in your words clearly so you can be understood.
Characterisation	Creating a believable character on stage. Becoming the character.
Facial Expression	Showing your emotion through your face.
Focus	Not laughing while you are on stage and staying in character.
Gesture	Using your hands to show the audience where to look through pointing, waving etc.
Line Memory Recall	A technique used to remember lines. Repeat one line with the rest covered up.
Mannerism	A movement which your character would do without thinking. Example: A twitch or playing with hair.
Pace	The speed at which you say something or do a movement to convey the emotion of your character.
Pause	To use your breath to create suspense within a line or a key moment.
Pitch	How high or low your voice is to convey emotion.
Projection	Using a loud volume to make sure you are heard.
Reaction	What did they say? How would your character respond?
Vocal Tone	Showing emotion through your voice.



## Milestone 1- Ideas Log:

1. What is the concept and style of your performance?
2. What is your target audience and why did you decide on this?
3. What resources do you think you will need to develop and perform your performance?
4. How do your ideas for the performance meet the brief ?
5. How has the work of Pantomime, Stanislavski, Frantic Assembly or any other practitioners influenced your performance?
6. What ideas have you contributed to the performance plan? Were these successful? Why?
7. How did you come up with the ideas you have

## Milestone 2- Skills Log:

1. What was your role in the group? (director, performer etc)
2. Which style did you choose? Why?
3. Which techniques and skills did you choose? Why did you choose them?
4. What work have you done individually to help the group? (research, rehearsal leading, choreographing movement etc)
5. How did the resources you chose aid your performance?
6. What would you change or improve?

## Milestone 3- Workshop Performance:

- You must present your group workshop performance or pitch/presentation to an invited audience.
- The group workshop performance must be between 10 and 15 minutes long.
- You will need to perform as part of a group and work well together.
- You will be assessed on your individual skills and techniques, collaboration with others and communication of creative ideas to the audience through your role.

## Milestone 4- Evaluation Report:

1. How did the result of your performance meet the brief?
2. How did you process and ideas develop through this project?
3. Was the outcome of the performance what you wanted? What did the audience learn?
4. What were the key strengths of your group's performance?
5. What were the key strengths in your individual performance?
6. What would you improve upon given the chance again? Why would you change this? How would that help your performance meet the brief?

Keyword	Definition
Articulation	Pronouncing the consonants and vowels in your words clearly so you can be understood.
Characterisation	Creating a believable character on stage. Becoming the character.
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Reaction	What did they say? How would your character respond?
Vocal Tone	Showing emotion through your voice.

## Key Words: Definitions

**Design Brief:** A Design Brief is a short paragraph explaining the situation you have been given and the problem you need to solve.

**Design Specification:** A Design Specification is a list of points that have been developed from research carried out that your design concept should meet t function with your client effectively.

**Client:** A Client is a group or a single person you are developing a new design or concept specifically for. This could be Gender or Age specific.

**Moral:** When something is right or wrong.

**Social:** the interaction between two or more people in various ways.

**Cultural:** Beliefs/attitudes/religious views of people.

**Anthropometrics:** analysis of data of the human body.

**Ergonomics:** the way a product is designed to fit the human body and to enable better comfort when used.

**Product Analysis:** the analysis of existing products to aid the development of new ideas.

**Primary Research:** involves the collection of data that does not yet exist.

**Secondary Research:** gathering research from resources where information already exists.

**Design Specification:** a list of points that have been developed from research carried out that your design concept should meet t function with your client effectively.

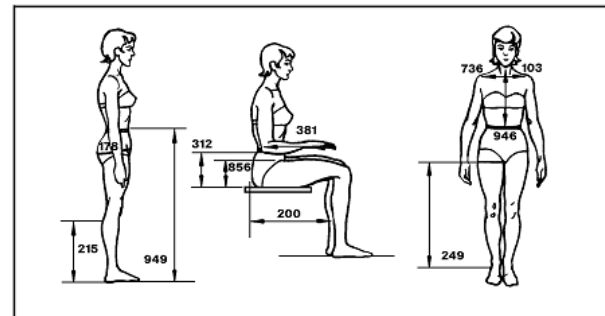
**Iterative Design:** a design methodology based on a cyclic process of prototyping, testing, analysing, and refining a product or process.

## Anthropometrics and Ergonomics

Ergonomics is the relationship and interaction between human body and the products, systems and environments they use. Product designers should design products that are easy to use taking into account colour, lighting, sound, comfort and visuals.

Anthropometrics (Anthro; man, Metrics; measurements) is the Human data that is collected and used to improve the ergonomics of products and data is taken from thousands of volunteers and collated into percentiles.

Average sizes is 50th percentile but most design activity is around 5th and 95th percentile to take into account majority of population



## Ethical Issues in design:

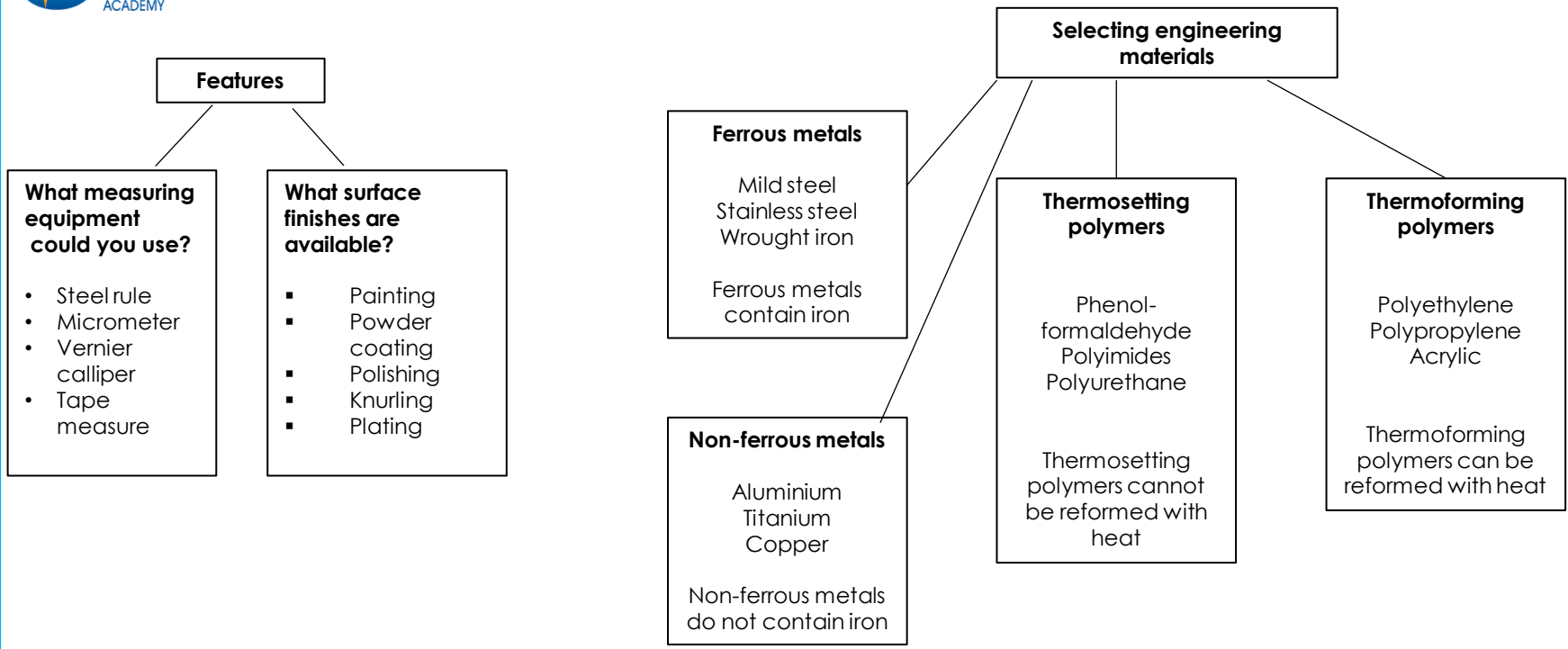
**Social:** This is the way in how people interact/communicate with each one another through the use of products. Possible Issues: Communicate, Language, Understanding, Meanings.

**Moral:** This is where the manufacture or use of a product is contributing to the good and bad issues within society. Possible Issues: Health and Safety, Religious Views or Beliefs, Environment/Sustainability.

**Environment:** How a product or manufacturing process may affect the environment: Possible Issues: Recycling, Renewable Energy, Materials, Disposal.



# BTEC Engineering Component 3 Learning Aim B (Year 11 Spring)

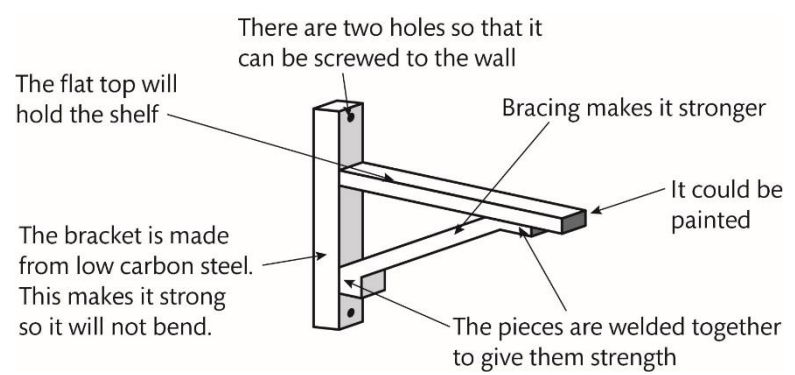


**Variations in form**  
When you think of design ideas, you must make sure that you meet the design brief.

Adapt an existing design that fulfils a different use.  
Modify the look of the designs.  
Can the product be put to another use?  
Are there ways you can eliminate parts that are not needed?

Change the shape or form of ideas.  
Consider different materials.  
Consider manufacturing techniques.  
Swap or substitute materials or processes.  
Combine features from different designs.

**Analysing features**  
Use a spider diagram to describe the features of your designs



**Reviewing ideas 2**

You will need to review your design ideas.

Consider each specification point and rate your ideas against individual points.  
Use a RAG rating approach to evaluate ideas.  
Make notes on your design work to explain how specification points are met.  
Think about which specification points are most important.

**Process considerations**

Things to consider when deciding about processes.  
How many products need to be made? Is it a one-off, a batch or mass production?  
What material will be used? Not all processes are suitable for all materials.  
Are there any features that need to be included in the design that might make it impossible to manufacture using certain processes?

## Annotated sketches

Annotations are used by engineers to give information about designs.

Annotations could include information about:  
 materials  
 processes  
 dimensions

When you are producing **2D annotated sketches**, you should think about the following.

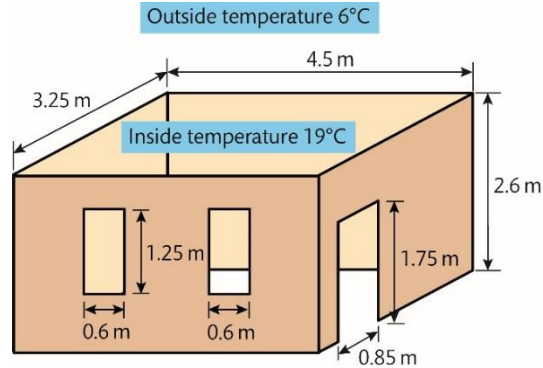
- Which view will show the most information about the component?
- What information needs to be explained in the annotations?
- Is the sketch large enough to show all the details you want to share?

## Using alternative components

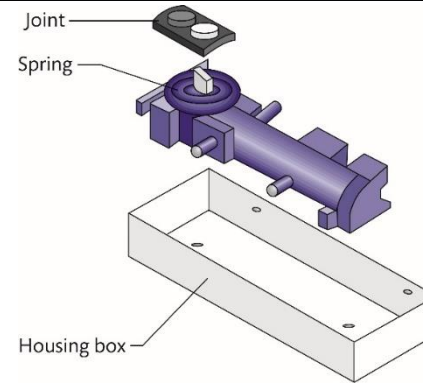
Ways that alternative components can be used include the following.  
 Manufacturing the component from a different material.  
 Using a different manufacturing process.  
 Redesigning the component to reduce its weight or volume.  
 Using common components that can be used for many different purposes.  
 Replacing two or more components with one that can perform the same functions.

There are three methods of 3D sketching that are often used as part of the design process. These are oblique projection, isometric projection and perspective drawings.

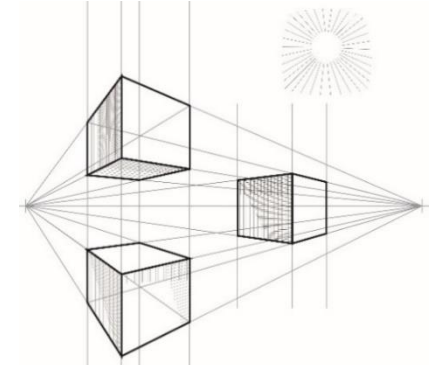
## 3D sketches



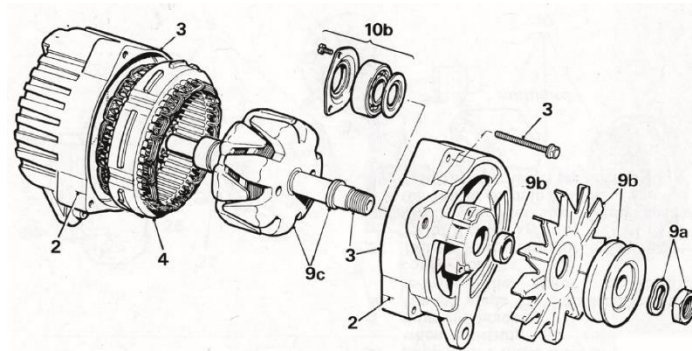
Oblique projection



Isometric projection

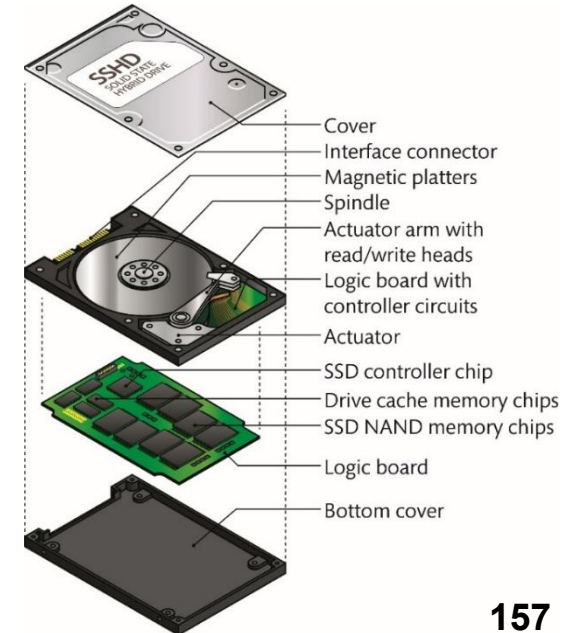


Perspective drawing



## Exploded diagrams

Exploded diagrams are isometric projections that show each of the individual parts that join together to produce the finished product



**AC 1.4 – Cooking Methods**

**Boiling** – A liquid is heated to 100°C to cook foods like pasta, rice and potatoes. A quick and simple method of cooking that does not require any fat. Boiling makes the texture of food soft, over boiling really soft. If boiling vegetables, B vitamins and vitamin C is lost during boiling. .

**Steaming** – Food is cooked from the steam of boiling water. Steaming food such as vegetables, fish and rice helps to preserve colour, texture and water soluble vitamins.

**Baking** – Food is cooked using the dry hot air of the oven. Foods that are baked such as cakes, pastries and biscuits cause the outer layers to turn brown and crisp.

**Grilling** – Dry heat is used to cook food at a very high temperature, it is fairly healthy because no fat is added, and fat drips out of the food as it cooks. Because the heat is so high the food cooks quickly and browns the outside.

**Stir-fry** – Food is cooked in a wok with very little oil. This is a healthy method as food cooks quickly due to very small pieces of meat and vegetables, leading to crunchy and colourful vegetables that have limited vitamin loss.

**Roasting** – Food is also cooked using dry heat in a hot oven. Fat is added to the outside of roasted food, causing the outside to go brown and crisp, while the inside stays moist.

**Poaching** – Food is cooked very gently in liquid that is below boiling point. Delicate foods such as meat, fish and eggs.

- ✓ Use seasonal ingredients
- ✓ Use ingredients from local farmers and markets
- ✓ Use ingredients from rooftop garden
- ✓ Use less plastic

- ✓ Cover pans
- ✓ Use the correct size hob and pan
- ✓ Cook different foods together
- ✓ Don't boil more water than you need
- ✓ Use water carefully – bowls to wash

- ✓ Order in bulk to reduce packaging
- ✓ use FIFO to rotate stock
- ✓ Prepare the correct amount of ingredients
- ✓ Use accurate portion control

**AC 2.2 – Environmental Policy**

An establishment requires an environmental policy because :

1. It is the law
2. Saves the establishment money
3. Builds a good reputation
4. It saves energy, water and reduces waste
5. Reduced the harm to the environment

- ✓ Fully load dishwashers
- ✓ Fully load washing machines
- ✓ Carry out maintenance checks
- ✓ Turn equipment off
- ✓ Use energy efficient equipment

- ✓ Recycle materials using recycling bins
- ✓ Use biodegradable packaging for taking away food
- ✓ Give foods to charities
- ✓ Weigh ingredients accurately

- ✓ Recycle materials using recycling bins
- ✓ Use biodegradable packaging for taking away food
- ✓ Give foods to charities
- ✓ Weigh ingredients accurately

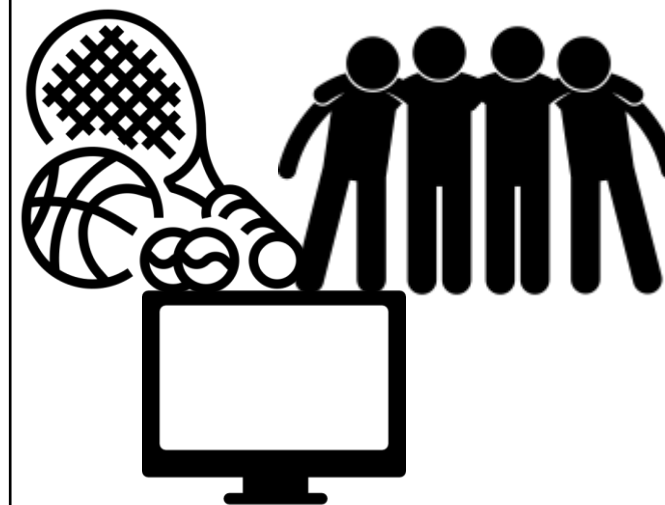
- ✓ Reuse glass bottles and plastic containers
- ✓ Reuse leftover food for stock, compost or animal feed
- ✓ Use cardboard for wet floors

Keyword	Definition
Biodegradable	Decomposes naturally in the ground
Food miles	The distance food has travelled from field to plate

Keyword	Definition
Recycle	Product is broken down and made into something new
FIFO	First In First Out

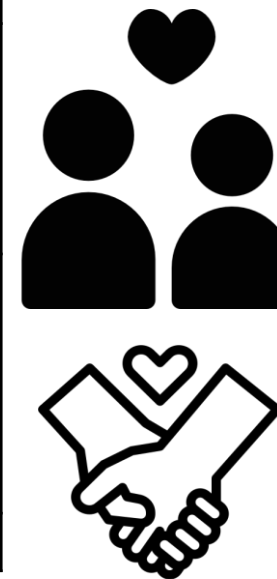


A. Qu'est-ce que tu fais pendant ton temps libre ? What do you do in your free time?						
Ce que j'aime le plus, c'est de/d' What I like the most is	faire to do	de la musculation. weight training. de la natation. swimming. du vélo. cycling. du lèche-vitrine. window shopping. les magasins. shopping.	Je crois que I believe that	c'est it is	chouette. great.	
	jouer to play	au basket. basketball. au foot. football. au tennis. tennis. aux échecs. chess. aux jeux-vidéos. video games.			Je pense que I think that	marrant. funny.
		de la batterie. the drums. de la guitare. the guitar. du piano. piano.			Je considère que I consider that	sensass. sensational.
Ce que j'aime le moins, c'est de/d' What I like the least is	aller to go	au centre commercial. to the shopping centre. au cinéma. to the cinema.	Je considère que I consider that	ce n'est pas it isn't	casse-pieds. irritating.	
Ce que je déteste, c'est de/d' What I hate is	bavarder avec des amis. to chat with friends. écouter de la musique. to listen to music. lire des bandes dessinées/des romans. to read comics/novels. manger au restaurant. to eat at the restaurant. passer du temps avec des amis. to spend time with friends. regarder des séries Netflix. to watch Netflix series. sortir avec des amis. to go out with friends.				embêtant. annoying.	



B. Est-ce que tu t'entends bien avec ta famille ? Do you get on well with your family?									
Je m'amuse avec I have fun with	Je m'entends bien avec I get on well with	Je m'entends mal avec I get on badly with	Je me dispute avec I argue with	Je me chamaille avec I bicker with	mon père my dad mon grand-père my grandad mon beau-père my stepdad mon frère my brother mon demi-frère my stepbrother mon oncle my uncle	car because	il est he is	bavard. chatty. compréhensif. understanding. généreux. generous. gentil. kind. respectueux. respectful. travailleur. hardworking.	égoïste. selfish. fou. crazy. menteur. liar.
					ma mère my mum ma grand-mère my grandma ma belle-mère my stepmum ma sœur my sister ma demi-sœur my stepsister ma tante my aunt	parce qu' because	elle est she is	bavarde. chatty. compréhensive. understanding. généreuse. generous. gentille. kind. respectueuse. respectful. travailleuse. hardworking.	égoïste. selfish. folle. crazy. menteuse. liar.
					mes parents my parents mes grands-parents my grandparents	puisque' as, since	elle n'est pas she is not	parce qu' because	égoïste. selfish. folle. crazy. menteuse. liar.
					mes parents my parents mes grands-parents my grandparents	cependant however	ils sont they are	bavards. chatty. compréhensifs. understanding. généreux. generous. gentils. kind. respectueux. respectful. travailleurs. hardworking.	égoïstes. selfish. fous. crazy. menteurs. liar. paresseux. lazy pinailleurs. fussy.
					ils ne sont pas they are not		travailleurs. hardworking.	égoïstes. selfish. fous. crazy. menteurs. liar. paresseux. lazy pinailleurs. fussy.	

C. C'est quoi un bon partenaire à ton avis ? What is a good partner in your opinion?			
D'après moi According to me			<b>m'accepte comme je suis.</b> accepts me as I am. <b>ne me critique jamais.</b> never criticises me. <b>m'écoute.</b> listens to me. <b>me fait confiance.</b> confides in me. <b>me fait rire.</b> makes me laugh. <b>ne me juge pas.</b> does not judge me. <b>pense à moi.</b> thinks of me. <b>me soutient quoique je fasse.</b> supports me no matter what I do.
Pour moi For me	<b>un bon partenaire</b> a good partner (m)	est quelqu'un qui is someone who	<b>affectueux / affectueuse.</b> affectionate. <b>amoureux / amoureuse.</b> loving. <b>drôle.</b> funny. <b>fiable.</b> reliable. <b>fidèle.</b> loyal. <b>généreux / généreuse.</b> generous. <b>honnête.</b> honest. <b>romantique.</b> romantic. <b>sensible.</b> sensitive.
Je dirais que I would say that	<b>une bonne partenaire</b> a good partner (f)		
J'estime que I feel that			
		a has	<b>un bon sens de l'humour.</b> a good sense of humour. <b>les mêmes intérêts que moi.</b> the same interests as me.

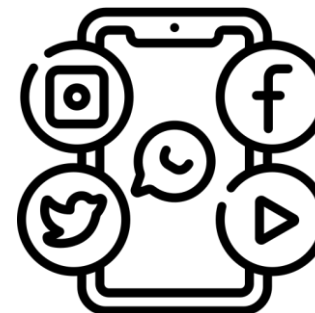


D. Est-ce que tu aimerais te marier dans le futur ? Would you like to get married in the future?				
Dans le futur In the future	j'aimerais I would like	me marier to get married	étant donné que/qu' given that	<b>c'est une tradition importante.</b> it's an important tradition. <b>ça montre au monde qu'on s'aime.</b> it shows the world you love each other. <b>on peut organiser une grande fête.</b> you can organise a big party. <b>on peut passer sa lune de miel.</b> you can go on honeymoon. <b>je ne veux pas être célibataire.</b> I don't want to be single.
A l'avenir In the future	je voudrais I would like		vu que/qu' seeing that	<b>c'est démodé.</b> it's old-fashioned. <b>c'est une perte d'argent.</b> it's a waste of money. <b>ça coûte cher.</b> it's expensive.
Quand je serai vieux/vieille When I'm older	je n'aimerais pas I wouldn't like		me pacser to enter in a civil partnership	<b>mais</b> but  <b>même si</b> even if
				<b>les divorces sont stressants.</b> divorces are stressful. <b>les noces sont trop chères.</b> weddings are too expensive.

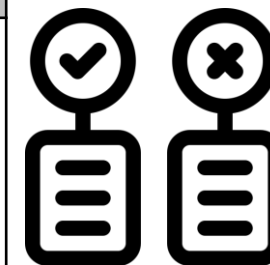




A. Comment est-ce que tu utilises des réseaux sociaux ? How do you use social media?					
<b>Normalement</b> Normally	<b>j'utilise</b> I use	<b>eBay</b>	<b>sur mon ordinateur</b> on my computer	<b>pour</b> to	<b>chatter avec des amis.</b> chat with friends.
<b>D'habitude</b> Usually	<b>je n'utilise pas</b> I don't use	<b>Facebook</b>	<b>sur mon portable</b> on my mobile		<b>contrôler mon activité physique.</b> control my physical activity.
<b>Quelquefois</b> Sometimes	<b>j'aime utiliser</b> I like to use	<b>Fitbit</b>	<b>sur ma tablette</b> on my tablet		<b>envoyer des messages.</b> to send messages.
<b>Souvent</b> Often		<b>Instagram</b>			<b>faire des achats.</b> to do shopping.
		<b>Netflix</b>			<b>jouer aux jeux-vidéos.</b> to play video games.
		<b>Snapchat</b>			<b>partager des vidéos.</b> to share videos.
		<b>Spotify</b>			<b>regarder des séries.</b> to watch series.
		<b>TikTok</b>			<b>surfer sur Internet.</b> to go online.
		<b>WhatsApp</b>			<b>télécharger de la musique.</b> to download music.



B. Quels sont les avantages et les inconvénients des réseaux sociaux ? What are the advantages and disadvantages of social media?					
<b>D'un côté, les réseaux sociaux sont</b> On the one hand, social media are	<b>divertissants</b> entertaining	<b>de l'autre côté</b> on the other hand	<b>un inconvénient</b> <b>c'est qu'</b> a disadvantage is that	<b>il y a le danger</b> there is the danger	<b>d'y devenir accro.</b> of becoming addicted.
	<b>gratuits</b> free of charge		<b>en revanche</b> on the other hand		<b>un désavantage</b> <b>c'est qu'</b> a disadvantage is that
	<b>pratiques</b> practical				<b>d'être victime de la cybercriminalité.</b> of being the victim of cybercrime.
	<b>populaires</b> popular				<b>de rencontrer des gens avec de mauvaises intentions.</b> of meeting people with bad intentions.
					<b>de voir du contenu inapproprié.</b> of seeing inappropriate content.



C. C'est comment ta routine quotidienne ? What is your daily routine like?			
<b>Avant d'aller à l'école</b> Before going to school	<b>je me brosse les dents</b> I brush my teeth	<b>à une heure</b> at 1 o'clock	<b>et quart</b> quarter past <b>et demi</b> half past <b>moins le quart</b> quarter to
<b>Après l'école</b> After school	<b>je me couche</b> I go to bed	<b>à deux heures</b> at 2 o'clock	
	<b>je me détends</b> I relax	<b>à trois heures</b> at 3 o'clock	
<b>Le matin</b> In the morning	<b>je me douche</b> I have a shower	<b>à quatre heures</b> at 4 o'clock	
	<b>je m'habille</b> I get dressed	<b>à cinq heures</b> at 5 o'clock	
<b>L'après-midi</b> In the afternoon	<b>je me lève</b> I get up	<b>à six heures</b> at 6 o'clock	
	<b>je fais la grasse matinée (jusqu')</b> I have a lie in (until)	<b>à sept heures</b> at 7 o'clock	
<b>Le soir</b> In the evening	<b>je fais mes devoirs</b> I do my homework	<b>à huit heures</b> at 8 o'clock	
	<b>je prends le petit-déjeuner</b> I have breakfast	<b>à neuf heures</b> at 9 o'clock	
	<b>je prends le dîner</b> I have dinner	<b>à dix heures</b> at 10 o'clock	
	<b>je rentre à la maison</b> I go back home	<b>à onze heures</b> at 11 o'clock	
		<b>à midi</b> at midday	
		<b>à minuit</b> at midnight	



**D. Décris-moi une fête que tu as fêtée/tu aimerais fêter.** Describe a festival that you celebrated/you would like to celebrate.

<b>L'année dernière</b> Last year	<b>j'ai fêté</b> I celebrated	<b>l'Aïd Eid</b> <b>le Dipavali</b> Diwali <b>le Hanouka</b> Hanukkah <b>le Pâques</b> Easter <b>le Ramadan</b> Ramadan <b>la Noël</b> Christmas	<b>et c'était</b> and it was	<b>agréable</b> pleasant <b>divertissant</b> entertaining <b>formidable</b> terrific <b>impressionnant</b> impressive <b>incroyable</b> incredible <b>passionnant</b> exciting	<b>car</b> because	<b>j'ai chanté.</b> I sang. <b>j'ai dansé.</b> I danced. <b>j'ai fait de nouveaux amis.</b> I made new friends. <b>j'ai mangé des repas délicieux.</b> I ate delicious meals. <b>j'ai passé du temps avec ma famille.</b> I spent time with my family. <b>j'ai reçu des cadeaux.</b> I received gifts.  <b>il y avait des feux d'artifice.</b> there were fireworks. <b>il y avait de grands repas.</b> there were big meals.
<b>Quand je serai vieux/vieille</b> When I'm older	<b>une fête que j'aimerais fêter, c'est</b> a festival which I would like to celebrate is	<b>le Carnaval</b> Carnival <b>Mardi Gras</b> <b>la Fête nationale</b> Bastille Day	<b>parce que ce serait</b> because it would be	<b>une opportunité de/d'</b> an opportunity to	<b>s'amuser.</b> have fun. <b>apprendre de la culture.</b> learn about culture. <b>décompresser.</b> relax. <b>découvrir de cultures différentes.</b> discover different cultures. <b>manger de la cuisine typique.</b> eat typical food. <b>passer du temps avec les autres.</b> spend time with others. <b>voir des défilés.</b> watch parades.	
<b>Dans le futur</b> In the future	<b>une fête à laquelle j'aimerais aller, c'est</b>	<b>la Chandeleur</b> <b>la Saint-Sylvestre</b> New Year's Eve <b>la Saint-Valentin</b> Valentine's Day				
<b>À l'avenir</b> In the future	<b>c'est</b> a festival to which I would like to go is					

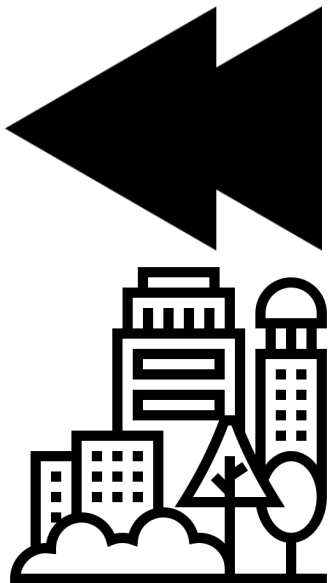
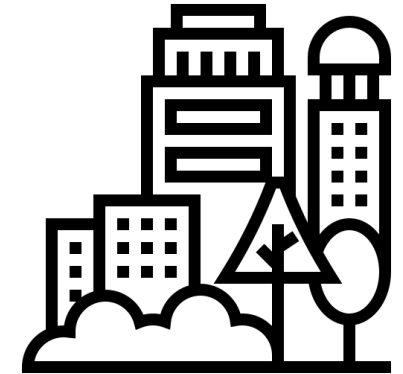


**E. Qu'est-ce que tu vas faire pour être en bonne santé ?** What are you going to do to keep healthy?

<b>Pour être en bonne santé</b> To be in good health	<b>je vais</b> I am going to	<b>avoir un régime équilibré</b> have a balanced diet <b>boire de l'eau</b> drink water <b>bien dormir</b> sleep will	<b>sinon je risque d'être</b> if not, I risk being	<b>accro.</b> addicted. <b>malade.</b> ill. <b>obèse.</b> obese. <b>stressé.</b> stressed.
	<b>je dois</b> I must	<b>éviter la malbouffe</b> avoid fast food <b>faire de l'exercice</b> do exercise <b>faire du sport</b> do sport <b>manger sainement</b> eat healthily <b>me reposer</b> rest	<b>sinon je risque d'avoir</b> if not, I risk having	<b>un cancer (des poumons).</b> (lung) cancer. <b>une crise cardiaque.</b> a heart attack.
	<b>je peux</b> I can		<b>puisque c'est bon pour</b> as it is good for	<b>le corps.</b> the body. <b>le mental.</b> the mind. <b>la santé.</b> the health.
	<b>je ne vais pas</b> I am not going to	<b>boire trop de l'alcool</b> drink too much alcohol <b>me droguer</b> take drugs <b>m'enivrer</b> get drunk <b>fumer</b> smoke	<b>étant donné que c'est</b> given that it is	<b>dangereux.</b> dangerous. <b>illégal.</b> illegal. <b>inquiétant.</b> worrying. <b>mauvais pour la santé.</b> bad for your health.  <b>une perte d'argent.</b> a waste of money. <b>une perte de temps.</b> a waste of time.
<b>Pour rester en forme</b> To stay in shape	<b>je ne dois jamais</b> I must never			



A. Qu'est-ce qu'il y a là où tu habites ? What is there where you live?						
Dans ma région In my region	il y a there is/there are	un aquarium an aquarium un bowling a bowling alley un centre commercial a shopping centre un centre sportif a leisure centre un cinéma a cinema un marché a market un stade a stadium un théâtre a theatre	par contre on the other hand	dans le passé in the past	il y avait there was/there were	un aquarium un bowling un centre commercial un centre sportif un cinéma un marché un stade un théâtre
Dans ma ville In my town		une bibliothèque a library une cathédrale a cathedral une église a church une gare a train station une mosquée a mosque une piscine a swimming pool une poste a post office				il n'y avait pas de* there wasn't
Dans mon village In my village	il n'y a pas de* there isn't	des galeries galleries des musées museums des monuments monuments des parcs parks des restaurants restaurants	pourtant however		il n'y avait pas de* there wasn't	des galeries des musées des monuments des parcs des restaurants
Dans mon quartier In my neighbourhood						



B. Qu'est-ce que tu as fait récemment dans ta région ? What have you done recently in your region?							
Hier Yesterday Hier soir Yesterday evening La semaine dernière Last week Le weekend dernier Last weekend Récemment Recently	je suis allé[e] I went nous sommes allés we went	à l'aquarium to the aquarium à la piscine to the swimming pool au centre commercial to the shopping centre au cinéma to the cinema à un concert to a concert à un match de foot to a football match prendre un verre for a drink	à mon avis in my opinion  sans doute without doubt	c'était it was  ce n'était pas it wasn't	absolument absolutely  extrêmement extremely  tellement so  plutôt rather	divertissant. entertaining. fascinant. fascinating. génial. great. sensass. sensational.  affreux. awful. barbant. boring. casse-pieds. Irritating. décevant. disappointing.	
	j'ai I nous avons we	appris de l'histoire learnt about history appris de la culture learnt about culture fait du shopping did shopping fait du sport did sport fait du tourisme did sightseeing fait de la natation did swimming fait des promenades did walks fait des randonnées did hikes joué au basket/tennis played basketball/tennis mangé des repas chinois/indiens/italiens ate Chinese/Indian/Italian meals visité le musée visited the museum visité la galerie visited the gallery					



C. Où vas-tu habiter à l'avenir – en ville ou à la campagne ? Where are you going to live in the future – in the city or in the countryside?				
Quand je serai vieux/vieille When I'm older	je vais habiter I am going to live	en banlieue in the suburbs		il y a beaucoup de magasins. there are lots of shops. il y a plus de distractions. there are lots of things to do. il y a plus de possibilités d'emploi. there are more employment opportunities.
Quand j'aurai x ans When I'm x years old	je ne vais pas habiter I am not going to live	en ville in town	parce que/qu' because	il y a tellement de bruit. there is so much noise. il y a trop de circulation. there is too much traffic. il y a trop de pollution. there is too much pollution. il y a trop de déchets par terre. there is too much rubbish on the ground.
À l'avenir In the future	je vais vivre I am going to live	au centre-ville in the town/city centre	vu que/qu' seeing as	il y a plus d'air frais. there is more fresh air. il y a plus d'espaces verts. there are more green spaces. il y a plus de pistes cyclables. there are more cycle paths. il y a de beaux paysages. there are beautiful landscapes.
Dans le futur In the future	j'aimerais habiter I would like to live	à la campagne in the countryside	néanmoins nevertheless	il n'y a rien pour les jeunes. there is nothing for young people. il n'y a rien à faire. there is nothing to do. il y a plus de chômage. there is more unemployment.
	je voudrais vivre I would like to live	dans un petit village in a small village		



D. Quels sont les problèmes pour les SDF ? What are the problems faced by homeless people?			
	les gens au chômage, unemployed people		ils ont faim. they are hungry. ils ont froid. they are cold. ils ont soif. they are thirsty.
Je considère que I consider that	les gens vivant dans la pauvreté, people living in poverty		ils n'ont pas d'argent. they don't have any money. ils n'ont pas d'amis. they don't have any friends. ils n'ont pas de médicaments. they don't have any medicine.
J'estime que I feel that	les sans-abris, homeless people	ils se sentent they feel	abandonnés. abandoned. déprimés. depressed. inutiles. useless. socialement exclus. socially excluded. seuls. alone. vulnérables. vulnerable.
	les SDF, homeless people	ils peuvent être they can be	victime d'une attaque. victims of an attack. en danger. in danger.

E. Qu'est-ce qui te préoccupe le plus dans le monde aujourd'hui ? What concerns you most in the world today?			
<b>Ce qui me préoccupe le plus, c'est</b> What concerns me the most is	<b>le changement climatique</b> climate change <b>le chômage</b> unemployment <b>le déboisement</b> deforestation <b>le racisme</b> racism <b>le sexisme</b> sexism	<b>car c'est</b> because it is  <b>puisque c'est</b> as/since it is	<b>catastrophique.</b> catastrophic.  <b>effrayant.</b> scary.  <b>inacceptable.</b> unacceptable.  <b>inquiétant.</b> worrying.  <b>préoccupant.</b> concerning.
<b>Ce qui m'inquiète le plus, c'est</b> What worries me the most is	<b>la corruption</b> corruption <b>la faim</b> hunger/famine <b>la guerre</b> war <b>la pauvreté</b> poverty <b>la pollution de l'air</b> air pollution <b>la surpopulation</b> overpopulation		
<b>Le plus grand problème pour la planète, c'est</b> The biggest problem for the planet is	<b>l'environnement</b> environment <b>l'inégalité</b> inequality <b>l'injustice</b> injustice		
	<b>les catastrophes naturelles</b> natural disasters		

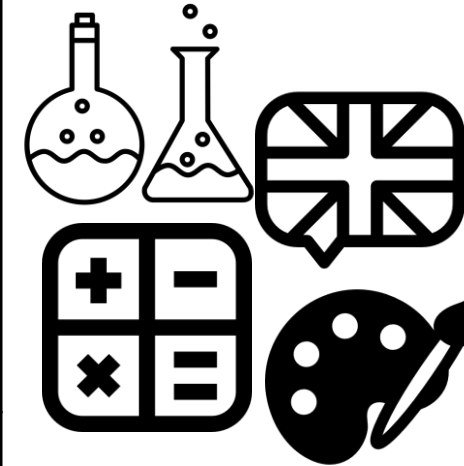
<b>À mon avis</b> In my opinion	<b>on a besoin de/d'</b> we need  <b>il faut plus de/d'</b> we must have more	<b>campagnes publicitaires.</b> advertising campaigns. <b>coopération internationale.</b> international cooperation. <b>investissement dans l'éducation.</b> investment in education. <b>investissement dans les énergies renouvelables.</b> investment in renewable energies. <b>lois plus strictes.</b> stricter laws. <b>paix dans le monde.</b> peace in the world. <b>projets d'aide.</b> aid projects.
<b>Selon moi</b> According to me		
<b>Sans doute</b> Without doubt		



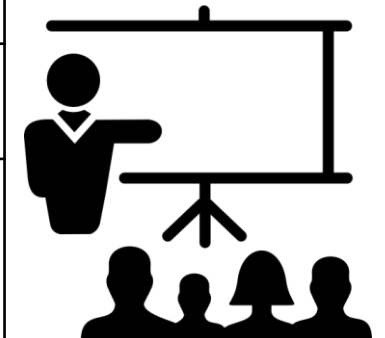
F. Qu'est-ce qu'il faut faire pour protéger l'environnement ? What must we do to protect the environment?					
<b>Bien que ce soit difficile,</b> Even though it is difficult,  <b>Bien que ce soit embêtant,</b> Even though it is annoying,	<b>pour protéger l'environnement</b> to protect the environment	<b>il faut</b> you must	<b>consommer moins d'énergie.</b> consume less energy. <b>créer d'espaces verts.</b> create green spaces. <b>économiser de l'eau.</b> save water. <b>faire du compost.</b> compost. <b>faire des achats responsables.</b> shop responsibly. <b>installer des panneaux solaires.</b> Install solar panels. <b>recycler.</b> recycle <b>utiliser les transports en commun.</b> use public transport.	<b>Personnellement, je vais</b> Personally, I'm going	<b>aller à l'école à vélo.</b> to go to school by bike. <b>baissier le chauffage.</b> to turn down the heating. <b>éteindre la lumière.</b> to turn off the lights. <b>recycler.</b> to recycle. <b>prendre une douche.</b> to take a shower. <b>réduire mon empreinte carbone.</b> to reduce my carbon footprint. <b>trier les déchets.</b> to separate rubbish.
	<b>pour protéger la planète</b> to protect the planet	<b>on doit</b> we must	<b>faire du compost.</b> compost. <b>faire des achats responsables.</b> shop responsibly. <b>installer des panneaux solaires.</b> Install solar panels. <b>recycler.</b> recycle <b>utiliser les transports en commun.</b> use public transport.		
	<b>pour lutter contre la pollution</b> to fight against pollution	<b>on peut</b> we can	<b>gaspiller de l'eau.</b> waste water. <b>manger de la viande.</b> eat meat. <b>prendre un bain.</b> take a bath. <b>utiliser les sacs en plastique.</b> use plastic bags. <b>voyager en voiture.</b> travel by car.		
		<b>il ne faut pas</b> you mustn't <b>on ne doit jamais</b> we must never			

**A. Qu'est-ce que tu penses de tes matières au collège ? Et tes professeurs ?** What do you think of the subjects at school? And your teachers?

<b>J'adore</b> I love <b>J'aime</b> I like <b>Je préfère</b> I prefer <b>Je n'aime pas</b> I don't like <b>Je déteste</b> I hate  <b>Ma matière préférée, c'est</b> My favourite subject is	<b>le commerce</b> business <b>le dessin</b> art <b>le français</b> French	<b>puisque</b> as, since  <b>vu que</b> seeing as  <b>même si</b> even if	<b>c'est</b> it is	<b>absolument</b> absolutely  <b>extrêmement</b> extremely  <b>tellement</b> so  <b>plutôt</b> rather	<b>captivant.</b> captivating. <b>créatif.</b> creative. <b>fascinant.</b> fascinating. <b>logique.</b> logic. <b>pertinent.</b> relevant. <b>utile.</b> useful.  <b>affreux.</b> awful. <b>compliqué.</b> complicated. <b>contraignant.</b> demanding. <b>insupportable.</b> unbearable. <b>inutile.</b> useless.
	<b>la géographie</b> geography <b>la religion</b> PRE <b>la technologie</b> technology				
	<b>l'anglais</b> English <b>l'étude des médias</b> media studies <b>l'EPS</b> PE <b>l'histoire</b> history <b>l'instruction civique</b> CORE				
	<b>les maths</b> maths <b>les sciences</b> science				



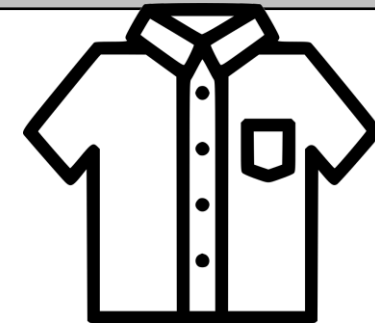
<b>J'aime</b> I like  <b>Je n'aime pas</b> I don't like	<b>mon prof</b> my teacher (male)  <b>ma prof</b> my teacher (female)	<b>d'anglais</b> of English <b>de commerce</b> of business <b>de dessin</b> of art <b>d'étude des médias</b> of media <b>d'EPS</b> of PE <b>de français</b> of French <b>de géographie</b> of geography <b>d'histoire</b> of history <b>d'instruction civique</b> of CORE <b>de maths</b> of maths <b>de religion</b> of PRE <b>de sciences</b> of science <b>de technologie</b> of technology	<b>car il est</b> because he is <b>parce qu'il est</b> because he is	<b>assez</b> quite <b>très</b> very <b>trop</b> too <b>un peu</b> a bit <b>vraiment</b> really	<b>compréhensif.</b> understanding. <b>patient.</b> patient. <b>travailleur.</b> hardworking. <b>tolérant.</b> tolerant.	<b>bête.</b> stupid. <b>impatient.</b> impatient. <b> paresseux.</b> lazy. <b>sévère.</b> strict.
			<b>car elle est</b> because she is <b>parce qu'elle est</b> because she is		<b>compréhensive.</b> understanding. <b>patiente.</b> patient. <b>travailleuse.</b> hardworking. <b>tolérante.</b> tolerant.	<b>bête.</b> stupid. <b>impatiente.</b> impatient. <b>paresseuse.</b> lazy. <b>sévère.</b> strict.
			<b>car il</b> because he <b>parce qu'il</b> because he		<b>a de grandes attentes.</b> has high expectations. <b>a un bon sens de l'humour.</b> has a good sense of humour. <b>nous aide.</b> helps us. <b>nous donne trop de devoirs.</b> give us too much homework. <b>enseigne bien.</b> teaches well. <b>nous fait réfléchir.</b> makes us think. <b>me tape sur les nerfs.</b> gets on my nerves.	



B. Qu'est-ce que tu penses du règlement scolaire ? What do you think about school rules?					
Dans mon collège In my school	il faut you must on doit we must	être à l'heure. be on time. faire de son mieux. do your/our best. faire ses devoirs. do homework. porter l'uniforme scolaire. wear school uniform. respecter les autres. respect others.	D'après moi According to me	c'est it is	juste. fair. logique. logical. raisonnable. reasonable.
	il est interdit de/d' it is forbidden to il ne faut pas you mustn't on ne doit jamais we must never	être impoli. be impolite. harcéler d'autres élèves. bully others. manquer les cours. skip lessons. porter des bijoux. wear jewellery. porter du maquillage. wear make-up. tricher pendant un contrôle. cheat in a test. utiliser son portable en classe. use your phone in class.	Sans doute Without doubt		frustrant. frustrating. ridicule. ridiculous. strict. strict.
			Je considère que I consider that		ça maintient l'ordre. it maintains order. ça promeut la bonne discipline. it promotes good discipline. ça réduit le harcèlement. it reduces bullying.
			J'estime que I feel that		ça limite la liberté d'expression. it limits freedom of expression. c'est une perte de temps. it's a waste of time.

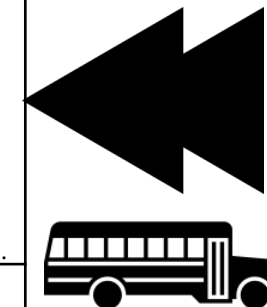


C. Que penses-tu de l'uniforme scolaire ? What do you think of school uniform?					
Je porte I wear	un jean jeans un pantalon trousers un pull a jumper un tee-shirt a T-shirt un uniforme a uniform	blanc white bleu blue gris grey jaune yellow marron brown noir black	orange orange rose pink rouge red vert green violet violet	à mon avis in my opinion	l'uniforme est uniform is
Nous portons We wear	une chemise a shirt une cravate a tie une jupe a skirt une robe a dress une veste a jacket	blanche white bleue blue grise grey jaune yellow marron brown noire black	orange orange rose pink rouge red verte green violette violet	selon moi according to me	
Il faut porter You have to wear				je crois que I believe that	
Je préférerais porter I would prefer to wear				je dirais que I would say that	
Je voudrais porter I would like to wear	des baskets trainers des chaussettes socks des chaussures shoes	blanches white bleues blue grises grey jaunes yellow marrons brown noires black	orange orange rose pink rouges red vertes green violette violet		beau. nice. chic. trendy. chouette. great. confortable. comfortable. pratique. practical.
					l'uniforme améliore la discipline. uniform improves behaviour. l'uniforme donne une impression positive du collège. uniform gives a good impression of the school. l'uniforme te fait gagner du temps. uniform gives you more time. les différents économiques ne sont pas si évidents. economic differences are not so obvious.
					l'uniforme coûte trop cher. uniform is too expensive. l'uniforme limite la diversité. uniform limits diversity. l'uniforme limite l'individualité. uniform limits individuality.





D. Décris-moi une visite scolaire que tu as faite. Describe a school visit that you have done.						
<b>L'année dernière</b> Last year  <b>Il y a deux ans</b> Two years ago  <b>Il y a huit mois</b> Eight months ago	<b>j'ai fait</b> I did  <b>ma classe et moi avons fait</b> my class and I did	<b>un échange</b> an exchange	<b>à Londres en France</b> to London to France	<b>j'ai adoré</b> I loved	<b>puisque</b> as, since  <b>vu que</b> seeing that	<b>j'ai beaucoup appris.</b> I learnt lots. <b>j'ai assisté aux classes.</b> I attended classes. <b>j'ai découvert une nouvelle culture.</b> I discovered a new culture. <b>j'ai fait des activités culturelles.</b> I did cultural activities. <b>j'ai passé du temps avec mes camarades de classe.</b> I spent time with my classmates. <b>j'ai pratiqué mon français.</b> I practised my French. <b>j'ai visité des monuments.</b> I visited monuments.  <b>je me suis bien amusé[e].</b> I had fun. <b>je me suis fait de nouveaux amis.</b> I made new friends.  <b>c'était une grande aventure.</b> it was a big adventure. <b>c'était une expérience enrichissante.</b> it was an enriching experience.
		<b>un voyage scolaire</b> a school trip	<b>à un musée à un parc national</b> to a museum to a national park	<b>j'ai aimé</b> I liked		
		<b>une excursion</b> a daytrip	<b>à une galerie à une université</b> to a gallery to a university	<b>j'ai détesté</b> I hated		<b>je n'ai pas aimé l'endroit.</b> I didn't like the location. <b>je n'ai rien appris.</b> I didn't learn anything. <b>je n'ai rien fait d'intéressant.</b> I didn't do anything interesting. <b>ce n'était pas mon truc.</b> it wasn't my thing.



My extra vocabulary:

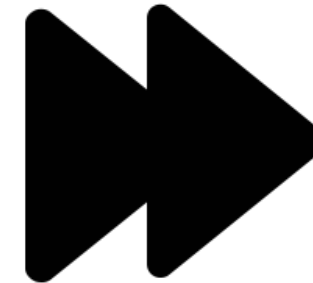




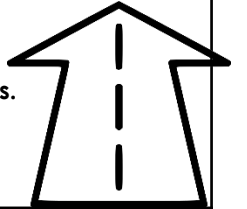
A. Quel emploi aimerais-tu avoir dans le futur ? What job would you like to have in the future?				
<b>À l'avenir</b> In the future	<b>j'ai l'intention de travailler comme</b> I intend to work as	<b>agriculteur</b>	<b>agricultrice</b>	farmer
<b>Dans le futur</b> In the future	<b>ça m'intéresse de devenir</b> I'm interested in becoming	<b>architecte</b>	<b>architecte</b>	architect
<b>Quand je serai vieux/vieille</b> When I'm older	<b>mon ambition est de travailler comme</b> my ambition is to work as	<b>avocat</b>	<b>avocate</b>	lawyer
<b>Quand j'aurai x ans</b> When I'm x years old	<b>mon rêve serait de travailler comme</b> my dream is to work as	<b>coiffeur</b>	<b>coiffeuse</b>	hairdresser
	<b>je vais devenir</b> I am going to become	<b>comptable</b>	<b>comptable</b>	accountant
	<b>je voudrais être</b> I would like to be	<b>électricien</b>	<b>électricienne</b>	electrician
		<b>infirmier</b>	<b>infirmière</b>	nurse
		<b>ingénieur</b>	<b>ingénieure</b>	engineer
		<b>journaliste</b>	<b>journaliste</b>	journalist
		<b>mécanicien</b>	<b>mécanicienne</b>	mechanic
		<b>médecin</b>	<b>médecin</b>	doctor
		<b>pilote</b>	<b>pilote</b>	pilot
		<b>plombier</b>	<b>plombière</b>	plumber
		<b>policier</b>	<b>policière</b>	police officer
		<b>pompier</b>	<b>pompier</b>	firefighter
		<b>professeur</b>	<b>professeure</b>	teacher
		<b>vétérinaire</b>	<b>vétérinaire</b>	vet



<b>Ce serait</b> It would be	<b>extraordinaire</b> extraordinary	<b>étant donné que</b> given that	<b>le travail a</b> the job has	<b>de bonnes perspectives.</b> good prospects. <b>beaucoup de responsabilité.</b> lots of responsibility. <b>un bon salaire.</b> a good salary.
	<b>gratifiant</b> rewarding		<b>j'aimerais travailler</b> I would like to work	<b>avec des adultes.</b> with adults. <b>avec des enfants.</b> with children. <b>avec des ordinateurs.</b> with computers. <b>dans une grande entreprise.</b> in a big business. <b>chez moi.</b> at home. <b>à l'étranger.</b> abroad. <b>à l'extérieur.</b> outside.
	<b>incroyable</b> incredible		<b>je suis</b> I am	<b>ambitieux.</b> ambitious <b>courageux.</b> courageous. <b>motivé.</b> motivated. <b>organisé.</b> organised. <b>travailleur.</b> hardworking.
	<b>merveilleux</b> marvellous	<b>puisque</b> as, since		<b>prêt à apprendre.</b> ready to learn. <b>prêt à vivre de nouvelles expériences.</b> ready to experience new things.
	<b>spectaculaire</b> spectacular			
	<b>stimulant</b> Stimulating			



B. Quels sont tes projets pour l'avenir ? What are your plans for the future?									
<b>Après avoir terminé le collège</b> After having finished school	<b>j'aimerais</b> I would like to	<b>aller à l'université</b> go to university <b>avoir des enfants</b> have children <b>commencer un apprentissage</b> start an apprenticeship <b>faire du bénévolat</b> do volunteering <b>habiter à l'étranger</b> live abroad <b>me marier</b> get married <b>me pacser</b> enter in a civil partnership <b>partir à l'aventure</b> go on an adventure <b>prendre une année sabbatique</b> take a gap year <b>trouver un emploi</b> find a job <b>voyager sac au dos</b> go backpacking	<b>ce serait</b> it would be	<b>divertissant</b> entertaining	<b>car</b> because	<b>je pourrais</b> I could	<b>beaucoup apprendre.</b> learn lots. <b>élargir mes horizons.</b> widen my horizons. <b>faire quelque chose de gratifiant.</b> do something rewarding. <b>faire de nouveaux amis.</b> make new friends. <b>gagner un bon salaire.</b> earn a good salary. <b>voir de nouvelles choses.</b> see new things.		
<b>Après avoir terminé mes études</b> After having finished my studies	<b>je voudrais</b> I would like to			<b>extraordinaire</b> extraordinary				<b>inouvable</b> unforgettable	<b>puisque</b> as, since
<b>Après avoir terminé mes études</b> After having finished my studies	<b>mon ambition serait de</b> my ambition would be to			<b>merveilleux</b> marvellous				<b>spectaculaire</b> spectacular	
<b>Quand je serai vieux/vieille</b> When I'm older	<b>mon rêve serait de</b> my dream would be to								



C. Est-ce que tu aimerais faire du bénévolat dans le futur ? Would you like to volunteer in the future?				
<b>À l'avenir</b> In the future	<b>j'aimerais faire du bénévolat</b> I would like to volunteer	<b>pour une organisation d'aide</b> an aid organisation	<b>parce que</b> because	<b>ça m'aide à rencontrer de nouvelles personnes.</b> it helps me to meet new people. <b>ça me donne plus de confiance en moi.</b> it gives me more self-confidence. <b>ça me donne le sentiment d'être utile.</b> it gives me the feeling of being useful. <b>ça me permet d'élargir mes compétences.</b> it allows me to widen my skills. <b>ça serait une expérience enrichissante.</b> it would be an enriching experience. <b>ça serait une expérience gratifiante.</b> it would be a rewarding experience. <b>ça en vaut la peine.</b> it would be worth it.
<b>Dans le futur</b> In the future		<b>pour une organisation de défense des animaux</b> an animal protection organisation		
<b>Quand je serai vieux/vieille</b> When I'm older		<b>pour une organisation environnementale</b> an environmental organisation		
<b>Quand j'aurai x ans</b> When I'm x years old		<b>dans un foyer pour enfants</b> in a children's home <b>dans un refuge pour les animaux</b> in an animal shelter <b>dans une maison de retraite</b> in a retirement home <b>dans une maternelle</b> in a nursery <b>avec les enfants défavorisés</b> with disadvantaged children <b>avec les réfugiés</b> with refugees <b>avec les sans-abris</b> with homeless people		



A. Décris tes dernières vacances. Describe your last holiday.						
L'année dernière Last year L'été dernier Last summer L'hiver dernier Last winter Récemment Recently Il y a x ans x years ago	je suis allé[e] I went  nous sommes allés we went  ma famille et moi sommes allés my family and I went	en Angleterre. to England. en Écosse. to Scotland. en Espagne. to Spain. en France. to France. en Grèce. to Greece. en Irlande. to Ireland. en Italie. to Italy en Turquie. to Turkey.  au Canada. to Canada. au Maroc. to Morocco. au Pays de Galles. to Wales. au Portugal. to Portugal.  aux États-Unis. to the USA.	J'ai voyagé I travelled  Nous avons voyagé We travelled	en avion by plane en bateau by boat en car by coach en train by train en voiture by car	et le voyage, c'était and the journey was  et le vol, c'était and the flight was	compliqué. complicated. long. long. passionnant. exciting. rapide. quick.



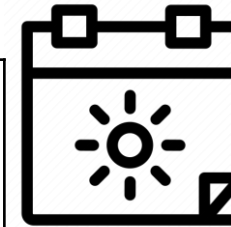
J'ai logé dans I stayed in Nous avons logé dans We stayed in	un appartement an apartment un camping a campsite un hôtel a hotel un hôtel cinq étoiles a 5* hotel une caravane a caravan	où il y avait where there was	un air de jeux. a playground. un court de tennis. a tennis court. un gymnase. a gym. une piscine. a swimming pool. une station thermale. a spa.
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	À mon avis In my opinion	c'était it was	assez quite	chouette great formidable terrific incroyable incredible inoubliable unforgettable passionnant exciting	car because	le premier jour on the first day	j'ai bronzé. I sunbathed. j'ai fait des excursions. I did trips. j'ai fait du tourisme. I did sightseeing. j'ai fait du vélo. I did cycling. j'ai mangé de la cuisine délicieuse. I ate delicious food. j'ai oublié mes problèmes. I forgot about my problems. j'ai rencontré de nouveaux amis. I met new friends. j'ai visité des monuments. I visited the monuments.
	D'après moi According to me		extrêmement extremely				
Sans doute Without doubt	ce n'était pas it wasn't	très very	puisque as, since	le matin in the morning	je me suis bien amusé[e]. I had fun. je me suis bien reposé[e]. I rested well.		
Selon moi According to me		un peu a bit	décevant disappointing désagréable unpleasant embêtant annoying insupportable unbearable	l'après-midi in the afternoon	il y avait beaucoup de choses à faire. there were lots of things to do.		
		vraiment really		le soir in the evening	j'ai été malade. I was ill. j'ai eu un accident. I had an accident. j'ai perdu mon passeport/mes clés. I lost my passport/keys. j'ai pris un coup de soleil. I got sunstroke. je me suis cassé la jambe. I broke my leg. je me suis ennuyé. I got bored. il n'y avait rien à faire. there was nothing to do.		



**B. Qu'est-ce que tu fais normalement pendant les vacances ? What do you normally do during your holidays?**

<b>J'adore</b> I love <b>J'aime</b> I like <b>Je préfère</b> I prefer <b>Je n'aime pas</b> I don't like <b>Je déteste</b> I hate	<b>les vacances actives</b> active holidays <b>les vacances d'aventure</b> adventure holidays <b>les vacances au camping</b> camping holidays <b>les vacances au ski</b> ski holidays <b>les vacances d'été</b> summer holidays <b>les vacances d'hiver</b> winter holidays	<b>donc</b> therefore	<b>tous les ans</b> every year  <b>tous les étés</b> every summer  <b>tous les hivers</b> every winter	<b>je passe mes vacances</b> I spend my holidays  <b>nous passons nos vacances</b> we spend our holidays	<b>à la campagne.</b> in the countryside. <b>à la montagne.</b> In the mountains. <b>à l'étranger.</b> abroad.  <b>au bord de la mer.</b> by the seaside.  <b>en safari.</b> on safari. <b>en ville.</b> in town.  <b>sur une île.</b> on an island.
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<b>Je considère que</b> I consider that <b>Je dirais que</b> I would say that <b>J'estime que</b> I feel that	<b>les vacances sont</b> holidays are	<b>essentielles</b> essential <b>importantes</b> important <b>nécessaires</b> necessary	<b>étant donné qu'</b> given that  <b>puisque'</b> as, since	<b>on peut</b> you can	<b>découvrir de nouvelles cultures.</b> discover new cultures. <b>découvrir de la nature.</b> discover nature. <b>passer du temps avec la famille.</b> spend time with family. <b>oublier le stress de la vie.</b> forget about the stress of the life. <b>se détendre.</b> relax. <b>se reposer.</b> rest.
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**C. Où aimerais-tu voyager si tu pouvais ? Where would you like to travel if you could?**



<b>Si j'avais de l'argent</b> If I had the money  <b>Si j'étais millionnaire</b> If I were a millionaire  <b>Si j'étais riche</b> If I were rich  <b>Si je gagnais la loterie</b> If I won the lottery  <b>Si je pouvais</b> If I could	<b>j'aimerais aller</b> I would like to go  <b>je voudrais aller</b> I would like to go  <b>mes vacances idéales seraient</b> my ideal holidays would be	<b>à Madagascar</b>  <b>au Canada / au Congo</b> <b>au Sénégal / au Viêt Nam</b>  <b>en Australie</b> <b>en Polynésie</b> to Polynesia  <b>aux Caraïbes</b> <b>aux États-Unis</b> to the USA <b>aux Seychelles</b>  <b>à Dubaï / à New York</b>	<b>J'aimerais loger</b> I would like to stay  <b>Je voudrais loger</b> I would like to stay	<b>dans un hôtel cinq étoiles</b> in a 5* hotel <b>dans un gîte à la campagne</b> in a cottage in the countryside <b>dans une auberge de jeunesse</b> in a youth hostel <b>dans une caravane</b> in a caravan <b>sur une île déserte</b> on a desert island <b>sur une île exotique</b> on an exotic island <b>sur un yacht</b> on a yacht	<b>avec un grand lit</b> with a big bed <b>avec un balcon</b> with a balcony <b>avec une baignoire</b> with a bath <b>avec vue sur la mer</b> with a view of the sea <b>avec piscine</b> with a pool
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<b>On peut y</b> There you can <b>On pourrait y</b> There you could	<b>s'amuser</b> have fun <b>découvrir la culture</b> discover culture <b>faire des excursions</b> do trips <b>faire des randonnées</b> do hiking <b>manger des plats délicieux</b> eat delicious meals <b>prendre des photos formidables</b> take terrific photos <b>regarder le coucher du soleil</b> watch the sunset <b>se reposer</b> rest <b>visiter des sites culturels</b> visit cultural sights	<b>et</b> and	<b>ce serait</b> it would be	<b>formidable.</b> terrific. <b>luxueux.</b> luxurious. <b>merveilleux.</b> marvellous. <b>passionnant.</b> exciting. <b>pittoresque.</b> picturesque. <b>reposant.</b> relaxing. <b>tranquille.</b> peaceful.
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D. Où vas-tu partir en vacances à l'avenir ? Where are you going to go on holiday in the future?

<b>Cet été</b> This summer	<b>je vais aller</b> I am going to go  <b>nous allons aller</b> we are going to go	<b>en Écosse.</b> <b>en Espagne.</b> <b>en France.</b> <b>en Grèce.</b> <b>en Irlande.</b> <b>en Italie.</b> <b>en Turquie.</b>  <b>au Canada.</b> <b>au Pays de Galles.</b> <b>au Portugal.</b>	<b>Je vais</b> I am going <b>Nous allons</b> We are going	<b>aller à la plage</b> to go to the beach <b>bronzer</b> to sunbathe <b>faire du canoë-kayak</b> to do kayaking <b>faire de la planche à voile</b> to do windsurfing <b>faire de la plongée</b> to do diving <b>faire du sport</b> to do sport <b>faire du tourisme</b> to do sightseeing <b>faire du vélo</b> to do cycling <b>jouer avec des amis</b> to play with friends <b>manger et dormir</b> to eat and sleep <b>passer du temps à la campagne</b> to spend time in the countryside <b>sortir en ville</b> to go out in town <b>visiter des monuments</b> to visit monuments <b>visiter des musées</b> to visit museums	<b>ce sera</b> it will be <b>ce ne sera pas</b> it won't be	<b>aventureux</b> adventurous <b>formidable</b> terrific <b>incroyable</b> incredible <b>merveilleux</b> marvellous <b>passionnant</b> exciting
<b>Cette année</b> This year						<b>décevant</b> disappointing <b>ennuyeux</b> boring <b>insupportable</b> unbearable
<b>L'année prochaine</b> Next year						
<b>Dans x mois/ans</b> In x months/years						
<b>Dans le futur</b> <b>À l'avenir</b> In the future						



My extra vocabulary:

 **Past**

**Perfect**

Hier – Yesterday  
Hier soir – Yesterday evening  
La semaine dernière – Last week  
Le weekend dernier – Last weekend  
L'année dernière – Last year  
L'été dernier – Last summer  
L'hiver dernier – Last winter

j'ai aimé – I liked  
j'ai détesté – I hated  
j'ai fait – I did  
j'ai fêté – I celebrated  
j'ai joué – I played  
j'ai mangé – I ate  
j'ai travaillé – I worked  
j'ai visité – I visited  
j'ai voyagé – I travelled

je suis allé[e] – I went  
je suis sorti[e] – I went out

**Imperfect**

Quand j'étais plus jeune – When I was younger  
Dans le passé – In the past

j'aimais – I used to like  
j'allais – I used to go  
j'avais – I used to have  
j'étais – I was/used to be  
je faisais – I used to do  
je jouais – I used to play  
je voulais – I wanted to

**Near future**



**Future**

Ce soir – This evening  
Demain – Tomorrow  
Ce weekend – This weekend  
Cet été – This summer  
Cette année – This year  
L'année prochaine – Next year  
À l'avenir – In the future  
Dans le futur – In the future

je vais aller – I am going to go  
je vais faire – I am going to do  
je vais fêter – I am going to celebrate  
je vais jouer – I am going to play  
je vais manger – I am going to eat  
je vais travailler – I am going to work  
je vais visiter – I am going to visit  
je vais voyager – I am going to travel

**Star phrases**



en général – in general  
en fait – in fact  
à vrai dire – to be honest  
bien sûr – of course

évidemment – obviously  
franchement – frankly  
malheureusement – unfortunately  
il faut que je dise que – I have to say that

autant que je sache – as far as I know  
je dois avouer que – I must admit that  
ça va sans dire que – it goes without saying that  
en ce qui me concerne – as far as I'm concerned

il me semble que – it seems to me that  
quel dommage! – what a shame!  
quelle barbe! – how rubbish!  
quelle horreur! – how awful!

j'adore – I love  
j'aime – I like  
je préfère – I prefer  
je n'aime pas – I don't like  
je déteste – I hate

ce que j'aime, c'est – what I like is  
ce que je déteste, c'est – what I hate is

à mon avis – in my opinion  
d'après moi – according to me  
pour moi – for me  
selon moi – according to me  
sans doute – without doubt

je considère que – I consider that  
je crois que – I believe that  
je dirais que – I would say that  
j'estime que – I feel that  
je pense que – I think that



**Opinions**

 **Reasons**

car, parce que – because	c'était it was		divertissant – entertaining formidable – terrific génial – great
étant donné que – give that	c'est it is	assez – quite très – very	incroyable – incredible inoubliable – unforgettable merveilleux – marvellous
puisque – as, since	ce sera it will be	trop – too un peu – a bit	merveilleux – marvellous
vu que – seeing that	ce serait it would be	vraiment – really	affreux – awful décevant – disappointing désagréable – unpleasant insupportable – unbearable
même si – even though/even if			

**Conditional**

Quand je serai vieux/vieille  
When I'm older

Si j'étais riche – If I were rich  
Si je pouvais – If I could

j'aimerais aller – I would like to go  
je voudrais faire – I would like to do  
j'aurais – I would have  
je serais – I would be

## Geology

- The study of rocks and different rock types
- Sedimentary = formed in layers (e.g. chalk)
- Igneous = formed from cooled lava (e.g. granite)
- Metamorphic = formed under intense heat and pressure (e.g. marble)



## Erosion

- There are four types of erosional processes that occur in both coastal and river landscapes.
  - Abrasion
  - Attrition
  - Hydraulic Action
  - Solution

## Weathering

- There are three main types of weathering processes that can affect rocks.
- Biological Weathering (e.g. plant roots)
- Chemical Weathering (e.g. acid rain)
- Mechanical/Physical Weathering (e.g. freeze-thaw)



## Transportation

- There are four main ways that sediment is transported in river and coastal environments.
  - Traction
  - Saltation
  - Suspension
  - Solution
- Longshore drift is also a method of transportation in coastal environments.

## Coastal Landforms

Depositional	Erosional
Beach	Headlands and Bays
Spit	Coves
Bar	Caves, Arches, Stacks and Stumps
Tombolo	Wave cut platforms

## Formation of a Wave-Cut Platform

1. Weather weakens the top of the cliff.
2. The sea attacks the base of the cliff forming a wave-cut notch.
3. The notch increases in size causing the cliff to collapse.
4. The backwash carries the rubble towards the sea forming a wave-cut platform.
5. The process repeats and the cliff continues to retreat.

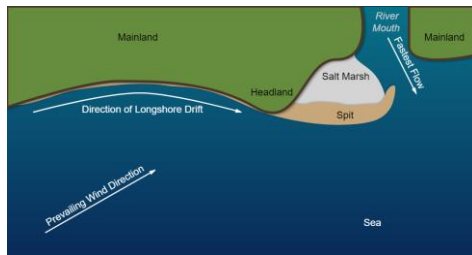
## Strategies to Reduce Coastal Erosion

Strategy Type	Strategy	Advantages and Disadvantages
Hard Engineering	<b>Sea Wall</b> – concrete walls built at the top of a beach	+ Effective at stopping the sea - Very expensive to build and maintain
Hard Engineering	<b>Rip Rap</b> – large boulders piled at top of a beach	+ Force waves to break, protecting cliffs + Relatively cheap and easy to maintain - Restrict access to beach - Do not fit in with local geology
Hard Engineering	<b>Groynes</b> – wooden or rock structures built along the beach at right angles	+ Quick to construct + Trap sediment and widens the beach reducing wave energy - Stopping movement of sediment can affect elsewhere on coast - Can be ugly
Soft Engineering	<b>Beach Nourishment</b> – adding sediment to a beach	+ Can absorb more wave energy + Easy and cheap to maintain - Needs constant maintenance
Soft Engineering	<b>Sand Dune Regeneration</b> – grasses and bushes are planted to stabilise dunes	+ Maintains a natural coastal environment - Areas of beach have to be fenced off

Keyword	Definition
Erosion	The wearing away and removal of material by a moving force e.g. rivers or waves.
Abrasion	Erosion caused by sediments rubbing against the river bed, bank or cliff.
Attrition	Erosion where particles in rivers or the sea are worn down as they collide with each other.
Hydraulic Action	Erosion caused by the sheer force of water wearing away cliffs, river beds or banks.
Solution	Erosion where some rock minerals slowly dissolve in water, which is slightly acidic.
Transportation	The movement of sediment by rivers or waves.
Traction	Transport of sediment through a rolling action along the river bed or sea floor.
Saltation	Transport of sediment being bounced along the river bed or sea floor.
Suspension	Transport of sediment carried within the water flow.
Solution	Transport of sediment particles that have been dissolved in the water.
Longshore Drift	The movement of material along a beach transported by wave action.
Weathering	The breakdown and decay of rock by natural processes acting on rocks, on cliffs and valley sides.
Mass Movement	The movement of material down a slope due to gravity.
Deposition	A process where sediments are dropped by the river or waves that carried them.
Hard Engineering	Strategies using artificial structures (e.g. concrete) to prevent river or coastal flooding
Soft Engineering	Flood defences that work with natural processes to reduce the risk of river or coastal flooding.

## Formation of a Spit

1. Prevailing wind blows at an angle to the coastline.
2. Waves come in at an angle, resulting in longshore drift.
3. Longshore drift moves sediment along the coastline.
4. A spit is formed when the material is deposited.
5. Over time, the spit grows and can develop a hook if wind direction changes further out.
6. Where the spit meets a river, or where there is faster water, the spit stops forming as deposition no longer occurs.
7. There is a sheltered area behind the spit. Silt (fine sediment) is deposited and mud flats or salt marshes form.

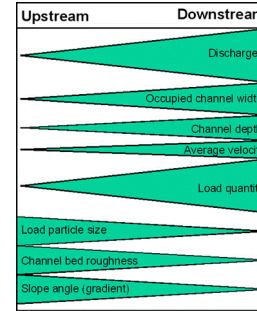


## Formation of Caves, Arches, Stacks and Stumps

1. Caves occur when waves force their way into cracks in the cliff face. The water contains sand and other materials that grind away at the rock until the cracks become a cave. Hydraulic action is the predominant process.
2. If the cave is formed in a headland, it may eventually break through to the other side forming an arch.
3. The arch will gradually become bigger until it can no longer support the top of the arch. When the arch collapses, it leaves the headland on one side and a stack (a tall column of rock) on the other.
4. The stack will be attacked at the base in the same way that a wave-cut notch is formed. This weakens the structure and it will eventually collapse to form a stump.

## How does a river channel change as it travels downstream?

- The Bradshaw Model is used by geographers to describe how the characteristics vary between the upper course and lower course of a river.
- Key characteristics are that width, depth, velocity and discharge all increase further downstream whereas particle size and gradient of the channel decrease further downstream.



## Causes of River Flooding

- Intense rainfall
- Long duration of rainfall
- Impermeable rocks
- Steeper relief of land
- Deforestation
- Urbanisation



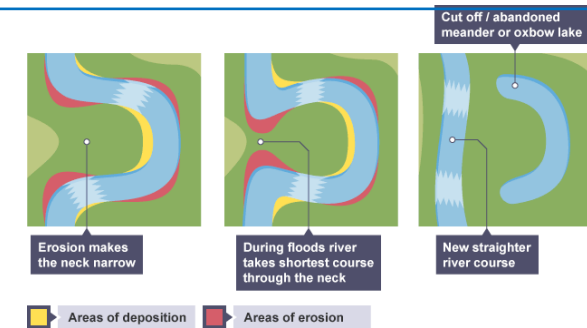
## Strategies to Reduce River Flooding

Strategy Type	Strategy	Advantages and Disadvantages
Hard Engineering	<b>Levees</b> – high banks on/near riverbanks	+ Stop water spreading into areas where it could be problematic - Can burst under pressure
Hard Engineering	<b>Channelisation</b> – deepening or straightening the river	+ Allows water to run through channel more quickly - Water taken downstream may put other places at risk
Soft Engineering	<b>Washlands</b> – areas on floodplain allowed to flood	+ Give a safe place for floodwater to go - May limit the use of the land (e.g. for recreation)
Soft Engineering	<b>Flood-plain Zoning</b> – allocate areas to different uses	+ Prevents using high risk zones for businesses and housing - May cause accessibility issues for the public

## Formation of a Meander

As the river makes its way to the middle course, it gains more water and therefore more energy. Lateral erosion starts to widen the river. When the river flows over flatter land they develop large bends called meanders.

1. As a river goes around a bend, most of the water is pushed towards the outside. This causes increased speed and therefore increased erosion (through hydraulic action and abrasion).
2. The lateral erosion on the outside bend causes undercutting of the bank to form a river cliff.
3. Water on the inner bend is slower, causing the water to slow down and deposit the eroded material, creating a gentle slope.
4. The build-up of deposited sediment is known as a slip-off slope (or sometimes river beach).



## Formation of an Oxbow Lake

1. Due to erosion on the outside of a bend and deposition on the inside, the shape of a meander will change over a period of time.
2. Erosion narrows the neck of the land within the meander and as the process continues, the meanders move closer together.
3. When there is a very high discharge (usually during a flood), the river cuts across the neck, taking a new, straighter and shorter route.
4. Deposition will occur to cut off the original meander, leaving a horseshoe-shaped oxbow lake.

## Formation of a Waterfall

Waterfalls form when there are horizontal bands of resistant rock (hard rock) positioned over exposed, less resistant rock (soft rock).

1. The soft rock is eroded quicker than the hard rock and this creates a step.
2. As erosion continues, the hard rock is undercut forming an overhang.
3. Abrasion and hydraulic action erode to create a plunge pool.
4. Over time this gets bigger, increasing the size of the overhang until the hard rock is no longer supported and it collapses.
5. This process continues and the waterfall retreats upstream.
6. A steep-sided valley is left where the waterfall once was. This is called a gorge.



## Global Atmospheric Circulation

Three atmospheric cells (Hadley, Ferrell, Polar) in which heat circulates (moves) globally.

- Hadley cells: warm, moist air rises at equator creating rainforests. Tropical air flows north and south creating areas of desert.
- Ferrel cells: air sinks over deserts creating dry conditions (warm deserts).
- Polar cells: air sinks over deserts creating dry conditions (cold deserts).



## Movements of air

- Rising air = low pressure = moist conditions.
- Sinking air = high pressure = dry conditions.
- Ocean currents transfer heat energy across the globe

## Global Climate Change

We live in the quaternary period (the last 2 million years).

### The climate is changing naturally:

- Eccentricity/orbit: Our orbit changes shape every 100,000 years. Circular orbit = interglacial period (warmer). When the Spherical = glacial period (colder)
- Precession: the earth wobbles on its axis creating warmer summers/colder winters as it wobbles towards/away from the sun.
- Large volcanic eruptions can block out solar radiation and cause glacial periods.



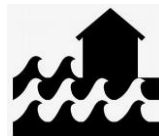
### Humans are causing climate change.

- Transport: cars become more affordable, people's disposable income increases. Burning fossil fuels release greenhouse gases.
- Industry: more disposable income means more goods need to be made by factories. More fossil fuels are burnt.



## Negatives of Climate Change

- Sea level rise: melting ice in Antarctica adds to the amount of water in oceans.
- Flooding: money lost as tourism reduces. Beaches close, coastal businesses close. Eg: The Maldives.
- Coral reefs: are bleaching which affects animal habitats.
- Food production: will be lower in some areas. Can cause malnutrition in developing countries.



## UK Climate

- Climate is temperate (mild temperatures, steady rainfall).
- Temperature is warmer in the south of England (nearer the equator).
- Precipitation is higher in the north and west of the UK because of the mountainous relief.
- The UK has gone through 2 major changes: medieval warm period (the year 1,000) and the little ice age (the year 1,700).



## The UK's climate is affected by its location:

- Maritime influence: the UK is surrounded by sea, meaning air over the UK is moist.
- Altitude: if air has to rise over mountain... it has to drop water as rainfall first.
- North Atlantic Drift: this warm ocean current from Mexico is driven by the prevailing wind. This makes our winter colder than expected.



Keyword	Definition
Altitude	The height of the land from sea level
Bleach(ing)	When the water is too warm, coral (below) loses its colour and is more likely to die
Circulates	Continuously moves
Coral	A hard stony material underwater in warm locations that is living
Disposable income	The money people have to spend on what they choose, not what they need
Fossil fuels	Coal, oil, gas. Are non renewable
Glacial	Colder periods of time when ice spreads on the land
Greenhouse gases	Gases such as carbon dioxide which cause global warming
Interglacial	Warmer periods of time where there ice is melting on the land
Malnutrition	A serious lack of food
Maritime	Describes anything related or connected to the sea
Orbit	The movement of the earth around the sun
Precipitation	Rainfall from clouds
Solar radiation	Energy that the sun gives out
Tourism	Travel for pleasure. For example, holidays
Transfer	The movement of one thing to another

## Tropical Cyclones

- Large rotating storms that start over oceans.
- Features: eye (center, calm). Eye wall (heavy clouds).

### Formation:

- High temperatures cause air to rise over oceans.
- This evaporation of the ocean creates heavy rain clouds.
- Cool air sinks towards the ocean surface which is then re – heated.
- The Coriolis effect causes the rapidly rising air to spin.

### Storms need:

- Warm air, over 27 degrees.
- Winds at the surface of the ocean.
- 30 degrees north and south from the equator.



EVAPORATION



## Causes of Drought

- Arid areas are based on dry climatic conditions whereas drought is an extreme weather condition.
- Causes of drought can be meteorological, hydrological or human.

### Meteorological:

- A lack of precipitation (rainfall).
- Climate change can affect and change patterns of rainfall.



### Hydrological:

- A lack of water stored. If water isn't stored and kept for when a country is in drought, more people will be without water.



### Human:

- Dams: they stop water moving down the river.
- Deforestation: means tree roots can't absorb water from underground, nor can the water be evaporated through transpiration.



## Impacts of Tropical Storms

- High winds – can damage buildings.
- Intense rainfall – can cause flooding.
- Storm surges – these tall waves can destroy coastal areas.
- Coastal flooding – can affect farming and tourism.

### The impacts are worse in developing countries because:

- They are slower to respond.
- There are no well trained response teams.
- Buildings are weak and easily collapse.
- The government can't track the tropical storm so they don't know when it will hit.
- People don't own vehicles so find it difficult to evacuate.



## Impacts of Drought

- Social: people become ill due to drinking poor quality water. Migration as people move away from affected areas.
- Economic: unemployment rises as businesses close. Food prices increase as there is a lack of food.
- Environmental: river habitats are destroyed. Endangered species become extinct.

### The impacts are worse in developing countries because:

- They don't have water stored.
- There aren't enough hospitals to help the ill people. The government can't predict when the drought will start.
- People are too poor so can't afford the higher food prices.



Keyword	Definition
Arid	Little or no rain, dry
Climatic	The weather over a long period of time
Coriolis	A force that causes rotation
Cyclone	A storm created by the weather. Also called hurricanes (around America) and typhoons (around south east Asia)
Dams	A barrier built on rivers to hold back water
Deforestation	The cutting down of trees
Endangered	At serious risk of being lost forever (extinct)
Evaporation	The sun heating up water and it turning into a gas (water vapour)
Hydrological	Water and the way it moves around the land
Meteorological	The weather high in the atmosphere
Migration	Permanent movement of people or animals from one place to another
Rotating	Spinning
Storm Surge	A rising of the sea and waves at approximately 3m higher than usual
Transpiration	Water evaporated from leaves on plants/trees
Unemployment	The loss of a job

## The World's Ecosystems

- Biomes are large ecosystems spread across the world.
- Each biome has a different climate and type of vegetation.



## Examples of Biomes

- Tropical Rainforest: hot & wet all year, tall trees.
- Deserts: very hot all year, very dry all year, plants have deep routes to find water.
- Tundra: freezing temperatures for most of the year, low precipitation. Very few plants grow.



## The Biosphere (The Earth's Surface)

- Humans use the biosphere for water, for fossil fuels and minerals like gold, silver and metal.
- Humans have exploited the biosphere.



## The Nutrient Cycle

- Nutrients move around the biosphere.
- Nutrients move between soil, biomass and litter.
- As animals die the nutrients fall into the litter store. As the animal body decomposes the nutrients move into the soil. As plants take nutrients from the soil the nutrients move back into the biomass (it's a cycle).
- The climate affects how quickly this cycle happens.



## UK Ecosystems

- UK terrestrial ecosystems are: woodland (deciduous trees), moorland (upland areas), wetlands (areas around rivers and lakes), heathland (sandy soil, can't be farmed).
- UK marine ecosystems are used for tourism and leisure activities.

## The Benefits of UK Ecosystems

- Bring in £3bn into the economy and provide 200,000+ jobs.



## Marine Ecosystems – Human Exploitation

- Chemicals used by farmers are being washed into rivers/lakes/seas.
- Large windfarms change bird migration routes.

## Tropical Rainforests

- High temperatures & rainfall = high biodiversity (lots of plant and animal species).
- Trees grow tall but have shallow routes because only the top layer of the soil is fertile.
- Nutrient cycle: biomass is the biggest store of nutrients. Small litter store because of decomposition.



## Tropical Rainforests – Importance

- They provide goods: timber, oxygen, medicine.
- They provide services: store carbon dioxide, provide animal habitats, bring in tourists.



## Adaptations To The Rainforest

- Buttress roots – think roots that spread across the soil to give tallest trees stability.
- Poison dart frog – its poison skin helps protect it from predators.



## Tropical Rainforests Are Changing

- Climate change: creating drier conditions which is increasing the risk of forest fires.
- Climate change: drier conditions are reducing biodiversity and causing animals to migrate away.



## Deforestation

- Trees are cut down for social and economic reasons.
- Social: population is increasing which means we need more space for housing and farming (growing food).
- Economic: more money can be made from farming animals, trees need to be removed so we humans can extract minerals.



## Deforestation Affects Animals

- Habitats are destroyed which might cause extinction of plant and animal species.
- Food chains are affected which means the number of animals is affected.



Keyword	Definition
Biodiversity	The number of plant and animal species
Biomass	Living things. Eg plants, animals
Biomes	A large area where plants and animals live together
Climate	The weather over a long period of time
Decomposes	Breaks down, usually an animal body
Economy /Economic	The number of jobs and money in an area
Fertile	Land that is good for growing crops
Fossil Fuels	Coal, oil, natural gas. When burnt, they create electricity
Litter store	Nutrients that are in dead plants or animals
Migration	The movement of plants or animals
Reduce	A less or smaller amount
Terrestrial	Land
Timber	Wood from trees for building
Tourism	Businesses and companies that support people going on holiday, eg hotels or restaurants.
Tundra	The Arctic area that is flat and permanently frozen
Vegetation	Trees and plants

## Managing & Protecting The Rainforest

- Selective logging: only older trees are cut down to allow younger trees to grow taller.
- Agribusiness: growing crops in between the trees of the rainforest.
- Reforestation/afforestation: re – planting trees.

Governmental policies: where the government encourage the protection of the rainforest.



## Temperate Deciduous Woodland - Importance

### They provide goods.

- Timber used to build with.
- Fuel: some UK power stations now burn wood to create electricity.



### They also provide services.

- Recreation: woodland is popular for dog walking, cycling, horse riding.
- Carbon capture: trees absorb and store carbon. This helps stop global warming.
- Conservation: forest areas are protected by law and protect animal/plant species.



## Case Study: Amazon Rainforest

- The Amazon rainforest, Brazil, is being cut down for: logging, minerals, building roads, houses and farming.



### The rainforest is being protected by:

- Agribusiness: farmers are encouraged to plant crops amongst the trees.
- Education: local people are being educated about why the rainforest needs protecting.
- Afforestation: trees are being replanted.



## Temperate Deciduous Woodland Are Changing

- Climate change: if winters become milder (slightly warmer) then diseases amongst trees can spread.
- Climate change: climate becomes drier = more droughts and forest fires.



### Deforestation of the Woodland

- Space is needed for people moving into cities (urbanisation).
- The timber from trees is used for building houses etc.
- Space is needed for land for farming.



## Temperate Deciduous Woodland

- Climate: 4 seasons. Cool summers. Mild winters. Rainfall all year.
- High biodiversity – lots of plants and animal species.
- Mostly deciduous trees. Nutrient Cycle In The Deciduous Woodland
- Summer: warm temperatures mean rapid decomposition = soil full of nutrients.
- Winter: decomposition is slow = soil lacks nutrients.



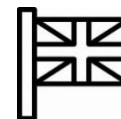
### Deciduous Trees

- Drop leaves in the winter because of the lower temperature.
- Deep roots to find water and nutrients.



## Case Study: The New Forest in the south of England

- Tourism in the area brings in £500m.
- The 15m visitors damage the area by:
  - Walking, cycling, driving, horse riding.



### The Area is Protected and Managed

- Conifer trees cut down are replaced by deciduous trees.
- Chemicals are rarely used in The New Forest.



### The New Forest is used Sustainably

- Cycle paths and routes keep people away from damaged areas.
- A visitor leaflet called '5 ways to love the Forest' explains how people can protect the forest.



Keyword	Definition
Carbon	A gas produced when burning fossil fuels
Conifer	A tree that has needle like leaves
Conservation	Protect or look after, make last longer
Deciduous	A tree that drops its leaves every year
Decomposition	Breaks down, usually an animal body
Drought	A severe lack of water and rainfall in an area
Logging	Trees being cut down
Policies	Something that is recommended by a government
Rapid	Very quick
Recreation	Activities that people do to have fun or relax
Seasons	Autumn, Winter, Spring, Summer. Changes in temperature and weather
Selective	Chosen, in this example chosen trees
Timber	Wood from trees for building
Tourism	Businesses and companies that support people going on holiday, eg hotels or restaurants.

# Geography – Topic 4 Changing Cities – Mumbai, India (Major City in an Emerging Country)

## Mumbai's Location

- Coastal city in the west of India.
- Has an international airport with major connections.
- Good road + rail connections to all of India.



## Mumbai's History

- Was a British colony called Bombay.
- City developed because of its textiles industry, coastal location and its port.
- The CBD is the historic center of the city.



## Quality of Life in Mumbai

- Urbanisation brings in migrants, they move to the slums, eg Dharavi.
- Rapid increase in population has led to huge unemployment.
- Richer people live in gated communities because of the drug + crime problems in the city.



## Mumbai's Rapid Growth

- Population: 20m in 2014. Predicted to be 30m in 2021.
- Industry: now a global financial hub and home to Bollywood.
- Birth rate is declining as women work.
- Life expectancy now higher as healthcare improves.



## Dharavi Slum (Informal Housing)

- Rapid growth has led to land being very expensive.
- Cost of housing is high in Mumbai – led to 9m people living in slums. 1m people live in Dharavi.
- Dharavi slum is Asia's 2<sup>nd</sup> largest slum.



## Negatives of Dharavi

- Health issues. Diphtheria + typhoid spread.
- 1 toilet per 1, 4440 people.
- Poverty. Many live on less than \$1 a day.



## Positives of Dharavi

- Strong community, people help each other.
- Slum businesses create \$40m for local economy.
- 85% of people have a job in the slum.



## Improving the Quality of Life in Mumbai

- The Dharavi Slum Redevelopment Project
- \$2bn development project planned for the land Dharavi is built on.
  - The people of Dharavi will be relocated to apartment blocks so the land can be used for gardens and shopping centers.
  - The people do not want this as it will break up their communities.
- The people would prefer small improvements.



- Bottom up development.
- Build green outdoor spaces for local people.
- Build clean water pumps and toilet blocks.



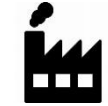
Keyword	Definition
Birth rate	The number of babies born (usually per person)
Bollywood	The Indian movie business
Bottom up Development	Where local people and/or charities are involved with improving something
British Colony	An area of land, or a country, that was owned by Britain
CBD	Central business district (the centre of the city, full of businesses and offices)
Coastal	Where the land meets the ocean
Connections	Where two or more things meet
Diphtheria	A serious infection of the nose and throat, can be deadly if not treated
Economy	The jobs, money and resources in a country
Industry	A type of business
International	From one country to another
Life Expectancy	The average age people are expected to live to
Migrants	People who have moved to a new area, usually looking for work, for at least 6 months
Population	The total number of people
Rapid	Very fast
Relocated	Moved to somewhere else
Textiles	Either a type of cloth or jobs around the making of clothes
Typhoid	A serious disease spread through contaminated (dirty) food and water
Unemployment	Without a job
Urbanisation	The movement of people into cities

# Geography – Topic 4 Changing Cities – Mumbai, India (Major City in an Emerging Country)

## Birmingham's Location

### History

- 1700s went from a small market town to creating industries in jewellery and guns.
- 1830s – canals and railways were built. This connected Birmingham to the country.
- Was an industrial city – secondary industry.



### Today

- CBD – is redeveloped. Expensive land. Lots of offices, theatres, hotels and shops
- Housing – tower blocks and terraced housing in the inner city. Larger semi detached housing in the suburbs.



## Birmingham – Changes in the 1900s

\*Urbanisation: happened in the 1800s because of the jobs in the city.

### 1920s/30s

- Suburbanisation happened.
- Semi detached homes built with greenery.



### 1970s - 1990

- Counter urbanisation happened.
- People left the city for a quieter lifestyle in rural areas.
- People could afford cars so they could commute back into the city for work.



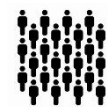
### After 1990

- Re – urbanisation happened.
- New apartments were built in the city center.
- Old factories were changed into apartments.



### Population

- 1.1m people live in Birmingham.
- Birmingham is ethnically diverse. 42% from non – white backgrounds.



## Migration

- Young people move into the city for work or for university (there are 78,000 students in Birmingham).
- 1950s – migrants came from old colonies such as India + Pakistan to work in transport and steel.
- 2000 – migrants came from eastern Europe to work.



## Industry in Birmingham

- Secondary industries are now in decline.
- Factories are moving abroad because of cheaper wages, land and better global transport.
- This has created unemployment and brownfield sites.



## Deprivation in Birmingham

- Areas are deprived because of deindustrialisation. Eg: South West of the city.
- Sparkbrook: deprived area, high unemployment, poor housing, health issues.
- Sutton Coldfield: wealthy area.



## Retail (Shopping) in Birmingham

- 1970s: decentralisation. Shops moved to the suburbs for space and cheaper land.
- 1980s onwards: CBD is redeveloped. The Mailbox has expensive shops and restaurants in.
- The Bullring shopping center is built in 2003 to attract people back into the city.



## Birmingham – trying to become sustainable

- The city is recycling 30% of waste. This is increasing.
- Bus + cycle lanes are being built to reduce greenhouse emissions.
- More schools are being built to improve education.
- Homes are built more energy efficient with insulation



Keyword	Definition
British Colony	An area of land, or a country, that was owned by Britain
Brownfield site	An area of land that has been built on before
CBD	Central business district (the centre of the city, full of businesses and offices)
Connections	Where two or more things meet
Decentralisation	Shops moving out of the city center (CBD)
Deindustrialisation	Factories and businesses moving abroad
Deprived	An area without basic things, eg good schools, good housing
Housing	Terraced – rows of smaller houses Semi detached – 2 houses joined together Detached – houses that aren't joined together Apartments – expensive flats
Industry	A type of business
International	From one country to another
Mailbox	A building in Birmingham that was turned from a Royal Mail building into expensive apartments and shops/restaurants
Migrants	People who have moved to a new area, usually looking for work, for at least 6 months
Re – urbanisation	The movement of people back into the city center
Redeveloped	When something is improved
Secondary Industry	Jobs that were in manufacturing/making things using materials, eg turning steel into guns.
Suburbanisation	The movement of people into the suburbs (edge of the city)
Sustainable	Improving something for the future, eg a city
Urbanisation	The movement of people into cities

## Development – an Introduction

- About improving people's quality of life.
- Examples:
  - Levels of literacy improve because teachers are trained.
  - Rural areas get electricity because there are more power lines.
- Factors that affect development:
  - Economic – average income, the unemployment rate.
  - Social – life expectancy, literacy rate.
  - Technological – % of people with internet access, % of people with electricity.



## Measuring Development

- Gross Domestic Produce (GDP): the total value of what is made in a country. Eg: if 2 cars are made and they cost £20,000 each. GDP = £40,000.
- GDP per capita: divide the GDP by the population.
- Human development index is a score between 1 – 0. 1 = most developed. It looks at:
  - Life expectancy
  - Literacy rate
  - Gross national income
- Single indicators are not as reliable as composite indicators. Composite indicator = HDI.
- Political corruption: the corruption index grades countries from highly correct to very clean.



## Food Security

- 800 million people live without enough food because:
- It isn't available in the right places for when people need it.
  - People don't have the money to buy it.
  - People in developed countries are consuming (eating) too much.



## Water Security

- People don't have access to clean water because:
- Water is being wasted in the developed world for industry and food production.
  - Water in oceans, rivers, lakes and reservoir is being polluted.



## Uneven Development - World

- There is a development gap between the wealthiest and poorest countries.
- The Brandt Line – shows the developed north and the developing south. Now outdated, Made in 1980s.
- Countries have variation in development. Urban areas are more developed than rural areas.
- Gini coefficient: shows income inequality in countries.



### Reasons why there is a gap in development:

- Physical environment: landlocked countries can't trade, some countries have natural disasters.
- Demography: a lower birth rate = economic growth.
- Politics: open economies (eg UK) encourage foreign investment. Closed economies (eg Russia) don't.
- History: European countries exploited the world's resources through colonialism.
- Social investment: countries that invest in education and health develop fastest.



## Uneven Development - UK

- The UK: has a north Vs south divide. London has the highest income per house. The south east has the highest average household price.
- Why:
  - Mountainous areas in northern Scotland, Southern England is quite flat (easy to build).
  - De – industrialisation happened in the north as factories moved abroad for cheap labour.



## The Impact of Uneven Development

- 30% of the world's population live in slums
- 6.6m children under 5 die every year
- 775m people cannot read or write
- 805m people are undernourished



Keyword	Definition
Capita	Person
Colonialism	Taking over another country and taking its resources (gold, diamonds, oil etc)
Corruption	People using their power for themselves
Composite	Made up of more than 1 thing
Demography	Population and its birth/death rate
De – industrialisation	Factories leaving to go abroad
Development (gap)	The difference between rich and poor
Domestic	Produced in that country. The home country
Exploited	Taken advantage of
Industry	Businesses and/or factories
Landlocked	Surrounded by land/other countries
Life expectancy	The age you are predicted to live until
Literacy rate	The amount of people that can read + write
Rural	Countryside, open green fields
Undernourished	Without proper food
Unemployment rate	The number of people without a job
Urban	City
Variation	Differences

## Reducing Uneven Development

- Fair trade: retailers in developed countries pay more for a product.
- Giving aid: developed nations give aid. Countries can buy resources, build infrastructure.
- Cancelling debts: helps countries develop as they can spend more on infrastructure.



## Top Down Development

- Experts from developed countries plan large projects.
- Doesn't involve local people.
- Eg: dam and reservoir project.



## Bottom Up Development

- Done by non government organisations.
- Involve local people and spend money where it is needed most.
- Eg WaterAid. More sustainable.



## India – An Emerging Country That Is Developing

### Introduction

- 7<sup>th</sup> largest country in the world.
- Population: 1.2 billion.
- Climate: tropical south, monsoon weather.



### Uneven Development

- Western India is most developed. Industries: Finance, ICT.
- Eastern India is least developed because of physical geography (mountains, desert).



### Mumbai: core region.

- Largest + wealthiest city.
- Home to Bollywood, ICT and TNCs such as Bank of America.
- 40% of houses are slums.
- Work on an Industrial corridor is underway. \$100bn project with Japan.



### Bihar: periphery area.

- 100m population.
- High fertility rate.
- Many live in poverty.
- 80% of people are farmers in rural areas.
- Lacks investment in education + health.
- Poor quality leadership by the government.



## India's Changing Economy

- Quaternary's GDP contribution is increasing (research + development).
- India's low cost labour force is providing ICT services. Makes \$100bn for India a year.
- Since 1990, its economy has opened up and allows foreign investment (2014: \$34bn).



## India's Demographic and Social Change

- Fertility rates have fallen.
- Mortality rates have fallen.
- Life expectancy improved to 68 years.
- Literacy rate has improved to 74%.



## India's Geopolitics

### India Vs Pakistan

- Gained independence from Britain in 1947 and the land was split into India and Pakistan.
- India and Pakistan have argued over where the border should be. Particularly an area called Kashmir (northern India).
- Both countries have nuclear weapons.



### India Vs China

- Both countries have nuclear weapons.
- Arguing over shortages of water from the Himalayan mountains.



## Impacts of Rapid Development

- Air is heavily polluted. Delhi is world's #1 polluted city.
- Deforestation for growing cities and space for industry.
- Coal is the main source of energy – gives off greenhouse gases.



### The Smart Cities Mission:

- Is a plan to improve quality of life across 100 cities.
- Aims to: improve water + electricity supply, build affordable housing for the poor and improve health + education.

Keyword	Definition
Affordable	Not expensive
Core area	The central area
Deforestation	The cutting down of trees
Fertility rate	The number of babies born per person
Himalayan	Mountains that are in India and Pakistan
independence	Being controlled by your own government, not of another country
infrastructure	Roads, bridges, schools, hospitals
Investment	Money spent in an area, eg schools
Mortality rate	The number of people that die
Non government organisations	Charities and businesses that aren't controlled by the government
Nuclear power	Very powerful weapons created by atoms and science
Periphery area	The areas outside the core area (see core)
Population	The total number of people
Quaternary	Jobs that are around research and development
Reservoir	A man made lake built to store water
Slums	Informal housing, usually built by the people themselves on illegal land
Sustainable	To look after future generations
Undernourished	Without proper food



## Types of Resources

- Abiotic: found from things that can't reproduce. Eg: soil, water.
- Biotic: found from things that can reproduce. Eg animals and plants.
- Non – renewable: resources that either cannot be remade or would take millions of years to make again. Eg: fossil fuels.
- Renewable: resources than can be used again and again or re-created in a short amount of time. Eg: wind, solar, hydro electric power.



## The Location of Natural Resources Around the world

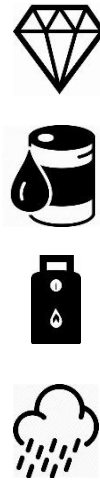
- Gold and diamonds are found near volcanoes.
- Fossil fuels are found where there is sedimentary rock.
- Oil is found in countries such as America, Iraq, United Arab Emirates.

### In the UK

- Iron and coal helped Britain in the industrial revolution but there is little left in Britain.
- Oil and gas are found in the north sea but these supplies are running out.

### Problems in the UK

- Rainfall is higher in the north and west of the UK but this isn't where people live.
- The water is in the wrong place. The supply of water cannot meet the demand.



## Consumption of Resources Around the world

- People are using more resources everywhere in the world, but the biggest increase is in Asia.
- America is eating up the most calories. This leads to undernourishment in other countries.



## Why are we using more resources?

- People are richer and can afford more cars.
  - The population is increasing.
  - People are buying more technology.
- All of this means we need to build/make more which takes up resources.



## Where do we get our electricity from?

- In the past, we have always burnt fossil fuels (non renewable energy sources).
- Recently, we have started to use renewable energy sources.
- All energy sources have positives & negatives



## The Energy Mix (where countries get there electricity from)

- 80% of the world's energy comes from non renewable sources.
- 60% of the UK's energy comes from non renewable sources.
- Factors that affect a country's energy mix: size of population, wealth of the country, what energy resources are nearby.



## Coal – a fossil fuel

### Advantages

- ✓ Should last for another 200 years.
- ✓ Cheap and easy to mine.
- ✓ Creates large amounts of electricity.

### Disadvantages

- Releases greenhouse gases, polluting the air.
- Destroys animal habitats.



## Wind energy – renewable energy

### Advantages

- ✓ Does not pollute greenhouse gases.
- ✓ Creates cheap electricity for customers.

### Disadvantages

- Can ruin the look of the landscape.
- Doesn't work when it isn't windy.
- Can be expensive to build.



Keyword	Definition
Calories	Energy that comes from eating food
Expensive	Costs a lot of money
Fossil fuels	Coal, oil, natural gas. All non renewable
Greenhouse gases	Harmful gases that are released into the air. For example when burning fossil fuels
Habitats	Places where something lives
Hydro electric power	Electricity that is made from water powering machines
Industrial revolution	Happened in the 1700s where people had jobs in factories
Landscape	The land, the environment. Eg fields
Population	The total number of people in an area
Reproduce	Make more of
Sedimentary rock	Layers of rock that have fossils (dead plants/animals) in them
Undernourishment	People that do not have enough food to eat

## Nuclear Power Plants

### Advantages

- ✓ Produce electricity all year round.
- ✓ Produces huge amounts of electricity.
- ✓ Produce less carbon dioxide than fossil fuels.



### Disadvantages

- Expensive to build.
- Can be dangerous if they explode.

## Fracking Natural Gas

- This is a new way of finding natural gas.
- Involves drilling down to shale rock.
- Blasting water, sand and chemicals into the rock.



This breaks the rock and allows the gas to come out.

### Advantages

- ✓ Produces large amounts of gas.
- ✓ Has made natural gas cheaper to use/buy.
- ✓ Produces less greenhouse gases than coal.

### Disadvantages

- Can be dangerous as gas enters the water supply and can come through kitchen taps.
- The use of chemicals can damage animal habitats.



## Managing & Protecting Our Energy

### Individuals can:

- Measure their carbon footprint.
- Use public transport like buses, not private transport like cars.
- Insulate homes and use solar panels.



### Companies can:

- Restaurants can re use cooking oil as fuel for lorries.
- Use LED lights which use less electricity.

### Governments can:

- Use smart meters in homes.
- Build renewable energy sources.
- Improve renewable energy sources by improving technology.



## Case Study: China, an emerging country

- 70% of its energy comes from burning coal.
- 7 cities in China are classed as 'heavily polluted'.



### Why does China have pollution problems?

- More people are owning cars.
- China's roads are heavily congested.
- Poor quality petrol causes air pollution.



### What has China done to solve these problems?

- 2006: China introduced the 'China Renewable Energy Law'. Which aims to minimise the use of coal and use more nuclear and wind power.
- China built the 'Three Gorges Dam' to create hydro electric power.
- Solar farms (rows of solar panels) have been built in the Gobi desert.



## Case Study: Germany, a developed country

- Germany wants to use less nuclear power because of the Fukushima disaster in Japan, 2012.
- By the end of 2020 Germany plans to reduce greenhouse emissions by 40%, and by 80% in 2050.



### How will it meet these targets?

- Germany has built the Bavaria solar park with 60,000 panels. This will reduce carbon emissions by 100,000 tonnes.
- Germany has invested in new wind turbines in the north sea, called Norsesee Ost farm. This will increase how much energy is created.



Keyword	Definition
Carbon dioxide	A gas that is given off when burning fossil fuels
Carbon footprint	The amount of carbon dioxide each person emits (gives out) because of their lifestyle. Eg, a person who drives will have a larger carbon footprint than someone who walks
Congested	Heavy traffic
Dam	A barrier built on rivers to hold back water
Emissions	Gases released into the air
Fossil fuels	Coal, oil, natural gas. All non renewable
Fukushima	An area of Japan where a nuclear power plants exploded because of a powerful earthquake
Greenhouse gases	Harmful gases that are released into the air. For example when burning fossil fuels
Hydro electric power	Electricity that is made from water powering machines
Invested	Money spent in a new area to improve something
LED lights	The best lights for the environment
Minimise	Reduce, make less
Nuclear	Electricity created by using atoms
Shale rock	A type of rock where natural gas can be found
Smart meters	A small computer that tells you how much electricity you are using each hour
Wind turbines	Large wheel that is turned by wind which creates electricity

## The UK's Population

- Is increasing. 2020: 67m. 2050: 77m people.
- This increase will put pressure on resources:**
- More housing means more greenfield sites are needed to be built on.
- More food will mean natural habitats are destroyed to make space for farms.
- More energy might mean more greenhouse gases if fossil fuels are burnt.



## To solve these problems:

- Use brownfield sites for building.
- Encourage people to limit their food intake and have a healthy lifestyle.
- Use sustainable, renewable energy sources for electricity.



## Transport in the UK

- Global transport releases emits huge amounts of greenhouse gases.
- The UK is trying to reduce greenhouse gases:
- Improve public transport so people leave their cars at home.
- London has created cycle routes and Boris bikes for people to rent for the day or longer.
- Congestion charges: charging people for driving through city centers has reduced traffic and pollution.



## Greenfield Sites

### Advantages:

- Cheaper and quicker to build on.
- Environment is usually cleaner and more pleasant to look at.



### Disadvantages:

- Valuable farms or open spaces are lost.
- Animal habitats are destroyed.

## Brownfield Sites

### Advantages:

- Less countryside is lost.
- Old dis – used urban areas are cleaned up.

### Disadvantages:

- Often more expensive because old buildings need to be destroyed/rebuilt.
- Higher levels of pollution in these areas.



## The UK's Economy

The 2 speed economy: London and the south east's economy grows faster than the north of England.



### Why is this?

- More government money is invested in the south to attract more businesses.
- The big businesses in London attract the brightest people from the north of England. These people move south to work.



### How is the government trying to stop the north Vs south divide?

- A high speed railway (HS2) is being built from London to northern cities. This will create jobs in the north.
- Airports in the north are improving to encourage travel and businesses to set up in the north.



## Migration

- Immigrants: mainly from India + China.
- Emigrants: mainly leave to Australia.
- Reasons for migration: better jobs, better education, family reasons or to retire.



### Advantages of migration nationally:

- Brings more workers so more taxes are paid.
- Different cultures bring different music and food.



### Disadvantages of migration locally:

- More people means we need more hospitals, schools and doctors. This costs money.
- Some people think migrants take jobs from British people.

Keyword	Definition
Boris bikes	Bikes that can be rented by the day in London. Boris Johnson, now the Prime Minister, introduced them when he was the Mayor of London
Brownfield	Land that has been built on before
Congestion	Heavy traffic
Culture	People's way of life, the music they listen to or the food they eat or the activities they enjoy
Economy	The jobs and money in an area
Emigrants	People that move out of a country. Eg: Jack has emigrated to Australia
Greenfield	Land that has not been built on before
Greenhouse gases	Gases that damage the environment and cause global warming
Immigrants	People that move into a country. Eg: Jack has immigrated into the UK
Urban	Cities and built up areas

## UK's Landscape Challenges

### How can we protect national parks?

- Employ young people to work in the park so they grow up seeing its importance.
- Encourage public transport into the national park.



### The UK is at risk from river flooding because:

- The population is increasing so more people have to live nearer rivers.
- More urban areas means more impermeable surfaces.
- More extreme rainfall because of climate change.



### The UK government is planning to:

- Reduce the number of buildings near rivers.
- Build flood defences – hard/soft engineering.
- Help people prepare through warnings.



### Specific example: Somerset floods, 2013/14.

- Heavy rainfall flooded 600 homes.
- Flood defences failed to protect people.
- Rivers were blocked with silt which meant rivers couldn't hold much water.



## UK's Coastal Challenges

- Storm surges cause severe flooding because of the wave height and wind power.
- Storm surges can destroy some coastal defences.



### Reducing coastal flooding in the UK:

- Build sea walls to reduce flooding and erosion.
- Use managed retreat in certain areas.

### Specific example: 2013, across east England.

- The Thames flood barrier protected London from flooding.
- Flood barriers were quickly built in Norfolk.
- Advice was passed out through social media which meant that 800,000 homes were protected.



## UK's Climate Change Challenges

### The UK will become:

- Warmer in winter and summer by 3 – 5 degrees.
- 30% wetter in winter, 30% drier in summer.
- Extreme rainfall will be more severe and often.



### Climate change will impact the UK:

- More flooding near rivers and the coast.
- More drought and less water in rivers may affect animal habitats and numbers of species.
- More heatwaves could mean more illnesses like heatstroke. This puts pressure on the NHS.



## Responding to climate change

### Individual people can:

- Walk or cycle to reduce greenhouse emissions.
- Recycle waste to reduce resource consumption.
- Build solar panels and insulate homes to conserve heat.



### Governments can:

- Place limits on carbon emissions from businesses.
- Create adverts which encourage recycling.
- Sign agreements like the Paris agreement to work with other governments.



### Problems governments face:

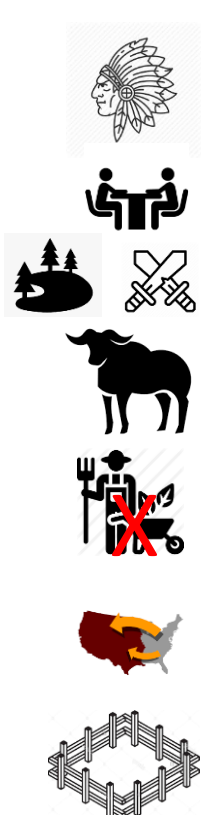
- Encouraging economic growth and development usually means using more resources.
- Reducing climate change can damage economic growth.



Keyword	Definition
Drought	Little or no rainfall for a long time, usually months or years
Economic growth	An increase in the number of jobs in an area and an increase in the number of money spent in an area
Emissions	When gases are released into the atmosphere (air)
Extreme rainfall	Very heavy rain
Flood defences	Things that aim to try and stop rivers from flooding
Greenhouse gases	Gases that damage the environment and cause global warming
Heatwaves	Very hot weather for a few days or possibly weeks
Heatstroke	An illness that makes the body weak. Is caused by being in hot temperatures for too long without drinking enough water
Impermeable surfaces	Building materials that don't allow water to pass through them. Eg concrete, tarmac
Insulate	Keep warm
Managed retreat	Allowing certain parts of the land to become flooded
National parks	Parks that cannot be built on. They are protected by laws
Severe	Very dangerous
Storm surge	This is when the wind 'picks up' the waves and makes them higher. About 6 feet higher than usual
Thames flood barrier	A barrier on the Thames river that protects London from flooding

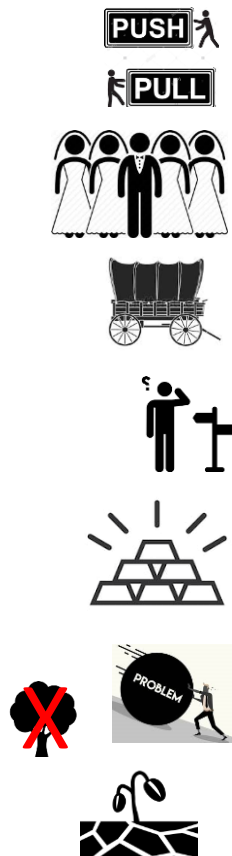
## The Plains Indians: Their beliefs and way of life

- The Plains Indians were made up of different tribes and nations – some with very different customs
- Each tribe had one or more chiefs who negotiated with the government or other tribes
- The Plains Indians ideas about land, nature, warfare and property were very different from the white American settlers
- The buffalo was extremely important to the Plains Indians – they used all parts of it
- The Plains Indians believed land was sacred and farming hurt it
- The US government supported the idea of Westward expansion
- Firstly, tribes were moved from the East behind a Permanent Indian Frontier
- Then, the tribes were put into reservations to keep them separate from the white settlers



## Migration and early settlement

- Different factors encouraged migration to the West – some 'pulled' people West and others 'pushed' them
- The Mormons moved West (1846-47) due to persecution and set up home in Salt Lake City
- The Oregon trail made migration to the West possible but it was not easy
- The Donner Party showed how disastrous it could be – even with planning
- The Gold Rush of 1849 encouraged settlers to move to California to find their fortune. It also attracted immigrants from all over the world
- Early settlers on the Plains had a hard life due to the conditions there
- Farming was hard due to lack of rainfall, few trees and extreme weather conditions



## Conflict and tension

- The growing number of people moving to the Plains caused tensions between the settlers and the Plains Indians
- The Fort Laramie Treaty (1851) involved promises being made to the Plains Indians and the settlers
- Law and order was difficult to enforce in the early towns and settlements
- A lack of government help meant local communities took it upon themselves to tackle lawlessness



Key Word	Definition
<b>Ecological</b>	Something that tries not to cause lasting harm to land or animal and plant life
<b>Homesteaders</b>	People who settled on the Plains
<b>Immigration</b>	The arrival of people from one place in another where they hope to stay and live
<b>Indigenous</b>	Something or someone whose origins are deeply rooted in a place e.g. Native Americans in America
<b>Manifest Destiny</b>	The belief in a God-given right to take over the whole of America
<b>Mormon</b>	Followers of the teachings of Joseph Smith and the book of Mormon
<b>The Plains</b>	The area of land between the Mississippi river and the Rocky mountains
<b>Reservation</b>	Areas of land set aside for Indian settlement
<b>The Oregon Trail</b>	A route across the middle of the USA from the Missouri to Oregon, some 3,000 km long
<b>Persecution</b>	Being treated badly because of race, religion, politics or gender
<b>Permanent Indian Frontier</b>	Land given especially to the Indians when they move West
<b>Donner Party</b>	A group of people who made the journey West but took a 'short cut' that led to major delays
<b>Gold Rush</b>	When gold was found in California and people migrated there on masse to find their share

## The development of settlement in the West

- The Homestead Act was passed in 1862 and encouraged more people to move West
- The Pacific Railroad Act of 1862 allowed companies to start building railroads on the Plains to connect the East and West
- The new wave of settlers started to benefit from new methods of farming the Plains such as barbed wire, sulky ploughs and steel blades
- The Timber Culture Act was passed in 1873 and allowed homesteaders to purchase an extra 160 acres of land if they promised to plant trees on ¼ of it.
- The large amounts of settlers and building of the railways led to an increase in lawlessness
- New towns build near the railroads were called Hell on Wheels



## Ranching and the cattle industry

- 1862-1876 saw the rapid growth of the cattle industry
- Ranching became common on the Plains
- Goodnight, Illiff and McCoy came up with new ways to meet the demand for beef in the East and West
- Abilene was the first cow town to be created.
- Cowboys drove the cattle to the railroads. This was called the long drive
- Homesteaders started to claim public land which caused tensions with the cowboys and ranchers



## Changes in the way of life of the Indians

- White settler's invasion of the Plains Indians land put pressure on the Indians
- As the number of cattle increased, the number of buffalo decreased as they ate the same food - grass
- Corrupt management of reservation food supplies caused desperation and conflict
- The Indian Appropriation Act came into place in 1871 and meant Indians were no longer treated as citizens of the USA and it was easy to take their land
- Government policy focused on moving the Indians to the reservations
- 3 major conflicts broke out due to the poor treatment of the Indians – Little Crows War (1862), The Sand Creek Massacre (1864) and Red Clouds War (1866-68)

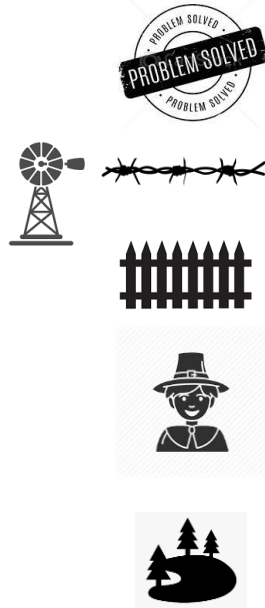


Key Word	Definition
<b>Homestead Act 1861</b>	Allowed people to claim 160 acres of land if lived & farmed there for 5 years.
<b>Pacific Railroad Act 1861</b>	Central Pacific Railroad built a train line from East, while the Union Pacific Railroad would build a from the West
<b>Windmills</b>	Used the wind to pump water from underground to water crops.
<b>Dry Farming</b>	Farmers ploughed their land straight after it rained to trap the water in the soil
<b>Cattle Industry</b>	The buying and selling of cows.
<b>Ranching</b>	Cows grazing on a range where cowboys would work to look after them.
<b>Open Range</b>	Originally cattle would graze and live on unfenced land/ranches.
<b>Cattle Drives</b>	Moving of cattle from Texas in the South to cow towns/railroads in the North. Cowboys would lead the cattle drives.
<b>Grant's Peace Policy 1868</b>	USA stopped policy of extermination against the Plains Indians. Instead he swapped to a non-violent policy
<b>Indian Appropriations Act 1871</b>	Cancelled former treaties with Plain Indians & US Government. Plain Indians would be treated as an individuals
<b>Red Cloud's War</b>	When gold was discovered in the Rocky Mountains, Plain Indians attacked settlers who entered their lands to get it.
<b>Sand Creek Massacre</b>	The US army attacked Black Kettle's camp killing 150 men, women and children despite the camp showing a white flag
<b>Little Crows War</b>	1861-62 Sioux starving on reservations killed settlers and soldiers.



## The development of settlement in the West

- Changes in farming solved most of the early problems the homesteaders faced
- New methods included dry farming, barbed wire and wind pumps
- The end of the 'open range' meant new, smaller ranches, fenced with barbed wire
- The Exoduster movement brought black American settlers to the Plains
- The Oklahoma Land Rush opened up land to settlers from previously protected Indian territory



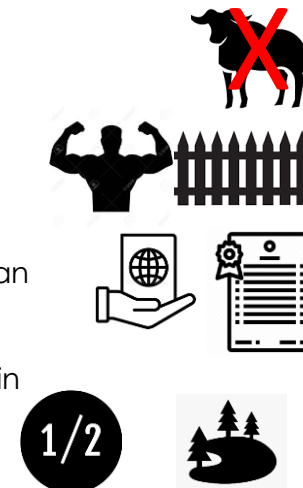
## Conflict and tension

- Conflicts over land continued to cause problems of law and order
- This was especially common between cattle ranchers and other land users as well as outlaws such as Billy the Kid
- In most parts of the West the government had more power to deal with crime and disorder
- The Johnson County War was a range war that made vigilante justice more common – many members of the public were unhappy about this
- The shock caused by the defeat at Little Bighorn meant the government were determined to prevent Indian resistance ever again



## The destruction of the Plains Indians way of life

- The destruction of the buffalo led to Indians staying off the white Americans land
- Reservation life was extremely tough and some believed it would mean the end of the Indians
- The Dawes Act of 1887 failed to encourage Indians to become American citizens and homesteaders
- By 1890, Plains Indians had lost over half the land they originally owned in 1887



Key Word	Definition
<b>The Great Die Up</b>	The horrible winter of 1886-7 was icy cold causing thousands of Cattle to die
<b>Exoduster movement</b>	The mass movement of African Americans to states like Kansas in 1879
<b>Indians Appropriation Act</b>	Saw two million acres of fertile Plain Indian land opened for settlement in the West by Homesteaders. It prompted a huge surge of settlers to the area.
<b>Dawes Act 1887</b>	Allowed shared reservation lands to be split up into individual plots of land. (160 acres). Plain Indians could each receive one plot. Remaining land was then put up for sale.
<b>Johnsons County War</b>	Conflict between settlers and powerful cattle ranchers in Wyoming in 1892. 1889 saw Jim Averill and Ella Watson killed by local cattle barons after they complained about the cattle barons grabbing land. No-one was prosecuted for the crimes and killings escalated leaving some small rancher holders dead. Cattle Barons responded by organising an invasion of Johnson County in 1892. The local governor knew about it and even provided extra guns for the invasion. Johnson County fought back and the President had to order US military in to resolve the conflict. Despite the public condemning them for their actions the Cattle Barons were never found guilty of any crimes.
<b>Indian agents</b>	Government officials in charge of a reservation. Some Plains Indians joined them to help keep the order on reservations.
<b>Ghost dance</b>	A special dance that would allow White people to disappear and for dead Buffalo and Plains Indians to return.
<b>Wounded knee</b>	US Cavalry shot at Plain Indians at Wounded Knee killing 146 Plains Indians including elderly, women, children and babies as well as adult males. The massacre was seen as the last battle in the Plain Indian wars.
<b>Vigilante</b>	Someone who takes it upon themselves to deal with law enforcement without legal authority
<b>Oklahoma Land Rush 1889</b>	US government opened up the middle section of Oklahoma for white settlers to claim land

**Key Words**

**Monotheistic:** A religion which believes in one God  
**Holy:** Separate and set apart for a special purpose by God  
**Omnipotent:** All powerful, Almighty  
**Omnibenevolent:** all-loving  
**Just:** Fair  
**Trinity:** One God has 3 parts; God the Father, Son and Holy Spirit  
**Holy Spirit:** God's presence in the world  
**God the Son:** Jesus – enables humans to have a special relationship with God  
**Creation:** God bringing the universe into being  
**The Word:** Jesus – as described in the book of John  
**Genesis:** The first book in the Bible which has the creation story in it  
**Incarnation:** God in human form – Jesus.  
**Resurrection:** coming back from the dead  
**Blasphemy:** saying or doing something which goes against God  
**Crucifixion:** Roman method of execution where a person is nailed to a cross  
**Ascension:** 40 days after the resurrection when Jesus returned to God in heaven  
**Afterlife:** What happens when you die  
**Day of Judgement:** God will judge all souls at the end of time  
**Heaven:** Eternal happiness, being in the presence of God  
**Hell:** Eternal suffering, absence of God  
**Purgatory:** Catholic belief in which souls are cleansed in order to enter heaven  
**Sin:** Any action against God  
**Original Sin:** First sin in the world committed by Adam and Eve which means all humans are born with this in them  
**Salvation:** saving the soul from sin and going to heaven thanks to Jesus' sacrifice  
**Grace:** A quality of God which shows to humans that God loves them, which they don't need to earn  
**Forgiveness:** pardoning someone for their wrong doing  
**Atonement:** restoring the relationship between people and God through the life, death and resurrection of Jesus

**God as omnipotent, loving and just**

- Christians believe **God is omnipotent: all-powerful. 'Nothing is impossible with God'**
- **God is omnibenevolent: all-loving.** Guidelines are given for us to live the best lives we can. Christians should love each other treating everyone with care and respect. **'God so loved the world he gave his one and only Son...'**
- God has unlimited power and authority, together with complete love, and therefore gives **justice** in a fair way. Christians should try and bring about fairness in the world.





**The Problem of Evil and Suffering: The Inconsistent Triad**




- Christians believe God is omnipotent (all-powerful) and omnibenevolent (all-loving).
- However, why is there evil and suffering?
- If God was all powerful, he would be able to stop evil and suffering.
- If he was all loving, he would care enough to stop it. So he would stop it.
- But he doesn't! So God cannot exist, or is at least not omnipotent or omnibenevolent.
- A Christian defence: God is transcendent (beyond our understanding) and therefore we can trust God to know best – there is a reason for this inconsistency, even if we can't understand it.



**Different Christian Beliefs about Creation**

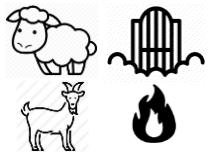
<p>Genesis 1 v 1-3</p> 	<ul style="list-style-type: none"> <li>- God created the world in 6 days and rested on day 7. <b>'In the beginning God created the heavens and the earth'</b>. God created the perfect world in the beginning: <b>'It was good'</b></li> <li>- Not all Christians believe this story is literally true, but rather believe it is a story which represents the idea that God created life.</li> <li>- A further quote from Genesis: <b>'The Spirit of God hovered over the waters'</b> indicates that the Holy Spirit was present at creation.</li> </ul>	<p>Combined, these ideas suggest that all 3 parts of the Trinity were present at creation.</p>
<p>John 1 v 1-3</p> 	<ul style="list-style-type: none"> <li>- <b>'In the beginning was the Word, and the Word was with God, and the Word was God....through him all things were made...'</b></li> <li>- 'The Word' refers to Jesus and therefore he was present at the beginning of the world and involved in the creation of the world</li> </ul>	

**The Oneness of God and the Trinity**





<ul style="list-style-type: none"> <li>- The Holy Trinity: God the Father, the Son and the Holy Spirit.</li> <li>- God is three in one. There are not three Gods, but different forms of the same thing. Each part is fully God, but also these parts of the Trinity are not the same.</li> </ul>		
<p><b>God the Father</b></p> <ul style="list-style-type: none"> <li>- First person of the Trinity.</li> <li>- Creator</li> <li>- Omnipotent, omnibenevolent, omniscient (all-knowing) and omnipresent (everywhere).</li> </ul> 	<p><b>God the Son</b></p> <ul style="list-style-type: none"> <li>- Second person of the Trinity.</li> <li>- Jesus, who became God in human flesh (known as the Incarnation).</li> <li>- Performed miracles, healed the sick and showed kindness to outcasts.</li> </ul> 	<p><b>God the Holy Spirit</b></p> <ul style="list-style-type: none"> <li>- Third person of the Trinity.</li> <li>- God sent the Holy Spirit to influence, guide and sustain all life on earth after Jesus ascended.</li> <li>- The unseen power of God.</li> </ul> 

**Different Christian Beliefs about the Afterlife**

- Based on God's judgement Christians believe that people will go to heaven or hell.
- Judgement will happen at death or at the day of judgement (Christians vary on their understanding of this)
- **The Parable of the Sheep and the Goats** shows how people will be judged by God. The sheep represent those who did good actions (therefore going to heaven) and the goats represent those who did bad actions (therefore going to hell)
- Jesus also said, **"I am the way the truth and the life, no-one comes to the Father except through me."**
- So, treating others well and believing in God is important to guarantee a good afterlife.
- Heaven is seen as being with God and eternal happiness where there is no suffering. Hell is seen as eternal torment or suffering and being absent from God, and where the Devil is.
- Some Christians believe that Heaven is a literal, real place you will go. Other Christians believe it is just being with God, in the same way hell may not be actually real but an absence of God.
- The Bible teaches that there will be a resurrection of the body for all people who go to heaven, though the details of this are debated.
- In the book of Revelation it mentions that people who go to hell will burn in a lake of fire.
- Roman Catholics believe in a place called purgatory in which your soul goes to be cleansed as not everyone is ready yet to go to heaven.

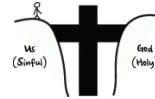


Jesus' Life: Key Events

Event	Key Details	Importance/ Influence on Christians
Incarnation: Jesus is God in human form 	<ul style="list-style-type: none"> <li>- 'Incarnate' mean 'In the flesh' – Jesus was God in the flesh.</li> <li>- Jesus' birth is explained in the Christmas story: the Nativity.</li> <li>- Humble birth (in a manger) shows Jesus was fully human, but he was born through the immaculate conception (Mary was a virgin), so he was fully God</li> <li>- This means Jesus does not have Original Sin because he was not conceived through sexual relations.</li> <li>- <b>'Before they came together, she was found to be pregnant through the Holy Spirit'.</b></li> <li>- <b>'The Word became flesh and made his dwelling among us'.</b></li> </ul>	<ul style="list-style-type: none"> <li>- Encourages them to celebrate Christmas for its true meaning</li> <li>- Helps them in difficult times as they know their role model was human too</li> <li>- Allows them to have a personal relationship with God through Jesus</li> </ul>
Crucifixion: Jesus' death on the cross 	<ul style="list-style-type: none"> <li>- Crucifixion is remembered on Good Friday.</li> <li>- Jesus was arrested (having been betrayed by Judas) and put to death by Pontius Pilate. He was crucified alongside two criminals.</li> <li>- As Jesus was fully human he suffered pain as an ordinary human did. <b>'Father, into your hands I command my spirit'</b></li> <li>- On the cross Jesus said <b>'Father forgive them, for they know not what they do'.</b></li> </ul>	<ul style="list-style-type: none"> <li>- By accepting Jesus' sacrifice they can be forgiven for sin and go to heaven.</li> <li>- Encourages them to follow Jesus' example and forgive others</li> <li>- Reminds them to be thankful and remember Jesus (especially on Good Friday)</li> <li>- Reminds them that suffering is a part of life and God can understand what it is like for someone to suffer.</li> </ul>
Resurrection: Jesus rose from the dead 	<ul style="list-style-type: none"> <li>- Jesus was buried in a tomb and left there until Sunday. Due to it being the Sabbath (on the Saturday), no-one could touch the body until after this.</li> <li>- Mary Magdalene returned to the tomb - it was open and empty.</li> <li>- An angel appeared and said Jesus had risen from the dead.</li> <li>- Evidence of resurrection: he appeared to people including disciples, they saw him eat, Thomas was encouraged to touch Jesus' palms to prove he was not a ghost.</li> </ul>	<ul style="list-style-type: none"> <li>- Shows Jesus was divine and not just a human so it may strengthen faith</li> <li>- Shows the power of good over evil</li> <li>- Encourages them to not fear death</li> </ul>
Ascension: Jesus went back up to heaven to be with God 	<ul style="list-style-type: none"> <li>- Happened 40 days after the resurrection - Jesus ascended to heaven.</li> <li>- He gave the disciples the Great Commission: <b>'Go and make disciples of all nations, baptizing them in the name of the Father, the Son and the Holy Spirit'.</b></li> <li>- The Holy Spirit was left to guide and comfort people.</li> </ul>	<ul style="list-style-type: none"> <li>- Will encourage them to call on the Holy Spirit for guidance and comfort</li> <li>- Will encourage them to spread the message of Christianity (evangelise)</li> </ul>

Sin and Salvation

- Sin: anything that goes against God's laws. Separates humans from God.
- Salvation means to be saved from sin (therefore being able to go to heaven)
- Humans are not perfect – impossible not to sin
- All humans are born with Original Sin – passed down from Adam and Eve.
- This action separated humans from God and brought about death into the world. They were tempted by the serpent (devil) and Christians believe that Christians are tempted in life to do bad things.
- **Salvation through Law:** humans have free will but should use this to make the right choices using God and Jesus' teachings to guide them, e.g. 10 Commandments.
- **Salvation through Grace:** being saved by accepting the sacrifice Jesus made on the cross – this showed God's grace: **'For by grace you have been saved through faith'**
- **Salvation through Spirit:** having the Holy Spirit as a guide to accept God's Grace and follow his Law.











The Role of Christ in Salvation: Atonement

- Salvation is offered through Jesus, **"For the wages of sin is death, but the gift of God is eternal life in Christ Jesus"**.
- Jesus' death makes up for Original Sin. Humans can receive forgiveness for their sins because of Jesus' death and then receive eternal life.
- His sacrifice provides atonement, which means our relationship with God is restored. This removes the effects of sin and allows humans to get back to God. **"He is the atoning sacrifice for our sins and for the sins of the whole world"**.
- Jesus paid the price for the sin of all mankind through his death and Christians believe if you put your trust in him you can receive eternal life with God.
- Links with Salvation through Grace: salvation is a gift people must choose through belief in Jesus atoning for their sins



Exam Terminology

- Influence:** The capacity to have an effect on people's character, behaviour or actions
- Contrasting:** To show a difference
- Contemporary:** Occurring in the present time
- Sacred Writings:** Writing that is believed to contain words of God e.g. The Bible
- Evaluate:** Consideration of different viewpoints before arriving at a final judgement
- Justified Conclusion:** A final decision which is based upon a range of evidence.

Worship and Festivals			
Practice and Key Words	Details/ Contrasting Views		Importance and Quotations
<b>Worship: Act of religious honour or devotion</b>  	<b>Liturgical</b> <ul style="list-style-type: none"> <li>- Takes place in a church and is led by a priest</li> <li>- <b>Formal, set prayers</b> are read out, and the worship follows a <b>set pattern and structure</b></li> <li>- A more <b>traditional</b>, and formal form of worship</li> <li>- E.g. Eucharist in the Catholic Church</li> </ul>	<b>Non-Liturgical</b> <ul style="list-style-type: none"> <li>- Also takes place in a church but <b>less formal</b></li> <li>- No set prayers, instead people take turns to preach and read from the <b>Bible</b></li> <li>- Can be modern and appealing to young people</li> <li>- Service is usually focused around a Bible reading</li> <li>- E.g. Methodist or Baptist services</li> </ul>	<ul style="list-style-type: none"> <li>- Shows gratitude, love and respect to God</li> <li>- Could be a way of asking for forgiveness or asking for help</li> <li>- Brings comfort and strength</li> <li>- Gives time for reflection</li> <li>- <i>'Sing to the Lord, for he has done glorious things; let this be known to all the world'.</i></li> </ul>
	<b>Informal</b> <ul style="list-style-type: none"> <li>- Spontaneous prayers or sharing of thoughts</li> <li>- Community or house churches might meet to eat together and share their faith</li> <li>- Pentecostal Church – 'charismatic' worship. Led by the Holy Spirit and may involve dancing, clapping, calling out, speaking in tongues.</li> </ul>	<b>Private</b> <ul style="list-style-type: none"> <li>- Spending time with God alone or with close friends/ family</li> <li>- May involve prayer, meditation, studying the Bible.</li> </ul>	
<b>Prayer: Communicating with God</b> 	<b>Informal</b> <ul style="list-style-type: none"> <li>- Prayers that are made up by the individual using <b>his or her own words</b>.</li> </ul>	<b>Set Prayers</b> <ul style="list-style-type: none"> <li>- Prayers which have been written down and said many times by many people</li> <li>- E.g. <b>The Lord's Prayer</b>: The prayer that Jesus taught the disciples to pray, which includes thanks, asking for forgiveness and asking for guidance. <i>"Our father who art in heaven...."</i></li> </ul>	<ul style="list-style-type: none"> <li>- Set prayers can bring a sense of unity</li> <li>- Prayer brings comfort and builds relationship with God</li> <li>- <i>'Call on me and come and pray to me, and I will listen to you'.</i></li> </ul>
<b>Sacraments: An outward sign of inward grace. Eucharist/ Holy Communion</b> 	<b>Roman Catholic Church (Mass)</b> <ul style="list-style-type: none"> <li>- Readings from the Bible</li> <li>- Offering of bread and wine <b>brought to the altar</b></li> <li>- Priest says the words of Jesus at the Last Supper, says the Lord's Prayer and <b>gives a sign of peace</b></li> <li>- <b>Congregation come to the altar</b> to receive the communion</li> </ul>	<b>Orthodox Church (Divine Liturgy)</b> <ul style="list-style-type: none"> <li>- Hymns, prayers, readings from Bible.</li> <li>- Priest comes through <b>Royal Doors</b> to chant the gospel.</li> <li>- Lord's Prayer said, behind Royal Doors words of Jesus said.</li> <li>- <b>Bread divided into four</b> – three consecrated as body and blood and fourth broken into small pieces. <b>Priest gives bread and wine together on a spoon.</b></li> </ul>	<ul style="list-style-type: none"> <li>- Jesus started the tradition at The Last Supper (which took place the day before he died)</li> <li>- Christians now remember Jesus' death – reminds them of Jesus' sacrifice, and reminds them to forgive others.</li> <li>- <i>"This is my body which is for you, do this in remembrance of me"</i></li> </ul>
<b>Sacraments: An outward sign of inward grace Baptism</b> 	<b>Infant Baptism</b> <ul style="list-style-type: none"> <li>- Everyone is a descendent of Adam and Eve and therefore carries <b>Original Sin</b>. Baptism washes this away.</li> <li>- It also <b>welcomes them to the church community</b>.</li> <li>- Infant wears white, Godparents are chosen, font holds the water</li> <li>- E.g. Catholic, Orthodox</li> </ul>	<b>Believer's Baptism (Adult Baptism)</b> <ul style="list-style-type: none"> <li>- Some Christians think children are too young to understand the meaning and therefore don't baptise infants.</li> <li>- The person is old enough to understand the meaning behind what they are doing.</li> <li>- This includes a <b>full immersion</b> in a pool to wash away sin and start a new life in Jesus.</li> <li>- This is known as being <b>'born again'</b></li> <li>- E.g. Baptist and Pentecostal churches</li> </ul>	<ul style="list-style-type: none"> <li>- Brings a person into the Christian family/ community</li> <li>- Water symbolises the washing away of sins</li> <li>- Jesus was baptised, setting an example for others to follow</li> <li>- Jesus also encouraged baptism in the Great Commission: <i>"Therefore go and make disciples of many nations, baptising them in the name of the father, son and Holy Spirit"</i>.</li> </ul>
<b>Pilgrimage: A special religious journey to a holy site.</b> 	<b>Lourdes (France)</b> <ul style="list-style-type: none"> <li>- Dedicated to Mary as Bernadette believed to have seen visions of Mary in the 19<sup>th</sup> Century.</li> <li>- A spring of water was discovered which had <b>healing powers</b>. Now millions of people have been to drink from the spring of water in the hope of being healed.</li> </ul>	<b>Iona (Island off west coast of Scotland)</b> <ul style="list-style-type: none"> <li>- Small community set up by St. Columba, an Irish missionary in the 6<sup>th</sup> Century</li> <li>- Pilgrimages happen there in dedication to the virgin Mary.</li> <li>- The community in Iona hold <b>daily services in the Church leading a seven mile hike</b> to holy spots – it is a physical and spiritual challenge</li> </ul>	<ul style="list-style-type: none"> <li>- Pilgrimage shows commitment to God and strengthens faith</li> <li>- People may go on pilgrimage for healing</li> <li>- It brings a sense of community</li> </ul>
<b>Festivals: Celebrations for religious reasons</b>  	<b>Christmas</b> <ul style="list-style-type: none"> <li>- Remembers the birth of Jesus – <b>his incarnation</b>.</li> <li>- It is celebrated on the 25<sup>th</sup> December.</li> <li>- Trees and homes are decorated <b>with nativity scenes</b>. Lights remember Jesus is the light of the world. <b>Carol services</b> happen in Churches with readings from the Bible. Children act out nativity plays and <b>midnight mass</b> takes place on Christmas Eve.</li> </ul>	<b>Easter</b> <ul style="list-style-type: none"> <li>- Most important festival which celebrates Jesus' resurrection from the dead leading up from holy week.</li> <li>- Jesus was crucified on <b>Good Friday and rose on Easter Sunday</b>.</li> <li>- Special services take place and processions led by someone carrying a cross.</li> <li>- On Easter Sunday, <b>sunrise services</b> take place with hymns which celebrate the resurrection. <b>Easter Eggs</b> are used as a reminder of new life. <b>Paschal candle</b> is lit.</li> </ul>	<ul style="list-style-type: none"> <li>- Festivals celebrate the most important events of Jesus' life – his birth, death and resurrection.</li> <li>- They are a time for believers to come together and celebrate their faith.</li> <li>- <i>"I bring you glad tidings that today a king is born"</i></li> <li>- <i>'Christ is risen from the dead'.</i></li> </ul>

## Key Words

**Church:** The holy people of God, the body of Christ or a building where Christians worship

**Agape:** compassionate love

**Mission:** A calling where an individual or group go out and spread the word of God.

**The Great Commission:** Jesus instruction to his followers to go and spread his message *“Go and make disciples of many nations”*

**Missionary:** A person sent on a religious mission to promote Christianity in a different country through preaching or charity work

**Evangelism:** Spreading the Christian message through preaching the Christian gospels

**Alpha course:** An example of evangelism – trying to tell others about Christianity

**Convert:** Someone who has decided to become committed to a religion and change his or her religious belief.

**Reconciliation:** A sacrament in the Catholic faith, also making up after an argument or disagreement

**Persecution:** hostility or ill-treatment, because of race or religious or political beliefs.

**Poverty:** When people live without having basic human rights such as having enough food, water or shelter

The Role of the Church in the Local Community		
<p><b>Food Banks</b></p>	<ul style="list-style-type: none"> <li>Provide <b>free food</b> (usually non-perishable items) to those in need, usually through donations</li> <li>Some food banks also offer support in seeking employment</li> <li>Example: The Trussell Trust</li> </ul>	<p>The work of food banks and street pastors supports the key Christian message to show love to all. Key words and quotes to support:</p> <p><i>Agape – compassionate love</i> <i>‘Love your neighbour as you love yourself’</i> <i>‘Faith, if not accompanied by action, is dead’</i> <i>‘For I was hungry and you gave me something to eat’ (Parable of the Sheep and the Goats)</i></p>
<p><b>Street Pastors</b></p>	<ul style="list-style-type: none"> <li>Volunteers who patrol streets in urban areas</li> <li>Do not actively preach but <b>show their faith through their actions</b></li> <li>Give out flip flops, lollipops and water on nights out, help people to get home safely, offer reassurance and support</li> </ul>	

The Role of the Worldwide Church: Reconciliation and Persecution		
<p><b>Working for Reconciliation</b></p>	<ul style="list-style-type: none"> <li>Jesus came to earth to restore the relationship between humans and God, so Christians believe they have a responsibility <b>to restore the relationship between themselves and others.</b></li> <li>Lots of examples of arguing between faiths, even within Christianity e.g. <b>Catholics and Protestants.</b> Irish Churches Peace Project set up to reconcile these denominations</li> <li><b>Coventry Cathedral</b> – bombed during WW2. Cathedral has now become a centre for reconciliation as Christians wanted to respond with forgiveness, not revenge.</li> </ul>	<p><i>‘Therefore, if you are offering your gift at the altar and there remember that your brother or sister has something against you, leave your gift there in front of the altar. First go and be reconciled to them; then come and offer your gift’.</i></p> <p><i>‘Blessed are the persecuted because of righteousness, for theirs is the Kingdom of Heaven’.</i></p> <p><i>‘If one part suffers, every part suffers with it’ (St Paul, likening members of the Church to different parts of the body)</i></p> <p><i>‘Love your neighbour as you love yourself’</i></p> <p><i>Agape: Compassionate Love</i></p>
<p><b>Responding to Persecution</b></p>	<ul style="list-style-type: none"> <li>Persecution (ill-treatment) happens all over the world – Christians are tortured or even killed for their faith</li> <li>Christians have a <b>responsibility to help those who are persecuted</b></li> <li>They might pray for them, donate to charity or get involved with charities who work abroad.</li> <li><b>The Barnabus Fund:</b> send financial support, raise awareness for those persecuted, send spiritual and material support.</li> </ul>	

Church Growth		
<p><b>Church Growth</b></p>	<ul style="list-style-type: none"> <li>Estimated to be 2.5 billion Christians in the world</li> <li>Christians are taught <b>to help to grow the church</b> by sharing testimonies (how God has changed their lives), inviting people to meetings, prayer, social events etc.</li> </ul>	<ul style="list-style-type: none"> <li><i>The Great Commission ‘Go and make disciples of all nations, baptising them in the name of the Father, the Son and the Holy Spirit’ (Jesus’ words before he ascended to heaven).</i></li> <li>Example: The Alpha Course. Anyone is welcome to join in with a meal and conversation about the ‘Big Questions’ of Christianity.</li> </ul>
<p><b>Mission and Evangelism</b></p>	<ul style="list-style-type: none"> <li>Evangelism means to <b>spread the message of Christianity</b> through preaching the Gospel (which means ‘Good News’)</li> <li>Some do this through Mission work, which means evangelism overseas</li> <li>The aim is to tell people that Jesus is the saviour of the world, in the hope of <b>converting them</b> to Christianity.</li> </ul>	

The Role of the Worldwide Church: World Poverty		
<p><b>Responding to World Poverty</b></p>	<ul style="list-style-type: none"> <li>Jesus emphasised helping the poor so Christians follow his example</li> <li><b>Jesus told a rich man to sell everything he had</b> and give it to the poor.</li> <li><b>Christian Aid:</b> They aim to stop poverty, encourage sustainable development and provide emergency relief in areas such as Africa and the Middle East.</li> <li>Their slogan is ‘We believe in life before death’</li> <li>They provide emergency food, shelter, water, sanitation and run a <b>Christian Aid Week</b> to fundraise every year.</li> </ul>	<ul style="list-style-type: none"> <li><i>‘If anyone has material possessions and see a brother or sister in need but has no pity on them, how can the love of God be in that person?’</i></li> <li><i>Parable of the Sheep and the Goats</i></li> <li><i>‘Go, sell everything you have and give to the poor, and you will have treasure in heaven. Then come, follow me.’</i></li> </ul>

## Exam Terminology

**Influence:** The capacity to have an effect on people's character, behaviour or actions

**Contrasting:** To show a difference

**Contemporary:** Occurring in the present time

**Sacred Writings:** Writing that is believed to contain words of God e.g. The Bible




**Evaluate:** Consideration of different viewpoints before arriving at a final judgement





**Justified Conclusion:** A final decision which is based upon a range of evidence.


Reasons for Crime			
Cause of Crime	Explanation/ Examples	Christian Responses	Sikh Responses
<b>Poverty and Upbringing</b> 	Some people may commit a crime as they do not have the money for what they need e.g. they may steal to feed their family. Or, they may have been brought up in an environment where crime is normalised or even expected of them.	<ul style="list-style-type: none"> <li>- Christians may be more sympathetic to those who have committed crimes for these reasons and show compassion: <b>'Love your neighbour as you love yourself' / Agape, 'Blessed are the merciful'</b></li> <li>- They would also feel a responsibility to help those in need so that they had no need to steal: <b>'Faith without actions is dead', 'I was hungry and you gave me something to eat'</b>.</li> <li>- However, the crime itself is still wrong: <b>'Do not steal' (10 Commandments)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Sikhs would also show some compassion and understanding: <b>'Show kindness and mercy to all life'</b></li> <li>- Sikhs would also feel a responsibility to help, which is why the service of the <b>langar, an example of sewa</b>, is so important. There should be no need for people to steal food as the langar is always open.: <b>'Keep the langar ever open'</b></li> <li>- Sikhs emphasise the importance of a strong family network in order to raise children in the right way.</li> </ul>
<b>Mental Illness</b> 	Mental illnesses can cause crime; kleptomania is a condition which leads people to steal. Mental illness can lead to anger issues which result in crimes such as assault, and some people feel driven to murder because of their illness.	<ul style="list-style-type: none"> <li>- Christians would be compassionate towards those with a mental illness as it is not their fault and they are not always consciously committing crimes: <b>'Love your neighbour as you love yourself' / Agape 'Blessed are the merciful'</b></li> <li>- However, justice for the victim is still important, so Christians would support an appropriate punishment coupled with medical support.</li> </ul>	<ul style="list-style-type: none"> <li>- Sikhs would also show compassion as the criminal was not in full control of their actions: <b>'Show kindness and mercy to all life'</b>.</li> <li>- They would support the criminal getting support and treatment, as well as showing compassion for the victim/ their family.</li> </ul>
<b>Addiction</b> 	Addiction means the body cannot cope without a substance e.g. alcohol or drugs. This can lead to crime if the person is not in control e.g. they are drunk. They may behave in ways they wouldn't usually, or they may drive while intoxicated and cause an accident. They may also steal to fund their habit.	<ul style="list-style-type: none"> <li>- Whilst illegal drugs are unacceptable, most Christians do not forbid drinking alcohol (Quakers do not drink at all). However, drunkenness is not encouraged, and it is a sin in Catholicism.</li> <li>- Addicts would be encouraged to seek support: <b>'Love your neighbour as you love yourself' / Agape</b></li> </ul>	<ul style="list-style-type: none"> <li>- Sikh teachings forbid the use of alcohol/ illegal drugs as they take the mind away from God, and a person is not able to worship.</li> <li>- Addicts would be encouraged to seek support: <b>'Show kindness and mercy to all life'</b></li> </ul>
<b>Greed</b> 	Greed can lead to crime e.g. stealing because you want more money/ possessions	Christians would not at all accept crime for this reason. One of the 10 Commandments says: <b>'Do not covet'</b> which means do not be jealous. In the Bible it says: <b>'you cannot serve both God and money'</b> and <b>'The love of money is the root of all evil'</b> , showing the problems with focusing on material wealth.	Sikhs are encouraged to be <b>Gurmukh</b> – God-centered, and to focus their minds on God and not on money/ possessions. <b>Worldly Attachment</b> is one of the 5 evils/ barriers to mukti, so crime for this reason is totally unacceptable.
<b>Hate</b> 	Hatred is a negative feeling which can lead to violence/ aggression. It might be based on a prejudice e.g. racism.	This is a totally unacceptable reason for crime as <b>'Human beings were made in God's image'</b> so everyone has the right to be treated fairly.	This is a totally unacceptable reason for crime as <b>'All are made of the same clay'</b> so all humans should be treated with love and respect.
<b>Opposition to an unjust law</b> 	There are times in history where people have broken the law as they felt the law was unfair, e.g. Rosa Parks refusing to give up her seat in 1950s America. In Britain today, our laws are generally fair but in some countries this is not the case.	<ul style="list-style-type: none"> <li>- In general, Christians are taught to obey the law: <b>'Those who refuse to obey the law of the land refuse to obey God'</b>.</li> <li>- However, if the law was in opposition to Christian beliefs they would perhaps campaign for it to be changed, ideally without breaking the law themselves.</li> </ul>	Sikhs have historically protested against laws they felt were unfair or in opposition to their beliefs, e.g. the law on motorcycle helmets. However, they would ideally protest to get the law changed rather than break it.

Types of Crime		
Type of Crime	Christian Responses	Sikh Responses
<b>Murder: Deliberately ending someone's life</b>	<b>'Do not commit murder'</b> <b>Sanctity of Life: 'Human beings were made in God's image'</b>	<b>Sanctity of Life: 'The Divine Light is within all'</b>
<b>Theft: Stealing something that does not belong to you</b>	<b>'Do not steal'</b>	<b>Rehat Maryada: (code of conduct) 'No Sikh should gamble or commit theft'</b>
<b>Hate Crime: Committing a crime based on prejudice e.g. race, age, sexuality</b>	<b>'Human beings were made in God's image', 'There is no Jew nor gentile... male nor female, for you are all one in Christ Jesus'</b>	<b>'All are made of the same clay', 'We are all sons of the one God, there is no Hindu and no Muslim'</b> .

Good and Evil Intentions and Action
<b>Christian Views:</b> <ul style="list-style-type: none"> <li>- The Bible warns Christians against having evil thoughts which lead to evil actions. Avoiding sin and temptation steers Christians away from crime.</li> <li>- Christians would be more willing to treat an offender who had good intentions with more mercy than one who acted out of evil intentions.</li> <li>- Christians do not believe that people are evil but that people can be tempted to do wrong and break the law.</li> <li>- Many Christians believe that we are born with <b>'Original Sin'</b> due to the actions of Adam and Eve, so we are inclined to be tempted and should resist this.</li> </ul> <b>Sikh Views:</b> <ul style="list-style-type: none"> <li>- There is no such thing as an evil person but humans do all make mistakes.</li> <li>- Having good intentions and obeying the law etc helps Sikhs to build bad karma; those who commit evil actions with evil intentions should face justice in this life but will also face punishment in the next life.</li> </ul>

Aims of Punishment		
Aim	Explanation/ Examples	Christian and Sikh responses
<b>Reformation</b> 	Supports the criminal in <b>changing their behaviour</b> for the better. May involve therapy, education, training.	Preferred aim of punishment for Christians and Sikhs: Christian: <b>'Love your neighbour as you love yourself' / Agape.</b> <b>'Do not take revenge but leave room for God's punishment... do not be overcome by evil but overcome evil with good'.</b> Sikh: <b>'Show kindness and mercy to all life'</b>
<b>Retribution</b> 	Seeking <b>justice or revenge</b> . The idea that 'you committed a crime, so you deserve to be punished'.	The Old Testament teaches <b>'An eye for an eye'</b> , but this really meant that a punishment should be proportionate to the crime. Christians do NOT agree with revenge. Jesus taught to <b>'Turn the other cheek'</b> meaning do not retaliate. Sikhs do NOT agree with revenge either: <b>'If someone hits you, do not hit him back. Go home after kissing his feet'</b> .
<b>Deterrence</b> 	<b>Putting people off from committing a crime</b> – either putting the criminal off from re-offending, or putting society off crime as they see the harsh punishments they could get.	Christians and Sikhs would want criminals to be deterred (put off) from committing crime but NOT in a way that violates their sanctity of life e.g. corporal or capital punishment. Christian: <b>'Human beings were made in God's image'</b> Sikh: <b>'All are made of the same clay'</b> .

Treatment of Criminals			
Type of Punishment	Explanation/ Examples	Strengths and Weaknesses	Christian and Sikh responses
<b>Prison</b> 	A secure building where offenders are kept for a period of time set by a judge	+ Protects society, usually gives opportunity for reformation e.g. counselling, good deterrent - Can lead to poor mental health, many people re-offend as they learn poor behaviour or become comfortable in prison.	Christian: Focus should be on reformation: <b>'Love your neighbour as you love yourself' / Agape</b> Sikh: Focus should be on reformation: <b>'Show kindness and mercy to all life'</b> .
<b>Community Service</b> 	An offender contributes to society as a punishment e.g. doing unpaid work in the community	+ Benefits the community, encourages reformation - Some see it as a soft punishment	Christian: Good punishment for minor offences as reformation is encouraged. Encourages <b>stewardship</b> . Sikh: Good punishment for minor offences; will build good <b>karma</b> and could lead to future acts of <b>sewa</b> .
<b>Corporal Punishment</b> 	Punishment of an offender by causing them physical pain e.g. whipping, cutting hands off. Illegal in the UK.	+ Good deterrent, brings justice for the victim/ their family (retribution) - Violates human rights, does not encourage reformation, promotes an attitude of revenge rather than compassion and forgiveness.	Christian: Disagree – violates sanctity of life and is a revenge-seeking punishment: <b>'Human beings were made in God's image', 'Do not take revenge but leave room for God's punishment'</b> Sikh: Disagree for same reasons: <b>'All are made of the same clay', 'If someone hits you, do not hit him back. Go home after kissing his feet'</b> .
<b>Capital Punishment/ The Death Penalty</b> 	Punishment where an offender is put to death for their crimes e.g. electric chair, hanging, firing squad. Illegal in the UK since the 1960s.	+ Good deterrent, brings justice e.g. if you kill, you deserve to lose your life. Supports <b>principle of utility</b> ; if it benefits society for one person to lose their life, perhaps it is acceptable. - No going back if you get the wrong person, hypocritical, no chance for reformation, violates human rights.	Christian: Disagree – violates sanctity of life. Does not allow for reformation: <b>'Human beings were made in God's image', Agape etc.</b> Sikh: Disagree for same reasons: <b>'All are made of the same clay', 'Show kindness and mercy to all life', 'If someone hits you...'</b> etc.

Forgiveness: To show grace and mercy, and pardoning someone for what they have done wrong.	
Christian Views	Sikh Views
<ul style="list-style-type: none"> <li>- Forgiveness is at the heart of Jesus' teaching.</li> <li>- Christians would still agree with justly punishing the criminal, but forgiveness is a key teaching within Christianity.</li> <li>- On the cross, Jesus said <b>'Father forgive them, for they know not what they do'</b>.</li> <li>- In his life Jesus was also asked how many times people should forgive. He replied: <b>'Not seven times, but seventy-seven times'</b>, meaning always forgive.</li> <li>- <b>'Love your neighbour as you love yourself' / Agape</b></li> <li>- Gee Walker gives Christians a modern role model on the importance of forgiveness.</li> </ul>	<ul style="list-style-type: none"> <li>- Forgiveness is a key teaching of Sikhism, closely linked with equality.</li> <li>- Guru Granth Sahib: <b>'Where there is forgiveness, there is God'</b>.</li> <li>- Forgiveness is not a replacement for punishment; fair punishment is still important but forgiveness can also be given.</li> <li>- The focus of punishment should always be reformation, which is closely linked with forgiveness.</li> </ul> 

### Exam Terminology

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**Evaluate:** Consideration of different viewpoints before arriving at a final judgement




**Justified Conclusion:** A final decision which is based upon a range of evidence.



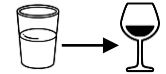
## The Design Argument (Teleological)

Basic Premise and Evidence	Criticisms
<ul style="list-style-type: none"> <li>- The universe is an intricate, complex design which is too complicated to have come about by chance</li> <li>- Therefore, a great design needs a great designer: God.</li> <li>- Telos = 'purpose' – the universe has been designed by God with a clear purpose in mind.</li> </ul> <p><b>William Paley's analogy of the Pocketwatch</b></p> <ul style="list-style-type: none"> <li>- If we found a watch, we would look at its intricacies and realise it has not come about by chance but had a watchmaker who had a clear purpose in mind. The same is true of the natural world – trees, the human eye, birds' wings and fish gills... they must have been designed by God.</li> </ul>  <p><b>Isaac Newton and the Thumb</b></p> <ul style="list-style-type: none"> <li>- Newton argued that the fact that every single human being has a different thumbprint, and the fact that we have opposable thumbs, was enough evidence for God's existence: <i>'In the absence of any other proof, the thumb alone would convince me of God's existence'</i>.</li> </ul>	<ul style="list-style-type: none"> <li>- Perhaps the complexities in the world e.g. the human eye, birds' wings, are the result of evolution, not God</li> <li>- If God deigned such a perfect world, why is there so much suffering? Yes, humans can be blamed for moral evil, but what about natural disasters e.g. earthquakes? Surely this shows the 'design' of the world is flawed.</li> </ul> 


## The First Cause Argument (Cosmological)

Basic Premise and Evidence	Criticisms
<ul style="list-style-type: none"> <li>- Everything that exists has a cause (everything is contingent) – relies on something else for its existence)</li> <li>- The universe must, therefore, have a cause too.</li> <li>- At some point, there needs to be something eternal, which requires no cause, in order to start the process off</li> <li>- This eternal, 'uncaused cause' needs to be an omnipotent being: God. Therefore, God exists.</li> <li>- The Bible supports the argument: <i>'In the beginning God created the heavens and the earth'</i></li> <li>- The Big Bang could still be true – but God caused it!</li> </ul>  <p><b>Dominoes</b></p> <ul style="list-style-type: none"> <li>- The argument can be compared to dominoes – one falls because the previous one fell. At some point, someone had to push the first domino. This can be compared to the need for an uncaused cause to the universe: God.</li> </ul>  <p><b>St Thomas Aquinas</b></p> <ul style="list-style-type: none"> <li>- An infinite sequence of cause and effect is impossible; there needed to be a starting point</li> <li>- We can clearly see that the universe exists so it needed a creator to begin with: God.</li> </ul>	<ul style="list-style-type: none"> <li>- Atheists say the argument contradicts itself; if everything needs a cause, then what caused God?</li> <li>- If you say that God is eternal and has always existed, why can't the universe just always have existed too?</li> <li>- The Big Bang was a random, spontaneous event, not an action caused by God</li> </ul> 


## The Argument from Miracles

Basic Premise and Evidence	Criticisms
<ul style="list-style-type: none"> <li>- There are 2 types of miracles:             <ol style="list-style-type: none"> <li>1) Events which break the laws of nature and cannot be explained by science e.g. Jesus turning water into wine</li> <li>2) Events which are happy coincidences which occur at just the right time for a positive outcome e.g. 16 people survived in Stairwell B during the September 11<sup>th</sup> terrorist attacks.</li> </ol> </li> <li>- This argument says that if there is no scientific explanation for an event, it must be supernatural i.e. caused someone/something who is outside of nature.</li> <li>- Only God is outside of nature, therefore, God exists.</li> </ul>  <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>- Incarnation and resurrection are the most important miracles of the Christian faith</li> <li>- Jesus performed many miracles – turning water into wine, healing the sick, feeding the 5000 etc.</li> <li>- Lourdes – many miracles have been recorded here which have been investigated by the church.</li> </ul>	<ul style="list-style-type: none"> <li>- Atheists would argue that 'miracles' are just lucky coincidences</li> <li>- There may be a scientific explanation which we just don't know about yet.</li> <li>- Miracle healings may be the result of mind over matter, or a misdiagnosis by doctors.</li> <li>- Some 'miracles' are fake or exaggerated by people wanting fame or money.</li> <li>- Even if miracles do prove that God exists, they show God to be unfair and as having favourites – why doesn't everyone who needs a miracle get one?</li> </ul> <p><b>David Hume</b></p> <ul style="list-style-type: none"> <li>- Argued that witnesses to miracles are primitive and uneducated, so the evidence is unreliable. (He was writing in the 18<sup>th</sup> century).</li> </ul>

## Arguments against God: Evil and Suffering

<ul style="list-style-type: none"> <li>- Atheists point to the existence of evil and suffering in the world as proof that God does not exist.</li> <li>- The argument is that Christians believe God to be all powerful, all knowing, all loving etc. Therefore God should be able to stop evil, would be aware of it and would care enough to stop it. But he doesn't, so he must not exist.</li> </ul>  <p><b>Christian Defence</b></p> <ul style="list-style-type: none"> <li>- Christians may defend God and say that evil and suffering is the result of human free will – Adam and Eve's disobedience brought evil and suffering into God's perfect world. However, this may explain moral evil (human action) but it does not necessarily explain natural evil e.g. earthquakes</li> <li>- Christians also defend God with arguments such as: without evil we wouldn't appreciate good. Perhaps suffering is a test of faith. Perhaps suffering is an opportunity to show compassion, learn from mistakes and make the choice to do good over evil.</li> </ul>
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## Arguments Against God: Science

<ul style="list-style-type: none"> <li>- Some atheists and humanists use the developments in scientific knowledge to challenge belief in God.</li> <li>- In the past, the origins of the universe and life on earth could not be explained, so people assumed it was God. Natural disasters etc were thought to be God's punishment.</li> <li>- Now, science can explain things that people couldn't previously understand, so people no longer look to religion for answers. Atheists argue that there is no need to 'invent' a God to fill the gaps of what we do not understand.</li> </ul>  <p><b>Christian Defence</b></p> <ul style="list-style-type: none"> <li>- Many Christians see no conflict between science and religion; many Christians do not take the creation stories literally, so the Big Bang/ Evolution can explain the universe and life on earth, but God was the force behind it happening as it did. (Fundamentalist Christians would have an issue, though, as they believe the creation story to be literally true).</li> <li>- Pope Francis said: <i>'The Big Bang does not contradict the divine act of creation; rather it requires it... When we read the creation story in Genesis we run the risk of imagining that God was a magician, with a magic wand... but it is not so. He created beings and let them develop...'</i></li> </ul>
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## Exam Terminology

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**Religious Traditions:** Viewpoints from either a religion or religious denomination  
**Justified Conclusion:** A final decision which is based upon a range of evidence

## Key Words

**Divine:** God, Gods or Ultimate Reality

**Enlightenment:** A state of spiritual awakening and the gaining of a deeper understanding of reality. E.g. Buddhists are seeking how to end suffering and achieve happiness.

**General revelation:** Indirect revelation; the idea of being able to see something of God through nature and scriptures which are readily available in everyday experience.

**Immanent:** A characteristic of God; the belief that God is present and involved in the world, (eg through special revelations/miracles).

**Impersonal:** A characteristic of God; the belief that God is beyond human understanding.

**Omniscient:** All-knowing; believed by theists to be an attribute of God.

**Omnipotent:** All-powerful; believed by theists to be an attribute of God.

**Personal:** A characteristic of God; belief that humans can build relationships with God.

**Revelation:** When God is revealed to humans; can be special or general.

**Special revelation:** Direct revelation; God being revealed directly to an individual or group through experiences such as visions.

**Transcendent:** A characteristic of God; belief that God is outside space and time.

**Ultimate reality:** Belief in a supreme and fundamental power in the universe. In Christianity, this ultimate reality is a personal being: one God in three persons. In Hinduism, Brahman is often referred to as the ultimate reality and supreme cosmic power.

**Vision:** An experience of seeing/experiencing something in the imagination or through a dream.

## The Divine/ Knowledge of God – An Introduction

- Every religion accepts that there is an ultimate reality that is eternal and unchanging.
- For Christians, their ultimate reality is a personal being, God, who makes himself known in 3 persons: the Father, the Son and the Holy Spirit.
- Some theists say God cannot be known because God is transcendent: beyond human understanding. God cannot be described using the limits of human language.
- Most Christians do accept this, but do think that God can be known through revelations – when God chooses to reveal himself to people.
- There are 2 types of revelation: special revelation and general revelation.
- Some experiences can be both general and special revelation.



## Special Revelation: Visions

### Basic Premise and Evidence

- When people experience God directly in a particular event or direct personal experience.
- Could be a dream, a vision, a prophecy, a miracle or 'hearing God's call'.
- Could be experienced alone or with a group of people.
- The experiences usually have a huge, life-changing impact on people e.g. Nicky Cruz (gang leader turned Christian minister).
- They are rare, and many believers never experience such events.

### Visions

- A form of special revelation which comes in a picture or image form.
- People may see holy people, angels or hear messages from God
- Example from the Bible: Saul on the Damascus Road
- Saul had sworn to wipe out the Christian church. He was travelling with others on the Damascus road to arrest any follower of Jesus.
- On the way, they were struck by a blinding light, and Saul had a vision of Jesus who spoke to him.
- Saul's life was changed – he changed his name to Paul (now known as St Paul) and spent the rest of his life committed to Christianity.

### Criticisms

- Special Revelations e.g. visions are subjective, open to interpretation and not open to scientific testing.
- Many religions have conflicting revelations so some could argue this invalidates them.
- Visions could be brought about by alcohol or drugs, or it could be wishful thinking so someone convinces themselves.
- It could be a mental or physical illness, or the mind playing tricks.
- People could also be lying to gain wealth or power, or they may have just been mistaken.



## General Revelation: Nature and Scripture

### Basic Premise and Evidence

- Ordinary, every day human experiences that reveal truths about God,
- General revelation comes to people through nature, a person's reason, their conscience (inner sense of right and wrong), reading scriptures, through worship etc.
- The experiences are available to everyone, but they do not convince everyone that God is real because they depend on people's interpretation.

### Nature as a way of understanding the Divine

- Links with the Design Argument: the beauty and order of the natural world gives theists a sense of awe.
- Just as a painting gives insight into the artist, nature gives an insight into God.
- God is shown through nature to be creative, artistic, clever, powerful and awesome.
- *'The heavens declare the glory of God; the skies proclaim the work of his hands'*



### Scripture as a way of understanding the Divine.

- Religious scriptures tell believers what God is like, how God acted in the past and how God wants people to live.
- E.g. the Bible tells the story of God's covenant with the Jews (Old Testament) and the life and teaching of Jesus (New Testament).
- All Christians believe the Bible is inspired by God but they may interpret it differently e.g. some take it literally and others take a more liberal approach.
- When Christians read the Bible, they hope to get a better understanding of the teachings of Christianity and receive spiritual strength from God's words.

### Criticisms

#### Nature

- Humanists – the works of nature are not a divine revelation but are special because they can lead to a greater understanding of the world through human observation and science.
- When a theist and an atheist look at a beautiful landscape, one just sees nature and the other sees God's creation – open to interpretation.

#### Scripture

- Some argue scriptures cannot reveal anything about God because they are merely their author's opinions and these could be wrong.
- Even Christians do not all agree on how scripture should be interpreted,

## Different ideas about the Divine: God's Nature

- It is difficult to describe the unseen, infinite God within the limits of human language.
- However, God is seen to have a number of characteristics:
- Omnipotent (all powerful) omniscient (all-knowing) and omnibenevolent (all-loving).

Religious thinkers also use the following words to describe different ideas about God:



- **Immanent:** God is present in the universe and involved with life on earth. God acts in history and influences people.
- **Transcendent:** God is beyond and outside life on earth and is not limited by the world, time or space. God does not act in the world or intervene in people's lives.
- **Personal:** God has human characteristics e.g. merciful, compassionate. God loves and cares for every individual and can be communicated with through prayer.
- **Impersonal:** God does not have human characteristics. God is more like a force or an idea. God is an absolute being who is only understood in terms of itself.



### Can God be immanent, transcendent, personal and impersonal?



- Many religious believers think that they can experience God and have a personal relationship with him (immanent and personal) but that at the same time, God is the eternal, unlimited creator of the universe (transcendent and impersonal).
- Some religions emphasise one description more than another but others say all descriptions are true, even if they seem contradictory.
- This is because God is a mystery and beyond human understanding.



### Christian interpretation:



- God's immanence is revealed in Jesus who was God in human form, and in the Holy Spirit who works through Christians today.
- God is also transcendent as he is the creator of the universe, without whom nothing would exist.
- Christians regard God as personal, a Father who cares for his children and with whom they can have a relationship through prayer.
- *'You know when I sit and when I rise; you perceive my thoughts from afar'*

Human Sexuality	
<p><b>Heterosexual relationship:</b> a sexual relationship with a member of the opposite sex  <b>Homosexual relationship:</b> a sexual relationship with a member of the same sex                      Homosexual couples can now marry, or convert civil partnerships into marriage (as of 2014)</p>	
<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- Catholic Church: homosexual people are not sinful, but the sexual act is.</li> <li>- Therefore they should not have sex, because the Bible recognises it as a sin:</li> <li>- <b>'Do not have sexual relations with a man as one does with a woman; that is detestable.'</b></li> <li>- Church of England: welcomes homosexuals who live in a faithful, committed relationship, but they cannot get married in church.</li> <li>- Liberal Christians: Loving, faithful homosexual relationships are just as holy as heterosexual relationships</li> </ul>
<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- The Guru Granth Sahib does not mention homosexuality. Some Sikhs may interpret this to mean that the only marriage that should occur is between a man and a woman, as this is the only type of marriage mentioned in the GGS.</li> <li>- Other Sikhs would not view homosexuality as a particular issue of concern.</li> <li>- Either way, Sikhs would not discriminate and would ensure homosexuals were treated fairly, in line with their teaches on equality: <b>'All are made of the same clay', 'Show kindness and mercy to all life'</b>.</li> </ul>

Sex Before Marriage	
<p>- In British society, sex before marriage is no longer considered as unacceptable, however some religious views on the issue remain traditional.</p>	
<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- Many Christians believe that the intimacy of sex requires the commitment of marriage – it should not be a casual, temporary pleasure.</li> <li>- In the Bible, St Paul wrote: <b>'Flee from sexual immorality... whoever sins sexually, sins against his own body... your body is a temple of the Holy Spirit'</b>.</li> <li>- Catholic and Anglican church teaches that unmarried people should not have sex. This would therefore make cohabitation (living together) wrong before marriage as well.</li> <li>- Liberal Christians accept that for some people, sex is a valid expression of love. Sex before marriage/ living together before marriage could be seen as acceptable.</li> </ul>
<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- Sex before marriage is not allowed within Sikhism; the Sikh code of conduct (Rehat Maryada) says that anyone who has sexual relations before marriage is not a true Sikh.</li> <li>- <b>'For a moment of sexual pleasure, you shall suffer in pain for millions of days'</b> (GGS)</li> <li>- Anything that might lead to <b>lust</b>, one of the <b>5 evils</b>, should be avoided.</li> <li>- This would also make cohabitation before marriage wrong.</li> </ul>

Sex Outside of Marriage: Adultery	
<p><b>Adultery:</b> Having sexual relations with someone who is not your husband or wife                      Regardless of religion, most people in contemporary society view adultery as wrong because it breaks trust, involves secrecy and lies, can affect children and causes pain to all concerned.</p>	
<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- Adultery breaks the promises Christian couples make before God during their wedding.</li> <li>- One of the <b>10 Commandments</b> is <b>'Do not commit adultery'</b>.</li> <li>- Jesus taught that lust, which could lead to adultery, is also wrong: <b>'I tell you that anyone who looks at a woman lustfully has already committed adultery with her in his heart'</b>.</li> </ul>
<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- Adultery is seen as a very serious sin – Sikh marriage is a sacred bond and adultery break that bond, betrays trust and brings shame on the family.</li> <li>- It is one of the <b>4 misdeeds (kurahat)</b> that members of the Khalsa must not commit.</li> <li>- The <b>Kachera</b> (cotton underwear) is one of the 5 Ks as a reminder to keep the body pure.</li> <li>- <b>'The blind fool abandons the wife of his own home, and has an affair with another woman'</b>.</li> </ul>

Marriage	
<p><b>Marriage:</b> A legal union between a man and a woman (or in some countries such as the UK, two people of the same sex), as partners in a relationship.</p>	
<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- Marriage was one of God's gifts at creation. The Bible teaches: <b>'A man shall leave his mother and father and be united with his wife, and the two will become one flesh'</b>.</li> <li>- Marriage represents a covenant (promise) before God – it is a spiritual bond of trust.</li> <li>- <b>'Husbands, love your wives, just as Christ loved the Church'</b>.</li> <li>- The purpose of marriage is to provide a stable, secure environment for family life.</li> </ul>
<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- Marriage is a spiritual act; an opportunity to become one spirit within two bodies.</li> <li>- The ceremony is called 'Anand Karaj' which means 'blissful union'.</li> <li>- Marriage is a union witnessed by God, shown by the presence of the GGS at the wedding ceremony.</li> <li>- The purpose of marriage is companionship and the spiritual development of both partners.</li> <li>- <b>They alone are called husband and wife, who have one light in two bodies' GGS.</b></li> </ul>

Divorce and Remarriage	
<p><b>Divorce:</b> Legal ending of a marriage  <b>Remarriage:</b> When someone marries again while their former spouse (husband or wife) is still alive.  <b>Annulment:</b> A Catholic Church ruling that a marriage was never valid</p>	
<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- Many churches offer courses to prepare couples for marriage, in the hope of avoiding divorce later.</li> <li>- Jesus taught: <b>'Anyone who divorces his wife and marries another woman commits adultery against her'</b></li> <li>- Christians must balance the need to respect the sanctity of marriage with showing compassion for those in difficult situation e.g. domestic violence.</li> <li>- Catholic Church: a civil divorce cannot dissolve a marriage between two baptised people. Catholics can separate but they cannot marry someone else in a Catholic church while their partner is still alive.</li> <li>- Catholics can obtain an annulment in certain circumstances if it was never a true marriage.</li> <li>- Other Christians see divorce as the lesser of two evils</li> <li>- Methodists: accept civil divorce and allow remarriage in a church, as long as the couple take the vows seriously.</li> </ul>
<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- Marriage should be for life as the couple are 'one spirit in two bodies' (Guru Armae Das).</li> <li>- The Rehat Maryada teaches that in general, no Sikh should marry a second time if their first spouse is still alive.</li> <li>- If divorce was looking likely, the Sikh community and the couple's family would support in helping the couple to work through their problems.</li> <li>- However, Sikhs reluctantly allow civil divorce – grounds for divorce include adultery, cruelty, desertion, insanity and change of religion.</li> <li>- Widowed Sikhs who wish to marry again are encouraged to do so in the gurdwara.</li> <li>- <b>Rehat Maryada: 'If a woman's husband has died, she may, if she so wishes, finding a match suitable for her, remarry. For a Sikh man... similar ordinance obtains'</b>.</li> </ul>


Exam Terminology
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## Part 1 Continued: Contraception and Family Planning

**Contraception:** the methods used to prevent a pregnancy from taking place. Natural forms include the rhythm method.

Artificial forms include: the pill, condom, diaphragm, coil, morning after pill.

**Family Planning:** The practice of controlling how many children couples have and when they have them.

<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- All Christian churches agree that having children is God's greatest gift to a married couple.</li> <li>- They also agree that there may be some circumstances where it is not appropriate to bring children into the world e.g. economic, environmental, physical or psychological reasons.</li> <li>- However, churches disagree on how pregnancy should be prevented.</li> <li>- <b>Catholics:</b> Artificial contraception goes against God's plans as the purpose of sex is to express love and make new life. These purposes should not be separated.</li> <li>- For Catholics, Only the <b>rhythm method</b> is suitable for family planning (having sex at times during a woman's cycle where conception is less likely).</li> <li>- The Church of England <b>support use of artificial contraception</b> so that couples can plan their families in a healthy and sensible way.</li> <li>- Many Christians do not support using the morning after pill because here, the egg may have already been fertilised. Since many Christians believe <b>life begins at conception</b>, preventing a fertilised egg from developing is seen as sinful as it is already a life.</li> </ul>
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<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- Sensible family planning is accepted by the Sikh community as morally responsible behaviour, since this would only be relevant to a married couple.</li> <li>- Sikh scriptures give <b>no specific guidance on contraception</b> so Sikh couples choose their own methods.</li> <li>- Contraception should not be used to prevent having children altogether, or to cover up an adulterous affair.</li> <li>- Some Sikhs would not agree with the morning after pill (reasons as above) and some would also view excessive sex, without allowing children to be conceived, is <b>lust</b>.</li> </ul>
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## The Purpose of Families

**Procreation:** bringing babies into the world

**Stability:** safety and security, being able to live peacefully

**Educating children in a faith:** bringing up children according to the religious beliefs of the parents.

<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- The idea of family is ingrained within the Christian faith – God reveals himself as a Father, with Jesus as his son, and humankind as his children.</li> <li>- Christian parents are expected to be good role models for their children and to teach them moral values.</li> <li>- Many Christians make prayer part of the family's daily routine, and some send their children to faith schools or groups run by the church.</li> <li>- Parents and children all have responsibilities to each other:</li> <li>- <b>'Listen to your father who gave you life, and do not despise your mother when she is old'</b> Proverbs.</li> <li>- <b>'Children are a heritage from the Lord, offspring a reward from him'</b></li> </ul>
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<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- Family life is the highest path to spirituality</li> <li>- The Sikh community itself is also a family as humans beings are sons and daughters of the same universal father (God).</li> <li>- Guru Arjan describes the ideal family where the mother is central to its happiness:</li> <li>- <b>'She is the most noble of all the family. She counsels and advises her hope and desire'</b></li> <li>- Raising a child in the Sikhs faith is very important, according to the Sikh code of conduct:</li> <li>- <b>'It is a Sikh's duty to get his children educated in Sikhism'</b> Rehat Maryada</li> <li>- Grandparents would play a large role in a child's upbringing – a married couple often move in with the groom's parents after marriage, and most Sikhs would also not consider putting their elderly parents in a care home, as it would be an honour to look after them themselves.</li> </ul>
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## The Nature of Families

**Family:** A group of people who are related by blood, marriage or adoption

**Nuclear Family:** A couple and their children regarded as a basic social unit


**Stepfamily:** A family that is formed on the remarriage of a divorced or widowed person and that includes a child or children


**Extended Family:** A family that extends beyond just parents and their children, by including grandparents and other relatives as well

**Polygamy:** The practice or custom of having more than one wife at the same time

**Bigamy:** The offence of marrying someone while already married to another person (illegal in UK).

**Same-sex parents:** People of the same sex who are raising children together

<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- Christian parents want their children to grow up with values such as respect for all life, generosity, compassion, loyalty and the ability to form loving relationships.</li> <li>- Christians are commanded to love one another, so they place very high value on family life.</li> <li>- The book of Timothy teaches: <b>'Anyone who does not provide for their relatives... has denied the faith and is worse than an unbeliever'</b>.</li> <li>- 10 commandments: <b>'Honour your mother and father'</b>. The importance of family, helping elderly relatives, supporting extended family etc is still crucial today.</li> <li>- Though there are examples in the Bible of people who practised polygamy, St Paul made it clear that each man should have his own wife and each woman her own husband to avoid sexual immorality.</li> <li>- Whilst some Christians disagree with same-sex parents, believing the ideal is for children to have a male and female role model, other Christians believe the most important thing is for a child to be in a loving household.</li> </ul>
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<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- Family is the <b>essential social unit</b> in Sikh society.</li> <li>- Guru Nanak preached that the life of the householder was the <b>highest path to spirituality</b>.</li> <li>- The family is where children are trained in <b>sewa</b> (selfless service) and where religious traditions are passed down. Learning the values of the family are needed for prosperity and world peace: <b>'Gazing upon his family, he blossoms forth like the lotus flower'</b>.</li> <li>- Sikhs believe in monogamy; having only one husband or wife).</li> <li>- Within Sikh families, men and women are equal but may have different role e.g. the mother usually takes the main role with children for the first few year while the father takes on household duties.</li> <li>- Amritdhari (baptised) Sikhs and many non-baptised Sikhs would not cut their children's hair.</li> <li>- When the children are older, Sikh parents would often support their child in finding a suitable marriage partner, and grown up children would support their elderly parents.</li> <li>- Sikhs do not generally approve of same-sex parenting, although more liberal Sikhs may support it.</li> </ul>
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## Gender Equality


**Gender equality:** the idea that people should be given the same rights and opportunities regardless of whether they are male or female







**Gender prejudice:** Unfairly judging/ holding biased opinions about an individual or group based on their gender



**Sexual stereotyping:** Having a fixed general idea or image of how men and women will behave

**Gender discrimination:** To act against someone on the bases of their gender

<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- All people have been created equal in the image of God: <b>'Human beings were made in God's image'</b></li> <li>- Jesus treated women with respect, and the key teaching of <b>'Love your neighbour'</b> shows that discrimination is wrong.</li> <li>- Some traditional Christians believe that men are the head of the family and that women should mainly stay at home and care for children. This may stem from literal interpretation of Bible texts that reflect the time in which they were written: <b>'Your desire will be for your husband, and he will rule over you'</b></li> <li>- Most Christians today see marriage as an equal partnership where the different gifts of men and women strengthen family life.</li> </ul>
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<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- Guru Nanak spoke up on behalf of women which was unusual at that time.</li> <li>- The Gurus changed Indian society as more women began to take part in social, religious and political matters.</li> <li>- Within Sikhism, all are treated equally and judged on their actions, not their caste, gender or race.</li> <li>- Amritdhari Sikhs use the name 'Kaur' which frees them from having to take their husband's name when marrying.</li> <li>- Many Sikh women are well educated and encouraged to pursue professional careers.</li> <li>- Some Sikh women feel that traditional Indian culture, rather than Sikhism itself, has limited their chance for education etc, but Sikhism itself fully promotes equality.</li> <li>- <b>'Without woman, there would be no one at all'</b>.</li> </ul>
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The Origins of the Universe		
<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- Creation story found in first book of the Bible: Genesis</li> <li>- Christians believe the world originated from a specific act of God and not by chance</li> <li>- Genesis 1 v 1: <b>'In the beginning God created the Heavens and the Earth'</b></li> </ul>	<p><b>Can religion and science co-exist?</b></p> <ul style="list-style-type: none"> <li>- Fundamentalist views on creation are NOT compatible with science – creation story vs Big Bang</li> <li>- Both Liberal and Sikh views on creation could co-exist with science, however the key conflicting point is that the religious views argue the universe was a deliberate creation by God, whereas science would argue it was random.</li> </ul> <div style="display: flex; justify-content: space-around; align-items: center;">    </div>
<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- The universe was not an accident, but was a deliberate act of God (Waheguru)</li> <li>- Waheguru spoke and his word created everything</li> <li>- He willed the whole of creation into existence</li> <li>- <b>'As he commands, so they exist'</b></li> </ul>	
<p><b>Scientific Views</b></p> 	<ul style="list-style-type: none"> <li>- Big Bang Theory: Suggests around 13.8 billion years ago there was a massive expansion of space</li> <li>- All the matter that formed the universe kept expanding and cooling, forming the stars and galaxies</li> <li>- This was random, not a deliberate act</li> </ul>	

The Value of the World and the Duty of Humans to Protect it	
<p><b>Christian Views</b></p> 	<ul style="list-style-type: none"> <li>- The world has value because God made it.</li> <li>- Christians would view the world with a sense of <b>awe and wonder</b> – amazement at God's wonderful creation.</li> <li>- Christians have a duty to protect the world – <b>stewardship</b>: <b>'The Lord took the man and put him in the Garden of Eden to work it and take care of it'</b></li> <li>- However, the Bible also states that 'Human beings were made in God's image' (Imago Dei), suggesting humans are set apart from God's other creations and have authority over the world – <b>dominion</b></li> <li>- <b>'They may rule over the fish of the sea and the birds of the air'</b></li> </ul>
<p><b>Sikh Views</b></p> 	<ul style="list-style-type: none"> <li>- The world has value because God made it.</li> <li>- Sikhs would feel a sense of awe and wonder: <b>'Beholding His wonders, I am wonder-struck'</b></li> <li>- Sikhs support <b>stewardship</b> - they must live in harmony with all of God's creation and take care of the earth: <b>'The sky, the earth, the trees and the water – all are the Creation of the Lord'</b></li> <li>- There is a <b>divine spark</b> in all living things that is part of God, and this spark or soul is taken back to God when released from the cycle of rebirth.</li> <li>- For this reason, Sikhs do NOT support the idea of dominion, and do not believe they are superior creations.</li> </ul>

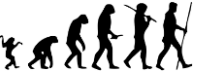
Use and Abuse of Animals: Animal Experimentation	
<p><b>What are the issues?</b></p> <ul style="list-style-type: none"> <li>- Animals used to be tested on for cosmetics e.g. makeup but this is less common today</li> <li>- Animals are still tested on for medicinal purposes, to advance science/research and benefit humans</li> </ul> 	<p><b>Christian Responses</b></p> <ul style="list-style-type: none"> <li>- Testing for cosmetics is <b>not essential</b> and does not show good <b>stewardship</b>, so would not be supported.</li> <li>- Testing to <b>benefit human life</b> may be supported as humans have <b>dominion</b>, and ultimately human life is sacred.</li> <li>- Whilst it is not ideal (due to stewardship), many would see it as acceptable for the <b>greater good</b> to humans.</li> </ul>
	<p><b>Sikh Responses</b></p> <ul style="list-style-type: none"> <li>- Sikhs would not encourage animal testing of any kind because animals have a <b>soul</b> too.</li> <li>- <b>Stewardship</b> is important and humans should not abuse their power. It will also have a negative effect on someone's <b>karma</b>.</li> <li>- However, a Sikh may not actively protest against testing for research/medicine if it is done as humanely as possible, and with the right <b>intention</b>.</li> </ul>

Use and Abuse of the Environment	
<p><b>How do we damage the natural world?</b></p> <ul style="list-style-type: none"> <li>- Use of natural resources: overuse of oil, gas and other non-renewable resources, deforestation.</li> <li>- Pollution: gas emissions, industrial waste etc.</li> </ul> 	<p><b>Christian and Sikh Responses</b></p> <ul style="list-style-type: none"> <li>- Both religions would encourage stewardship – taking care of the environment by recycling, generating less pollution by walking more etc, saving electricity, encouraging sustainable development, voting for people who support environmental issues, supporting charities such as Greenpeace or World Wildlife Fund and praying to God.</li> </ul>

Use and Abuse of Animals: Food	
<p><b>What are the issues?</b></p> <ul style="list-style-type: none"> <li>- Many people choose not to eat meat, perhaps for ethical, environmental or religious reasons.</li> <li>- Vegetarian: does not eat meat</li> <li>- Vegan: does not eat animals products</li> </ul> 	<p><b>Christian Responses</b></p> <ul style="list-style-type: none"> <li>- There are no dietary requirements within Christianity – individual choice.</li> <li>- The Bible states that <b>'Everything that lives and moves about will be food for you'</b> which suggests animals can be consumed however, Christians would not promote the cruel conditions some animals face for the production of food.</li> </ul>
	<p><b>Sikh Responses</b></p> <ul style="list-style-type: none"> <li>- Most Sikhs would be vegetarian, especially if they have joined the Khalsa</li> <li>- Animals have souls, and the Guru Granth Sahib forbids killing living beings             <ul style="list-style-type: none"> <li>- Food served in the langar is always vegetarian</li> <li>- <b>'Show kindness and mercy to all life'</b></li> </ul> </li> </ul>

## The Origins of Human Life

<p><b>Christian Views: Summary</b></p> <ul style="list-style-type: none"> <li>- Day 6 of creation: story of Adam and Eve found in first book of the Bible: Genesis</li> <li>- Adam was created from the dust of the earth, then Eve from one of Adam's ribs.</li> <li>- God 'breathed life' into Adam's nostrils</li> <li>- <i>'Human beings were made in God's image': 'Imago Dei'.</i></li> </ul>	<p><b>Contrasting Christian Views</b></p> <ul style="list-style-type: none"> <li>- <b>Fundamentalist Christians:</b> take the creation of Adam and Eve to be literally true. Also known as Literalists as they believe the Bible is the exact, literal word of God.</li> <li>- This view cannot co-exist with science - Adam and Eve vs Evolution</li> <li>- <b>Liberal Christians:</b> believe God was the creator but the theory of evolution explain how it happened, whereas the Bible addresses why. Evolution is the way God designed life to advance and evolve. (Also known as non-literalists)</li> <li>- This view can co-exist with science, other than the idea that evolution was by chance.</li> </ul>
<p><b>Sikh Views</b></p> <ul style="list-style-type: none"> <li>- The 'how' and 'when' humans came to exist is not as important as the 'why'.</li> <li>- Sikhs do not oppose evolution, but nothing would happen if it wasn't for hukam (Waheguru's Divine Will)</li> <li>- Waheguru oversees the natural process of evolution – it isn't left to random chance</li> <li>- <i>'Without God, there is nothing at all... He is woven into His creation'</i></li> </ul>	<p><b>Scientific Views</b></p> <ul style="list-style-type: none"> <li>- Charles Darwin published 'The Origin of Species..' in 1859 and outlined the theory of evolution.</li> <li>- Single-celled creatures appeared in the sea which eventually evolved into other species.</li> <li>- Humans evolved over millions of years from other animals on land.</li> </ul>



**Sanctity of Life vs Quality of Life**

- Sanctity of Life is the concept that life is sacred and given by God; both Christians and Sikhs believe in this.
- **For Christians.** Sanctity of Life only applies to human life and not the life of animals. Sikhs see animals as more valuable as they believe they have a soul too.
- **'God breathed life into Adam'** supports the Christian view that human life is sacred and symbolises that a part of God lives within all of us – for Christians this is our soul
- **The quality of life** refers to the **general wellbeing** of a person e.g. their health and happiness.
- When faced with matters of life and death Christians have to consider the quality of a person's life and this can often conflict with the **Sanctity of Life**
- **Christians and Sikhs would largely view the sanctity of life as more important than the quality of life.**

**Exam Terminology**

**Influence:** The capacity to have an effect on people's character, behaviour or actions

**Contrasting:** To show a difference

**Contemporary:** Occurring in the present time

**Sacred Writings:** Writing that is believed to contain words of God e.g. The Bible

**Evaluate:** Consideration of different viewpoints before arriving at a final judgement

**Religious Traditions:** Viewpoints from either a religion or religious denomination

**Justified Conclusion:** A final decision which is based upon a range of evidence

Attitudes Towards Abortion	
<ul style="list-style-type: none"> <li>- Deliberate ending of a pregnancy.</li> <li>- England: can take place before 24 weeks and 2 doctors have to agree.</li> <li>- Reasons may include: physical or emotional wellbeing of the mother, or potential wellbeing of the foetus or existing children.</li> <li>- After 24 weeks: can only take place if there is a serious risk of disability or illness, or if the mother's life is at risk.</li> <li>- Pro-life arguments: Against abortion, due to respecting the life of the foetus</li> <li>- Pro-choice arguments: May support abortion due to respecting the choice of the mother</li> </ul>	
<p><b>Christian Views</b></p>	<ul style="list-style-type: none"> <li>- Sanctity of Life – many Christians do not support abortion as the foetus' life is sacred from conception: <b>'Before I formed you in the womb, I knew you'</b></li> <li>- Roman Catholics – do not support abortion at all (only perhaps if the mother's life was at risk): <b>'Do not commit murder'</b></li> <li>- Liberal Christians – generally oppose it, but it's acceptable in some circumstances e.g. mother's life at risk, rape, child would have severe disability (arguments relating to <b>quality of life</b>): <b>Agape, 'Love your neighbour as you love yourself', 'Blessed are the merciful'.</b></li> </ul>
<p><b>Sikh Views</b></p>	<ul style="list-style-type: none"> <li>- Sanctity of Life – Sikhs do not generally support abortion because it interferes with God's creative work: <b>'You were cast into the womb by the Lord's command'.</b></li> <li>- It is still not acceptable even if the child may have a disability – <b>sanctity of life is more important than quality of life.</b></li> <li>- Only acceptable circumstances might be rape or if the mother's life is at risk.</li> </ul>

Attitudes Towards Euthanasia	
<ul style="list-style-type: none"> <li>- Euthanasia is assisting with the ending of life for a person who is terminally ill or has a degenerative illness.</li> <li>- <b>Active euthanasia:</b> life is ended at the request of the patient via lethal injection or poison (assisted suicide). This is also known as <b>voluntary euthanasia.</b></li> <li>- <b>Passive euthanasia</b> : whatever is keeping the patient alive is taken away e.g. life support, medication. Their illness is then what kills them. This might be <b>non-voluntary euthanasia</b>, as they may not be able to give consent.</li> <li>- Active euthanasia is illegal in UK. It is allowed in some countries e.g. Switzerland</li> </ul>	
<p><b>Christian Views</b></p>	<ul style="list-style-type: none"> <li>- Sanctity of Life – many Christians do not support euthanasia as life is still sacred, even if its quality is poor: <b>'Human beings were made in God's image'</b></li> <li>- Roman Catholics – do not support euthanasia at all; only God has the right to end life: <b>'Do not commit murder'</b></li> <li>- However, if large doses of painkillers are used to help a person's suffering, and as a result, the person dies, this is OK in the eyes of the Catholic Church and is called the <b>Doctrine of double effect</b></li> <li>- The Bible teaches that <b>'There is a time to be born and a time to die'</b> and therefore people shouldn't meddle in God's plans.</li> <li>- Some Christians might argue that humans have been given freewill to make their own choices.</li> <li>- Liberal Christians – whilst euthanasia would not be encouraged, it may be acceptable if it will relieve unbearable suffering (arguments for <b>quality of life</b>): <b>Agape, 'Love your neighbour as you love yourself', 'Blessed are the merciful'.</b></li> </ul>
<p><b>Sikh Views</b></p>	<ul style="list-style-type: none"> <li>- Sanctity of Life – Sikhs do not support euthanasia because only God has the right to take life; he created everyone so their life is sacred: <b>'He created the creation and watches over it'.</b></li> <li>- Suffering in this life may be a result of bad karma from a previous life, so escaping this suffering with euthanasia would only lead to more suffering in the next life.</li> <li>- Helping those who are ill and suffering is a good opportunity for sewa (selfless service): <b>'Through selfless service, eternal peace is obtained'.</b></li> <li>- A Sikh would most likely support withdrawing medical provision e.g. life support if there is no chance of recovery.</li> </ul>

Death and the Afterlife	
<p><b>Christian Views</b></p>	<ul style="list-style-type: none"> <li>- Death is not the end – God judges whether people go to heaven or hell</li> <li>- Our eternal life is more significant than our temporary life on earth. Heaven is a place where God can be found ; indescribably wonderful. <b>'God will wipe every tear from their eyes'</b></li> <li>- Hell is a place of torment, where God is not present: <b>'Throw them into the burning furnace'</b></li> <li>- Christians vary on whether heaven and hell are literal or spiritual places.</li> </ul>
<p><b>Sikh Views</b></p>	<ul style="list-style-type: none"> <li>- Death is not the end – good or bad karma in this life dictates what our afterlife will be like</li> <li>- We are all in a cycle of samsara – birth, death and re-birth</li> <li>- Those who have built bad karma will stay in the cycle, and be reincarnated into lower beings.</li> <li>- Those who have built good karma will be reincarnated into a higher being or, eventually, reach mukti (union with God).</li> <li>- Each life is, therefore, a preparation for the next and should be used wisely.</li> <li>- <b>'They die, over and over again, only to be reborn, over and over again'.</b></li> </ul>

**The Nature of God: The Mool Mantra**

- Opening words of the Guru Granth Sahib (GGS 1a)
- 'Mool Mantra' means 'Main Chant'.
- Sikhs believe the words were the first teachings of Guru Nanak after he became enlightened
- Most important part of the Guru Granth Sahib (GGS) and most important statement for Sikhs
- Said daily in Sikh prayers and recited in worship.

*One Universal Creator God (Ik Onkar)  
The Name is Truth  
Creative Being Personified  
No Fear, No Hatred  
Image of the Undying  
Beyond Birth  
Self Existent  
By Guru's Grace*



**God as Creator**

- God (Waheguru) created everything.
- There are no creation stories in Sikhism, and Sikhs accept scientific views about how the universe came to be here, but nothing would have happened without it being God's will (hukam).
- Sikhs believe God is both separate from and part of His creation: *'He possesses all qualities; He transcends all qualities'*

**God as separate from the Universe**

- God is transcendent – beyond human understanding
- He does not have a physical form, is timeless and spaceless, and has no limits
- God is without gender (Sikhs use 'He' to have a simple way to talk about God) and has no beginning or end.
- 'Nirgun' – without qualities or form.
- *'He is the Perfect Transcendent Lord, from the very beginning and through the ages'*

**God shown in and through the Universe**

- God is present within creation and within human beings, as a soul or Divine Spirit
- There are ways that God can be understood by humans, e.g. through the Mool Mantra, the teachings of the Gurus, other parts of the GGS or through his creation.
- 'Sargun' – with qualities or form
- *'The Lord is seen to be manifest and present'*
- *'He Himself is the water... He Himself abides in each and every heart'*

**The Virtues**

- God has given people an opportunity to reunite with Him (Mukti)
- To achieve this, Sikhs must build good karma in the hope of being released from the cycle of birth, death and rebirth
- One way to build good karma is to live a good life, developing certain positive characteristics known as **virtues**.

Truth and Truthful Living	Telling the truth, living an honest life. Includes promoting justice and not discriminating. <i>'Truth is higher than everything; but higher still is truthful living'</i>
Compassion and Patience	Being kind and aware of the needs of others. Being able to accept/put up with delays/problems with a calm mind and attitude. <i>'Show kindness and mercy to all life'</i> .
Contentment	Not being greedy, being satisfied with what you have, maintaining detachment from material things.
Humility	To be humble, not proud. Not full of your own importance.
Love	To show a loving attitude to everyone, to show kindness, respect and forgiveness (just as God would do for them)
Wisdom	Having experience, knowledge and good judgement – understanding all of the virtues and being able to put them into practice.
Courage	Being brave. Many Sikhs throughout history have shown bravery in remaining true to their faith, even if they have suffered for it.
Temperance/ Self-Control	Showing self-control and moderation, can include not partaking of alcohol or drugs. Being able to control one's temper and behaviour.
Justice	Working to make all things fair, or to bring equality.

**Gurmukh and Manmukh**

- **Gurmukh: God centered.** Someone who prays, worships, follows the virtues etc and keeps God in mind at all times. *'The Gurmukh acts in harmony with God's will; the Gurmukh finds perfection'*
- **Manmukh: Man centered.** Someone who is selfish, thinks they are above God and others, succumbs to the evils. *'The foolish, self-willed manmukh is blind in the world'*.

**Beliefs about Life After Death**

Rebirth	<ul style="list-style-type: none"> <li>- <b>Reincarnation:</b> when a human dies, their soul is reborn into another body</li> <li>- This rebirth is part of a cycle of being born, dying and reborn, known as <b>samsara</b>.</li> <li>- The cycle will repeat until the soul is freed/ liberated and becomes united with God</li> <li>- All animals, including humans, have souls, so a human may be reborn as an animal.</li> <li>- <i>'They die and die, over and over again, only to be reborn, over and over again'</i></li> </ul>
Karma	<ul style="list-style-type: none"> <li>- Sum total of a person's actions and words which determines their afterlife</li> <li>- Reincarnation is based on the good or bad karma they built in a previous life.</li> <li>- A human is the best being you can be reborn into as it gives you the best chance to build good karma and be liberated from samsara.</li> <li>- Good actions = good karma = a good reincarnation/ liberation from samsara</li> <li>- Bad action = bad karma = a lower reincarnation e.g. animal.</li> <li>- <i>'The body is the field of karma in this age; whatever you plant, you shall harvest'</i></li> </ul>
Mukti	<ul style="list-style-type: none"> <li>- Liberation, freedom and release from the cycle of samsara</li> <li>- The final goal for Sikhs - individual soul reunites with God</li> <li>- Negative aspects: To achieve mukti, a person must rid themselves of all that stands in the way of getting close to God. This can be challenging.</li> <li>- Positive aspects: the soul is free to unite with God. This is indescribable and can only be experienced.</li> <li>- <i>'Through selfless service, eternal peace is obtained'</i></li> </ul>

**Exam Terminology**

- Influence:** The capacity to have an effect on people's character, behaviour or actions
- Contrasting:** To show a difference
- Contemporary:** Occurring in the present time
- Sacred Writings:** Writing that is believed to contain words of God e.g. The Guru Granth Sahib
- Evaluate:** Consideration of different viewpoints before arriving at a final judgement
- Justified Conclusion:** A final decision which is based upon a range of evidence.

## Key Beliefs Continued

The Stages of Liberation: The 5 Khands	
<ul style="list-style-type: none"> <li>- Stages a human being must pass through on the way to mukti.</li> <li>- Usually will not all happen in one lifetime</li> </ul>	
1) Piety	- The opportunity for devotion to God, awareness of God.
2) Knowledge	- Knowing about God; learning about and experiencing God
3) Effort	- Devoting oneself to tuning in with God e.g. through prayer, worship, meditation
4) Grace	- Spiritual blessing given by God (as we can only go so far in developing ourselves)
5) Truth	- Finding God, the realisation of God. Can only be experienced, not described.

The Barriers to Mukti	
<ul style="list-style-type: none"> <li>- Sikhs must avoid those things which will stop them from achieving mukti. There are 5 evils (below) but Sikhs should also guard against:</li> <li>- <b>Haumai</b> (pride and ego)</li> <li>- Illusion (inability to see the truth; focus on material things)</li> <li>- Self-centredness (ego, selfishness)</li> </ul>	
Anger	- An emotion causing someone to act without balance
Lust	- Sexual desire – sex outside of marriage leads people away from God: <b>'Sexual desire and anger are broken, like a jar of poison'</b>
Greed	- A desire to possess more than you need
Worldly Attachment	- Placing too much emphasis on material possessions and worldly relationships
Pride	- False pride – being proud of things that were given rather than achieved: <b>'Why do you take pride in trivial matters?'</b>

### The Oneness of Humanity

- Guru Nanak, the founder of Sikhism, had an experience where he disappeared into a river for 3 days. During that time, he said he met with God.
- Following this experience, he taught that there was not only one way to God; there is no need to convert others to Sikhism because we can all follow our own path to God.
- Everyone has a divine spark within them which unites us all, and this is known as the **oneness of humanity**.
- **God is neither Hindu nor Muslim and the path I follow is God's**
- **'We are all sons of the one God; there is no Hindu and no Muslim'**
- **'The Divine Light is within all'**
- This also means that everyone is equal – this was one of Guru Nanak's most important teachings.

### The Equality of All

Equality is shown in Sikhism in the following ways:

<h4>The life of Guru Nanak</h4> <ul style="list-style-type: none"> <li>- Had both Hindu and Muslim friends. His best friend was a Muslim man called Mardana</li> <li>- Emphasised equality between men and women: <b>'From her, kings are born... without woman, there would be no one at all'</b></li> <li>- Taught: <b>'There is no Hindu and no Muslim'</b></li> <li>- Introduced the practice of the langar: <b>'No discrimination... must be made while making people sit in rows for eating'</b></li> </ul>	<h4>The life of Guru Gobind Singh</h4> <ul style="list-style-type: none"> <li>- Started the Khalsa – both men and women can join.</li> <li>- When the first 5 members joined, they wore identical coloured robes to show equality.</li> <li>- One key role of the Khalsa is to stand up against inequality</li> <li>- Introduced surnames Singh (Lion) and Kaur (princess) to remove inequality shown by the caste system</li> </ul>
<h4>The Guru Granth Sahib</h4> <ul style="list-style-type: none"> <li>- The GGS is a collection of hymns and writings from many teachers and saints e.g. the Gurus.</li> <li>- Writers also included Hindus and Muslims, showing the inclusivity of Sikhism.</li> <li>- Guru Gobind Singh declared the GGS 'The Living Guru' and is the 11<sup>th</sup> and final teacher for Sikhs. It contains many teachings about equality: <b>'All beings and creatures are His; He belongs to all'. 'All are made of the same clay'.</b></li> </ul>	<h4>Sikhism Today</h4> <ul style="list-style-type: none"> <li>- The Langar: free kitchen where everyone is welcome. All sit on the floor together to show all are equal. Food is vegetarian so everyone can eat it.</li> <li>- Both men and women take part in worship, reading GGS in the Gurdwara, cooking or serving food etc.</li> </ul>

### Sewa: Selfless Service

- Sewa is a duty Sikhs have to help others without expecting anything in return
- It will build good karma and help a Sikh on the path to achieving mukti
- **'Through selfless service, eternal peace is obtained'**
- It helps Sikhs to show many of the virtues whilst avoiding the 5 evils.

<h4>Tan (Physical Sewa)</h4> <p>Using the body to help others e.g. serving in the langar, cleaning shoes or floors</p>	<h4>Man (Mental Sewa)</h4> <p>Using the mind and mental skills e.g. reading the GGS, teaching others, inspiring others</p>
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#### Dhan (Material Sewa)

Using material wealth to help others e.g. giving a tenth of their income to the sangat or to charities. This 10% is known as Dasvandh

### The Sangat: Sikh Religious Community

- The company of Sikhs meeting in the presence of the Guru Granth Sahib
- 'Sat Sangat' means 'True Congregation'
- **'Join the Sat Sangat, the True Congregation, and find the Lord'**
- Sikhs may gather together to learn, pray, hold a ceremony, read the GGS etc
- Importance: provides opportunities for sewa, gives the chance to learn from other Sikhs, builds a supportive community to strengthen faith, helps to develop religious understanding.

### Amritdhari and Sahajdhari Sikhs

- Amritdhari Sikhs are those who have been initiated into the Khalsa.
- They are expected to offer daily prayers, wear the 5Ks, take the name Singh and Kaur, practise the virtues, be vegetarian and obey the code of conduct (which includes rules such as no smoking, drinking or adultery)
- 5 Ks: **Kara** (steel bracelet), **Kirpan** (ceremonial sword), **Kachera** (cotton underwear), **Kanga** (wooden comb), **Kesh** (uncut hair). Amritdhari Sikhs must wear all of the 5 Ks. Sahajdhari Sikhs may choose to wear some.
- Sahajdhari Sikhs have not been initiated into the Khalsa whilst they believe in Waheguru and the Gurus, they do not have to follow the strict rules.




## The Gurdwara: Religious Features

- The gurdwara is the Sikh place of worship. Translates to 'Door of the Guru'
- Technically a gurdwara is any place in which the Guru Granth Sahib is installed and treated with proper respect
- The gurdwara is open to all, no matter their age, race, religion etc.

### Outside the Gurdwara:

- Many have a dome and decorations on the outside
- All will have a flag outside – the Nishan Sahib. This is usually yellow with the Khanda symbol in blue.



Prayer Hall: Darbar Sahib	Large space with a throne at one end Men and women sit separately so they are not distracted by one another, and all sit on the floor so they are lower than the GGS
Takht 	Throne: represents the GGS being treated like royalty/ a human guru. Seat covered in fine cloth, often surrounded by flowers, space for money and food offerings, and a bowl containing karah parshad ( a sweet food which is seen as a blessing)
Palki	Domed structure used to cover the raised area where the GGS is placed. Canopy at the top may be engraved with the word 'Waheguru' or with scripture.
Manji	A small bed on which the GGS is placed during the day.
Chanani	Large canopy made of decorated cloth which is placed over the palki.
Langar Hall	The area of the gurdwara where free food is served. All are welcome, everyone sits together on the floor to represent equality.

## Worship in the Gurdwara

- Worship can include meditating, listening, singing, reciting, working and serving people – is it true worship as long as God is kept in mind.
- **'Worship and adore Him, and you shall be at peace forever'.**
- Worship in the gurdwara may last up to 5 hours but people may come and go.
- Shoes are removed, heads are covered, hands/ feet washed, before bowing and touching the floor in front of the GGS.
- Worship services start and end with the Ardas Prayer
- Kirtan – singing of hymns which nourishes the soul
- Ragis – musicians who sing or play accompaniment for kirtan
- Karah Parshad – given out at the beginning and end of the service, from the same bowl to show equality. Sweet like God's blessings.



## The Role of Prayer in the Home

- Sikhs are expected to remember God at all times which includes reciting daily prayers at home.
- Some Sikhs have a copy of the GGS at home but many have a gutka instead, a prayer book, which is treated with as much respect as the GGS (ideally has its own room, or section of a room, and is kept in a clean cloth).
- GGS 305, written by Guru Ram Das, outline how Sikhs should pray:
- **'One who calls himself a Sikh of the Guru, the True Guru, shall rise in the early morning and meditate on the Lord's Name'.**
- Prayer routine includes waking early, bathing, repeating the japji (a prayer given by Guru Nanak), and repeating other prayers at different points of the day.



## Nam Japna: Meditating on the Name of God

- One key responsibility of Sikhs is to meditate on the name of God, known as Nam Japna.
- This keeps God in mind at all times and helps them to act well in their life.
- It may involve quietly reciting God's name to oneself, or by saying it out loud in a community recitation.
- It is the community recitation that is usually known as Nam Japna.
- **'Those who have the treasure of the Lord's Name deep within their hearts – the Lord resolves their affairs'**

## The Role of the Gurdwara in the Sikh Community

### Management and Role

- There are very few paid roles as most Sikhs volunteer as part of sewa.
- A granthi (or management team) manage and maintain the gurdwara.
- Many gurdwaras are open 24/7 and all are welcome
- Besides prayer and worship, other roles for the gurdwara include: langar, meeting/ education rooms to teach Punjabi and Gurmukhi, committee meetings, youth clubs etc.






### Granthi:

- A male or female Sikh, who has been initiated into the Khalsa, who reads the Guru Granth Sahib.
- They are expected to be of good character and live life according to the Sikh code of conduct
- They do not have a higher status than other Sikhs but they are highly respected.
- Granthis arrange and conduct religious services, maintain the gurdwara, leads kirtan (singing hymns), lead an akhand path etc.
- Most importantly, granthis take care of the Guru Granth Sahib, organizing the ceremony to bring it to and from the rest room each day.



## The Role and Importance of the Akhand Path

What 	<ul style="list-style-type: none"> <li>- A continuous reading of the Guru Granth Sahib from start to finish – all 1430 pages.</li> <li>- Takes approx. 48 hours – male and female Sikhs take shifts to complete it.</li> <li>- Karah Parshad is given out at the beginning and the end as a blessing</li> </ul>
When/ why 	<ul style="list-style-type: none"> <li>- Usually takes place at the start of a festival</li> <li>- Times of joy and sorrow e.g. wedding, funeral, birth of a baby, death of a family member</li> <li>- GGS may be taken to a new home or new business as a blessing</li> </ul>
Importance 	<ul style="list-style-type: none"> <li>- Seen as a great blessing to have the Living Guru recited at an important event – it should not be taken lightly.</li> <li>- If it is to bless a new home or business, the family are expected to listen and take part at some point during the 48 hours to show respect</li> </ul>

## Showing Respect to the Guru Granth Sahib

- GGS is known as the Living Guru (as declared by the 10<sup>th</sup> and final human guru, Guru Gobind Singh) and is treated with as much respect as a human guru would be.
- Sikhs show respect to the GGS in a number of ways, e.g.:
- All printed copies have 1430 pages to show they are identical and the words do not change
- Sikhs sit on the floor to worship so they are lower than the GGS
- They do not point their feet towards it
- They bow before it
- They cover it with a rumalla, a decorated cloth (often made of silk)
- They wave a chauri over it – a fan made from yak's hair which would have been waved over honoured teachers to keep them cool and keep flies away
- At the end of each day it is wrapped in clean cloth and carried in a procession to its rest room, where it is effectively put to bed overnight. The room is called Sach Chand.



## Langar as an expression of Sewa

- Started by Guru Nanak to promote equality in a time of the Caste System
- Shows equality: all are welcome, all sit on the floor so they are on the same level, food is vegetarian so everyone can eat it.
- Excellent way for Sikhs to carry out Tan – physical sewa – by cooking, serving, cleaning. Can also show Dhan – material sewa – by donating produce.
- Both men and women take equal roles in helping in the langar.
- Many langars run in times of crisis, and to help those in poverty.
- **Guru Gobind Singh: 'Keep the langar ever open'.**

## Festivals: Vaisakhi

- Originally a harvest festival where farmers would show thanks to God for a good harvest
- Usually celebrated on 13<sup>th</sup> or 14<sup>th</sup> April
- Vaisakhi in 1699**
- Guru Gobind Singh started the Khalsa – he asked who would be willing to die for their faith and 5 men stepped forward. They became the Panj Piare, the first 5 members of the Khalsa. The practice of the surnames Singh and Kaur began here.
- Vaisakhi in 1919**
- During celebrations at Jallianwala Bagh, Amritsar, many Sikhs were shot and killed by a British general who was acting on the orders of the Lieutenant Governor of the Punjab. Sikhs remember sad occasions such as this at Vaisakhi and it's a reminder to stand up for people's human rights to practise religion freely.

### Celebrations at Vaisakhi

- Akhand Path
- Act of worship including Ardas Prayer and kirtan
- Community meals – langar
- Many Sikhs choose to join the Khalsa at Vaisakhi
- New clothes, especially for children
- Sending Vaisakhi cards
- Processions through the streets – floats, singing, dancing etc
- Nishan Sahib – a new flag replaces the old flag. Flagpole washed in yogurt and milk then rinsed with water as a symbol of purity.



## Festivals: Diwali

- Name means 'a row of lights' so Diwali is often known as the festival of lights.
- Held in October/ early November
- Celebration of freedom, and the victory of good over evil.
- It's a time for Sikhs to remember those who have stood strong in their faith and who have been brave in times of persecution.
- Sikhs are encouraged to follow the example of Sikhs who have promoted and protected people's freedom
- Guru Hargobind and the 52 princes**
- Guru Hargobind (6<sup>th</sup> Guru) and 52 princes were arrested and imprisoned for political reasons.
- The emperor believed the charges were false and demanded Guru Hargobind be released, but he refused to leave unless the princes were released as well.
- The emperor said as many princes as could hold on to the Guru's clothes as he walked out of the gate could be released.
- The Guru's cloak had 52 long tassels – all could hold on and all were freed.
- Became known as 'prisoner release day' and is celebrated at Diwali.

### Celebrations at Diwali

- Akhand Path
- Street Processions, firework displays and langars
- Homes are spring-cleaned and decorated with oil lamps and lights
- New clothes and presents given to children
- Huge celebrations at the Golden Temple – pool and buildings decorated with thousands of lights.



## Festivals: The Gurburbs

- Take place at anniversaries – usually the birth or death of a guru.
- 4 most widely celebrated gurburbs: Guru Nanak's birthday, Guru Gobind Singh's birthday, martyrdom of Guru Arjan and Guru Tegh Bahadur.
- **Importance:** remind Sikhs of their religion's history, strengthen their faith as they join together to celebrate, enable Sikh children to learn about the gurus, gives Sikhs chance to share their faith and perform acts of sewa.

### General Celebrations

- Akhand Path
- Guru Granth Sahib carried in processions
- Kirtan
- Langars

### Guru Nanak's Birthday

- October/ November
- Most important gurburb
- Processions, candles lit, firework displays, new clothes for children, holiday from school (in India)

## Different Celebrations in Great Britain and India

### Great Britain

Celebrated on nearest Sunday  
Takes place at weekend so no schools closed  
Quieter and more local celebrations, focused around gurdwara.



### India

Celebrated on actual day  
School often closed  
Much bigger celebrations – colourful processions, firework displays, fairs.



## Pilgrimage: Visiting the Golden Temple

### Pilgrimage: a religious journey

- Many Sikhs travel to the Golden Temple (Harimandir Sahib) in Amritsar in the Punjab.

#### Features:

- Surrounded by a pool of fresh, clear water
- 4 entrances to represent that everyone around the world is welcome
- The upper storey is covered with gold leaf
- The original Adi Granth, the first version of the holy book, is installed on a takht inside the temple

#### Akal Takht

- Political building
- Houses the rest room for the GGS – it is carried in procession every morning and evening.

### Visiting/ Importance

- Pilgrims may bathe in the sacred water, thought to have healing properties
- They visit the gurdwara, listen to kirtan, hear readings from GGS, meditate etc
- Langar feeds thousands of pilgrims
- Pilgrimage is not compulsory but Sikhs may choose to do as it can strengthen and deepen their faith
- It teaches pilgrims more about the history of their faith and is a time for Sikhs, and non-Sikhs, to gather together
- Rituals such as pilgrimage, or bathing in the sacred pools, are less important than a person's inner faith – bathing would do nothing if they are not clean inside.

## Naming Ceremony

What happens?



- Takes place around 2 weeks after a baby is born
- Baby is given a spoonful of amrit (sugar and water) and the amrit is stirred with a khanda by the granthi.
- Granthi dips the sword into amrit and lightly touches the baby's head and tongue with the tip of the sword.
- Mother drinks the rest of the amrit
- Karah Parshad is given out.

Naming the baby



- First name: Granthi opens the GGS at a random page. First letter of the first word of the first hymn on left hand page decides the first letter of baby's name.
- Surname: Many Sikhs use Guru Gobind Singh's tradition of Singh (lion) or Kaur (princess)

Importance



- A human is the greatest thing to be reincarnated into as it offers the best chance of achieving mukti, so the birth of a baby is a time to celebrate and give thanks to God.

## Amrit Sanskar: Initiation Ceremony

What is it?

A ceremony where those who are prepared to be a fully committed Sikh are initiated into the Khalsa

What happens?



Person being initiated must wash their hair, cover their head and wear clean clothes and the 5Ks.  
6 other amritdhari Sikhs present – 5 to represent the Panj Piare, plus the granthi.  
They drink amrit from the bowl 5 times. Amrit is sprinkled on their eyes and hair 5 times. The remaining amrit is then shared between those being initiated, drinking from the same bowl. Karah Parshad is shared out.

What changes?



Initiated Sikhs are known as amritdhari Sikhs. They will follow the Sikh code of conduct (Rehat Maryada) and keep rules such as: no smoking, alcohol or drugs, no eating meat, wearing the 5Ks, no stealing or gambling.  
They will also take the surname Singh or Kaur, if they didn't have this already.

### Exam Terminology

**Influence:** The capacity to have an effect on people's character, behaviour or actions

**Contrasting:** To show a difference

**Contemporary:** Occurring in the present time

**Sacred Writings:** Writing that is believed to contain words of God e.g. The Guru Granth Sahib

**Evaluate:** Consideration of different viewpoints before arriving at a final judgement

**Justified Conclusion:** A final decision which is based upon a range of evidence.

15-week assessment period, response to a set brief

A - Develop ideas in response to a brief

**Activity 1: Ideas Log**  
(2 hours, 15 marks)

- Research to support idea generation
- Ideas log: Initial idea, target audience, influences, content of idea

B - Develop planning materials in response to a brief

**Activity 2: Planning Material**  
(3 hours +prep time 15 marks)

- Annotated flat plan design including headlines, positioning of copy, images, assets, design notes

C - Apply media production skills to the creation of a media product

**Activity 3: Final Media Product.**  
(4 hours + prep time, 30 marks)

- Use ideas and planning to create media product in response to brief.
- Assessed on skills and techniques used and how follow brief

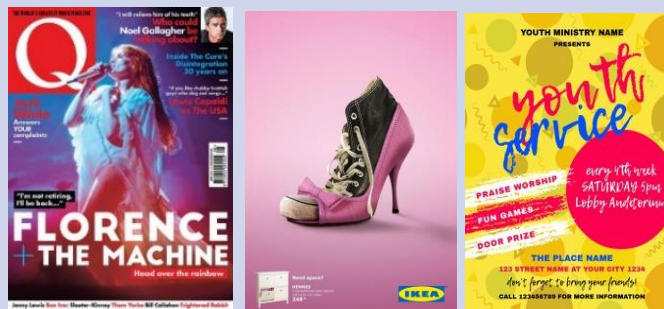
PRODUCTION PROCESS

**Pre-production:** Planning and research

**Production:** Creation of content such as article/ images/ graphics

**Post production:** Editing and putting together considering space and layout choices

PRINT MEDIUM POSSIBILITIES



AUDIENCE KEY TERMS RECAP

**Primary audience**

The audience that the media producer has in mind for consuming the text. This is the audience they intend to target.

**VALS profiles**

These define an audience by how they think and by considering their values, attitudes and lifestyle (VALs). People can be classed as 1 of the following:

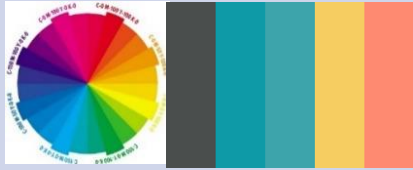
- The Aspirer - seeks status
- The Explorer - seeks discovery
- The Mainstreamers - seeks security
- The Reformer - seeks enlightenment
- The Resigned - seeks to survive
- The Struggler - seeks to escape
- The Succeeder - seeks control

**Socio Demographic groups**

Group Description and examples.  
**A** Higher managerial, Professional  
 e.g. Chief executive, senior civil servant,  
**B** Intermediate managerial, professional  
 e.g. bank manager, teacher  
**C1** Supervisory, junior managerial  
 e.g. shop floor supervisor, sales person  
**C2** Skilled manual workers e.g. electrician  
**D** Semi-skilled and unskilled manual workers  
 e.g. assembly line worker, refuse collector  
**E** Casual labourers, pensioners, unemployed  
 e.g. pensioners without private pensions and anyone living on benefits

## Activity 2: Planning Material. Consider...

House style



Typography fonts

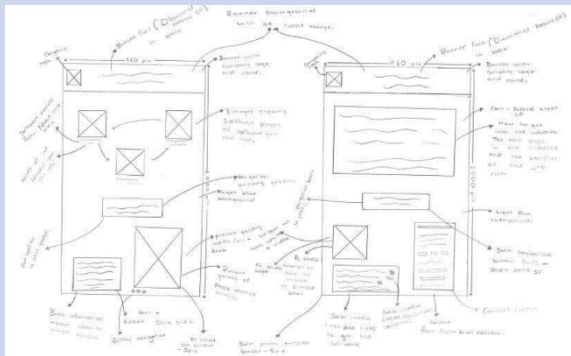


Typography styles



Leading to...

Sketches/  
thumbnails



## Activity 1

Primary research:



Secondary research:



## PHOTO SHOT TYPES



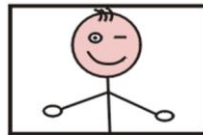
Extreme Close-Up (ECU)



Big Close-Up (BCU)



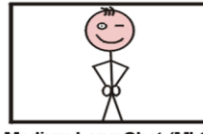
Close-Up (CU)



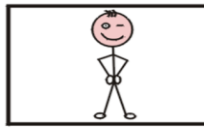
Medium Close-Up (MCU)



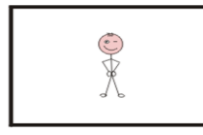
Medium Shot (MS)



Medium Long Shot (MLS)

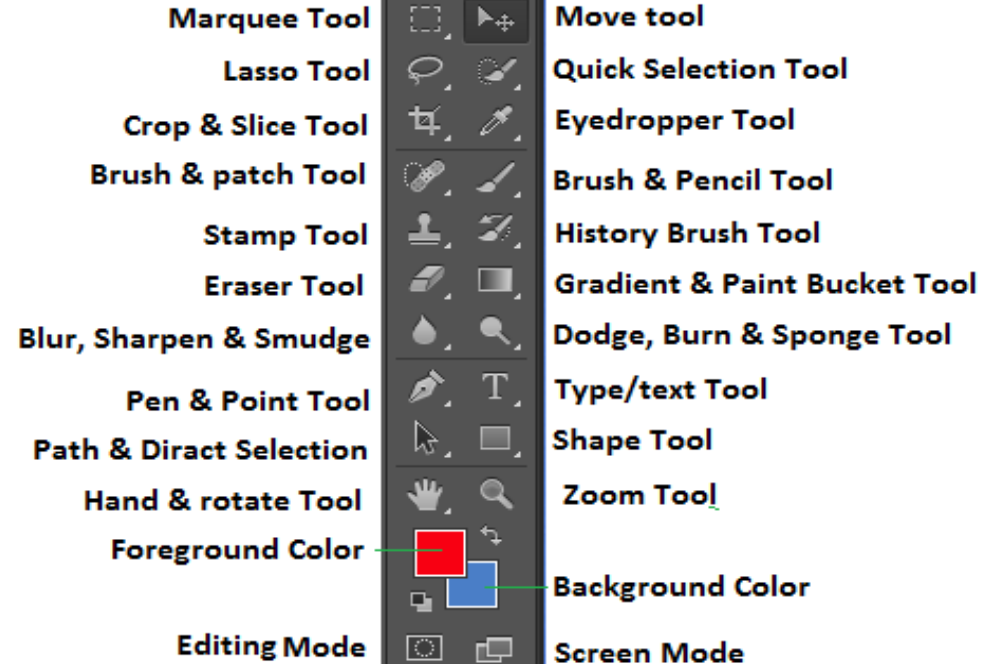


Long Shot (LS)



Very Long Shot (VLS)

## Activity 3: PHOTOSHOP TOOLS



## PURPOSE

Depending on the brief, will your product promote, raise awareness or create profit?

## NARRATIVE

What story does your product tell?  
Connotations for the audience?

## GENRE

Steve Neale: "Genres are instances of repetition and difference... difference is absolutely essential to the economy of genre: mere repetition would not attract a 212 audience."

**Milestone 1- Ideas Log:**

1. What is the concept and style of your performance?
2. What is your target audience and why did you decide on this?
3. What resources do you think you will need to develop and perform your performance?
4. How do your ideas for the performance meet the brief ?
5. How has the work of Pantomime, Stanislavski, Frantic Assembly or any other practitioners influenced your performance?
6. What ideas have you contributed to the performance plan? Were these successful? Why?
7. How did you come up with the ideas you have

**Milestone 2- Skills Log:**

1. What was your role in the group? (director, performer etc)
2. Which style did you choose? Why?
3. Which techniques and skills did you choose? Why did you choose them?
4. What work have you done individually to help the group? (research, rehearsal leading, choreographing movement etc)
5. How did the resources you chose aid your performance?
6. What would you change or improve?

**Milestone 3- Workshop Performance:**

- You must present your group workshop performance or pitch/presentation to an invited audience.
- The group workshop performance must be between 10 and 15 minutes long.
- You will need to perform as part of a group and work well together.
- You will be assessed on your individual skills and techniques, collaboration with others and communication of creative ideas to the audience through your role.

**Milestone 4- Evaluation Report:**

1. How did the result of your performance meet the brief?
2. How did you process and ideas develop through this project?
3. Was the outcome of the performance what you wanted? What did the audience learn?
4. What were the key strengths of your group's performance?
5. What were the key strengths in your individual performance?
6. What would you improve upon given the chance again? Why would you change this? How would that help your performance meet the brief?

Keyword	Definition
Posture	The way in which you hold your body position in certain dance genres or characters
Characterisation	Creating a believable character on stage. Becoming the character.
Facial Expression	Showing your emotion through your face.
Focus	Not laughing while you are on stage and staying in character.
Gesture	Using your hands to show the audience where to look through pointing, waving etc.
Professional Practioners	Previous professional works studied earlier, Christopher Bruce, Kate Prince
Genre	They style of dance or dances you may wish to perform using
Pace	The speed at which you dance/perform something or do a movement to convey the emotion of your character within the your music
Choreography	To use movement to create your dance piece from
Researcher	Use of research to help develop your ideas/scene/setting and production
Stimulus	This will instigate your initial idea of the dance
Professional dance techniques	Various styles of dance and the different techniques used within that genre
Collaborative team- work	How well you communicate your ideas verbally, practically and how well you interact with your group