Year 11 Core Subjects

Knowledge Organiser

January - April 2025

AMBITION, CONFIDENCE, CREATIVITY,
RESPECT, DETERMINATION

Proud to be part of the GREENSHAW LEARNING TRUST

FIVE ACRES HIGH SCHOOL

Why do we have knowledge organisers?
Knowledge organisers are a collation of the basic essential knowledge for success in each subject area that will underpin your learning for the term.

They are designed to provide the information you will need to be committing to your long term memory through recall exercises in Low Stakes Quizzing.

How do we use knowledge organisers?
You should be using these KOs to create your homework quizzes so that you are practising retrieving information.

1. You can do this by testing yourself on the definition of key terms (both recalling the key term and then swapping to recall the definition), practice labelling diagrams, retrieves reasons and justifications for the main learning points.
2. They can also be used for 'memory dumps' where you try to recall as much of the information about a topic as possible and then use the KP to fill in the gaps.
3. They can also be used in class to assist with retrieval of the core knowledge needed for each subject.

You should have these with you at all times in school and out on your desk in all lessons.

If you lose your KO or it becomes too dishevelled, please purchase a new one from the Head of Year or the School Office.

Contents

AQA Language Paper 1 Section A

Question 1 – retrieval, 4 marks, 5 minutes

SKILL: identify specific information.

- Only select answers from within the specified section of the text.
- Use quotations or paraphrase.
- Make sure your responses are relevant to the focus of the question.

Question 2 – language analysis, 8 marks 10-12 minutes

SKILLS: identify and comment on specific language choices and methods used by the writer.

- Only select quotations from within the specified section of the text.
- Consider the connotations of the language.
- What do you find out? How is this achieved by the writer? Why does the writer show you this?
- Look for patterns or a semantic field in the language and then explore the effect.
- Aim to include 2-3 developed responses to quotations.

Useful techniques to look for might include:

- Tone: The writer's attitude towards the subject
- Metaphor: Direct comparison of two things
- Simile : Comparison using 'like' or 'as if'
- Symbol: The use of an object, figure or event to represent something else
- Verb: Action word, they drive the pace
- Modifier: Adjectives and adverbs modify nouns and verbs
- Personification: Giving an object human characteristics
- Onomatopoeia: Words that directly represent sounds
- Semantic Field: A group of words or images that are linked by theme
- Imagery: Description that helps visualisation.

Question 3: Structure 8 marks, 10-12 minutes

Skill: to explore the structure of a text and comment on writers' structural choices.

- Look for the focus shifts. These can include changes in things such as mood, place, time, characters, narrative perspective, tense, repletion of ideas.
- Look at the text holistically and see how ideas progress and develop, and why this may be.
- Where something changes, again, explore why this may be.

Useful structural techniques may include:

- Narrative Frame: A story within a story
- Foreshadowing: When a writer indirectly hints at events that will come later in the story
- Juxtaposition : Comparing and contrasting of two or more (usually opposite) ideas, characters, objects etc.
- Antithesis :Two opposing ideas put together in a sentence.
- Contrast: The state of being strikingly different from something else
- Repetition: A word, image or idea that is repeated throughout
- Flashback: An interruption to a narrative that refers back to earlier events
- Climax : The most intense, exciting or important point
- Focus Shift: The point where the reader's attention is redirected.
- Development: The process in which someone or something changes or grows

Question 4: evaluation of a text against a statement. 20 marks, 20-25 minutes

Skill: To be able to critically respond to a text, evaluating evidence to support a convincing argument.

- The statement will always give you two things to explore within the text.
- You can agree or disagree or partially agree with the statement.
- At least 4 quotes to discuss.
- Start with a thesis statement outlining your views having identified the two points for evaluation from the statement.
- Make sure you have at least 4 points to explore. Constantly refer to the keywords (or synonyms) from the statement.
- Comment on the writer's methods and how and WHY they either support or oppose the
- Statement, making sure you explain why they make you think something.
- Keep including the keywords from the statement throughout your 'argument'.

Useful phrases could include:

- In relation to the statement...
- In connection with the statement....
- To a certain extent, in connection to the statement...
- The writer seems to suggest...
- The writer seems to imply...
- The writer emphasises....
- The writer conveys....
- A reader here....
- A reader can certainly see...
- A reader interprets this as....

English Language Paper 1 Section B

Question 5: Descriptive or narrative writing.

40 marks

24 marks for content, 16 marks for technical accuracy.

45 minutes writing time approximately.

You are given an image.

From this image, you are asked to create either a piece of descriptive or narrative writing.

The image is there to springboard your ideas and you are not expected to write a photographic representation. Your writing should be using the image for inspiration.

A suggested paragraph structure could include:

Wide focus, narrow focus, switched focus to a person and then either their internalised thoughts or how they make you feel as the narrator.

DO NOT ATTEMPT UNTIL YOU HAVE PLANNED!!!

- Choose a narrative perspective and a mood - this will drive your content and vocabulary choices
- Remember, the image a springboard to help your imagination!
- Maintain a high standard of SPaG throughout- proof read. It's worth 16 marks.
- Include a variety of techniques consistently throughout the piece of writing and make your paragraphs cohesive.

Punctuation should be accurate a varied and you need to be able to use the following your writing:

- . to mark the end of a sentence that is a complete statement
- , use in lists, in direct speech, to separate clauses, with however.
- ; indicating a pause, typically between two main clauses, takes the place of a co-ordinating conjunction (and, but, or, so).
- : used to precede a list of items, a quotation, or an expansion or explanation.
- A versatile punctuation mark that creates a short pause and emphasise an embedded clause.
- ( ) used to enclose words or figures so as to separate them from the context.
- ... inserted into a sentence to indicate a pause or silence.
- ' ' Inverted commas are used for quotations or can sometimes be used to create a sarcastic tone.
- " " Used to show direct speech.
- ? Used at the end of questions
- ! Used to add impact. DO NOT use more than one at a time!

Sentence types:

- Simple sentence: one main clause with a subject and a verb
- Compound sentence: 2 or more main clauses on the same topic joined by a co-ordinating conjunction or semi colon.
- Complex sentence : has one subordinate clause which needs the main clause to make sense.
- Embedded clause : subordinate clause inserted into a main clause to add information
- Fragmented clause: doesn't follow the rules for a main. If used, use very sparingly!
- Vary sentence starters- -ly, double adjective, similes, verbs and prepositions.

Techniques to include:

- Imagery, sensory description, meaningful similes and strong verbs to add tone!
- Make sure you are specific in your noun choices to further show your reader.
- Paragraphs: your work **must** have cohesive paragraphs.

Word to use instead of very.
Very noisy
Deafening, clamorous, rowdy, riotous
Very often
Frequently, repeatedly, habitually
Very old
Ancient, elderly, decrepit
Very old-fashioned
Archaic, antiquated, obsolete,
Very painful
Excruciating, agonizing, harrowing
Very pale
Ashen, muted, wan, pallid
Very poor
Destitute, impoverished, deprived
Very powerful
Compelling, dominant, formidable
Very quiet
Hushed, tranquil, serene, undisturbed
Very sad
Sorrowful, inconsolable, forlorn
Very shiny
Gleaming, glossy, lustrous
Very short (in extent)
Brief, condensed, compact
Very shy
Timid, reticent, introverted
Very small
Miniscule, diminutive, squat
Very large
Gargantuan, colossal, tremendous
Very young
Juvenile, babyish, infantile
Very pretty/attractive
Prepossessing, winsome, ravishing
Very scared
Petrified, hysterical, agitated
Very worried
Disturbed, overwrought, fretful

KS4 English Language Paper 2 Section A KO

Question 1: identify 4 true statements from a possible 8. 4 marks, 5 minutes

Skill: identify specific information.

- Read the statements carefully
- Skim and scan through the text, looking for one thing at a time.
- Only shade in the box once you have established all the correct answers.
- Take care for misleading statements!

Question 2; Write a summary of the differences or similarities in a text. 8 marks, 12 minutes

Skills: to synthesise two texts but also to make details inferences, which is not clear form the question.

- Make sure that you refer to both texts
- Need to use inference
- Read the question closely – similarities or differences?
- Use comparative connectives
- Use quotations to support
- Keep quotations short
- Use key words for the question
- Aim for 2-3 similarities/differences
- 1-2 sides of the answer booklet

Language of inference:

- Suggests
- Implies
- Demonstrates
- Insinuates
- Conveys
- Indicates
- Hints
- Signifies
- Represents

Language of comparison, used for both question 2 and 4:

- On the other hand
- In contrast
- Contrastingly
- In opposition
- Differs
- Alternatively
- Elsewhere
- On the contrary
- Whereas
- However
- Likewise
- Also
- In addition
- Additionally
- Moreover
- Furthermore
- Accordingly
- Indeed
- Equally
- Similarly

Question 3: comment on the writer's use of language. 12 marks 15-18 minutes

SKILLS: identify and comment on specific language choices and methods used by the writer. Very similar to language paper 1, except it is worth more marks and may find some persuasive techniques as well as literary ones.

• Uses the whole text

•Consider the connotations of the language.

•What do you find out? How is this achieved by the writer? Why does the writer show you this?

•Look for patterns or a semantic field in the language and explore the effect.

•Aim to include 3-4 developed responses to quotations. (2-3 sides)

Other useful techniques in addition those on Paper 1 to look for might include:

- Hyperbole
- Facts and statistics
- Opinions
- Expert opinion
- Rule of three
- Anecdotal evidence
- Emotive language
- Pronouns

Helpful sentence starters:

- The writer implies, indicates ...
- The reader interprets...
- The use of... suggests...
- What is emphasised is...
- One interpretation may be...
- The effect on the reader is...
- The reader is invited to feel...
- The author is trying to...
- The use of... is indicative of...

Question 4: compare the writers thoughts and feelings and the methods they use. 16 marks, approximately 20 minutes

Skill: to be able to compare the key components of a text and identify what the writer's opinion is by making inferences and referencing subject terminology.

- Use both texts and includes quotations from both texts.
- Starts with a thesis statement which is then proved through the body of the essay.
- Needs to include inferences about what the writer thinks or feels about the topic.
- Uses comparative connectives and discourse markers
- Keep quotations short to show confident handling of the text.
- A high proportion of the response will be inference about what the writer thinks or feels.
- Should be 3-4 sides of an answer booklet
- Clear focus on the effects of the language and techniques and what they reveal about the writer's opinion.

Useful phrases, as well as language of comparison and inference might included:

- The writer seems to suggest...
- The writer her is indicating that they think...
- The writer is implying...
- The writer seeks to convey the impression that...
- The writer is clearly demonstrating that...
- The writer is of the opinion that...

KS4 English Language Paper 2 Section B KO

Question 5: persuasive writing.
40 marks, 45 minutes writing time
24 marks for content, 16 marks for technical accuracy.
Skill: to write a structured argument using a variety of rhetorical techniques.
You are given a statement.
From this statement, you are asked to create either a newspaper article, letter speech, blog or magazine article outlining your opinion on the topic.
DO NOT ATTEMPT UNTIL YOU HAVE PLANNED!!!

- An adjustment to the format to show you are writing a letter, article, report or speech.
- A clear introduction which includes an opinion AND DOES NOT REFER TO THE STATEMENT!
- A structured argument which moves through the problems, solutions and benefits associated with the topic and your opinion.
- You should aim to say 3 things about each point to develop what you say and create a sustained response.
- You need to include a range of rhetorical devices throughout your response which may include literary techniques but in addition AFORESTD/RASH.
- Clear paragraphs
- Accurate and varied spelling and punctuation
- End with a clear conclusion with your final word- we recommend beginning with the adverb Ultimately,..

Punctuation should be accurate a varied and you need to be able to use the following your writing:

- . to mark the end of a sentence that is a complete statement
- , use in lists, in direct speech, to separate clauses, with however.
- ; indicating a pause, typically between two main clauses, takes the place of a co-ordinating conjunction (and, but, or, so).
- : used to precede a list of items, a quotation, or an expansion or explanation.
- A versatile punctuation mark that creates a short pause and emphasise an embedded clause.
- ( ) used to enclose words or figures so as to separate them from the context.
- ... inserted into a sentence to indicate a pause or silence.
- ' ' Inverted commas are used for quotations or can sometimes be used to create a sarcastic tone.
- " " Used to show direct speech.
- ? Used at the end of questions
- ! Used to add impact. DO NOT use more than one at a time!

Sentence types:

- Simple sentence: one main clause with a subject and a verb
- Compound sentence: 2 or more main clauses on the same topic joined by a co-ordinating conjunction or semi colon.
- Complex sentence : has one subordinate clause which needs the main clause to make sense.
- Embedded clause : subordinate clause inserted into a main clause to add information
- Fragmented clause: doesn't follow the rules for a main. If used, use very sparingly!
- Vary sentence starters- -ly, double adjective, similes, verbs and prepositions.

Key Techniques to include:

- Anaphora, epistrophe, repetition, tripling, emotive language, expert opinion, juxtaposition (They say; we say) and clever use of pronouns will all help to add weight to your argument.
- Paragraphs: your work **must** have cohesive paragraphs. Problems, solution and benefits help you to create a structured argument, rather

Key definitions:

Formats:

A letter will usually start with Dear Sir, Dear Editor, Dear Prime minister or the name of the person you are writing to.
A speech will normally begin with a salutation such as Good evening, ladies and gentlemen (Or whoever you are addressing.)
A Newspaper article will start with a headline whilst **a magazine article** will need a title. Similarly **a blog** will start with a headline/title.
Report: uses a heading and subheadings

Techniques to use

Anaphora: Repetitive of a word at the beginning of successive clauses
Antithesis: Contrast of ideas by creating parallel structures
Epistrophe: Repetition of a word at the end of sentences
Epizeuxis: repetition of a word in the middle of clause
Euphemism: A politer/more pleasant way of saying something that is less pleasant or socially acceptable
Hyperbole: Deliberate exaggeration
Hypophora: When a writer poses a question and then immediately answers.
Metaphor: A figure of speech that includes a direct comparison between two things
Onomatopoeia: Words that directly represent sounds
Oxymoron: Two words together with opposing meanings
Pronouns: I, you, we, they, us, them are used to create unification or division
Simile: A comparison using 'like' or 'as'
Tripling: repeating a word or phrase or idea three times.

Macbeth KO Lit Paper 1

Key Characters

Macbeth Eponymous protagonist, ambitious and ruthless

Lady Macbeth Defies expectations, strong and ambitious, evil and conniving, but is driven mad through guilt.

Witches Supernatural beings, give prophecies, could represent conscience or fate

Banquo M's friend, sons prophesied to rule, killed and returns as ghost

Duncan A Good king, praises M at start and rewards him but is politically weak. Heis murdered in Act 2

Macduff The Thane of wife who is loyal to Scotland, sacrificing his wife and children who are both killed by Macbeth; he kills M; born by caesarean

Malcolm Heir to throne, a good holy man, finally crowned as the rightful heir and restores Scotland from Macbeth's tyranny.

Fleance Banquo's son, represents innocence and justice and escapes Macbeth's murderers.

Ross, **Lennox** (and **Old Man**) minor Lords who are used to demonstrate the negative impact Macbeth's tyrannous reign has on The great chain of being

The Porter Comic interlude after Duncan's murder which breaks the tension but also alludes to hell.

Hecate The Goddess of witchcraft who intervenes with the witches and demands that they work against Macbeth. Not necessarily a part written by Shakespeare but added later to demonstrate the complete chaos and how evil has to work for good to restore equilibrium.

Lady Macduff The antithesis to Lady Macbeth, and serves as a shining example of a medieval woman, brutally slaughtered by Macbeth. She emphasises his wickedness.

Key Vocabulary

Ambition A strong desire to achieve something (Latin ambire – to canvas for votes)

Regicide Killing a king (Latin rex – king, French –cide kill)

Antithesis Direct opposite (Greek – opposition, resistance, placing against)

Hallucination To see something that does not exist (Greek allusein – be uneasy or distraught)

Atrocity Cruelty (Latin atrox – cruel, terrible)

Treason Betraying one's country (Latin traditio – handing over, surrender, a giving up)

Divine Of, or like God (Latin divinus – of a god)

Manipulation The act of manipulating someone in a skilfull manner (Latin manipulus – handful, handling of objects)

Remorseless Without guilt or regret (Re – again Latin mordere – to bite)

Virtuous Having high moral standards (Latin virtus – virtue)

Prophecy A prediction of the future (Latin prophetia – gift of interpreting the will of gods)

Masculinity Qualities considered to be of a man (Latin – masculus – male)

Equivocator Someone who uses language to hide the truth (Latin aequivocator – agent)

Tanistry The strongest warrior succeeds the leader

Primogeniture The first born son succeeds as leader.

Context

Queen Elizabeth Loved Shakespeare's plays as a great supported – inspired many powerful female characters such as Lady Macbeth. She famously said 'I have the body of a woman but the heart of a man.'

King James I Elizabeth I had no children so James I was deemed the 'rightful king' in the 'Great Chain of Being' but this caused much disruption to religious subjects, and so, many were hung for treason. He was particularly interested in the supernatural and ghosts – even writing a book on the subject - Deamonologie

Gun Powder Plot Guy Fawkes amongst others plotted to blow up the houses of Parliament in a perilous act of treason against James I and this clearly inspired much of this play.

Supernatural Due to a lack of modern science, witches and the supernatural were often blamed for bad luck and natural disasters.

Scottish Society Scottish society believed that, to be a man, one must take advantage of opportunities given to climb the social ladder.

The Divine Right of Kings The idea that kings got their power from God and not from their subjects. James I was a believer in this, and the idea meant that any treasonous activity was a crime against God. Only a century earlier, England had suffered under the massive disorder of the Wars of the Roses, so many supported the idea to avoid civil unrest

The Great Chain of Being A hierarchy with God at the top, then angels, kings and queens, nobles, humans, animals, plants, minerals. Any disruption to this chain was thought to lead to dire consequences for the world.

Patriarchy Patriarchal societies are those in which men dominate, and inheritance passes through male heirs, see primogeniture and tanistry for clarification.

Plot Summary:
Act I scene i – The three witches gather to meet Macbeth and Banquo.
Act I scene ii – Duncan hears that the Thane of Cawdor has betrayed him, and that Macbeth has proven himself to be a hero.
Act I scene iii – Macbeth and Banquo hear the predictions from the witches that Macbeth will be Thane of Cawdor and the next king, and Banquo's children will be kings. Ross arrives and tells Macbeth that he is the new Thane of Cawdor. Act I scene iv – Duncan decides to make his son Malcolm the heir to his throne and tells Macbeth that he will visit his castle.
Act I scene v – Lady Macbeth reads a letter from her husband about the events so far, and invokes the spirits to give her the strength to do what needs to be done to murder the King. Act I scene vi – Duncan arrives at Macbeth's castle and is
Act II scene i – Banquo feels uneasy about the night. Macbeth makes his way to Duncan's room to kill him and sees a dagger floating in the air before him. He leaves the stage to murder Duncan.
Act II scene ii – Macbeth forgets to leave the bloody daggers in Duncan's room after the murder and Lady Macbeth berates him before putting them back.
Act II scene iii – Duncan's body is discovered by Macduff the next day. Macbeth pretends to be angry and kills the servants to keep them out of the way. Duncan's sons, Malcolm & Donalbain, flee the castle.
Act II scene iv – Macduff reports that suspicion for the murder has fallen on the kin's sons; Macbeth has travelled to Scone to be crowned. welcomed by Lady Macbeth.
Act III scene i – Macbeth is king and Banquo is suspicious about how the witches' predications have come true. Macbeth convinces murderers to assassinate Banquo.
Act III scene ii – Lady Macbeth tries to get her husband to talk to her about his plans but he refuses.
Act III scene iii – Banquo is murdered but his son, Fleance, escapes.
Act III scene iv – At a feast that night, Macbeth sees the ghost of Banquo and acts strangely in front of his guests. Lady Macbeth tries to convince everyone this is normal behaviour.
Act III scene v – The witches discuss events so far; Hecate, the ruler of the witches, predicts the downfall of Macbeth.
Act III scene vi – Macduff has left for England to rouse support against Macbeth as suspicion and grows against the new king.
Act IV scene i – Macbeth meets the witches who show him a series of apparitions. They tell him to beware Macduff, that he cannot be harmed by anyone 'born of a woman' and that he will be safe until Birnam Wood moves to the castle at Dunsinane. They also show him a line of Banquo's heirs. Macbeth decides to murder Macduff's family as a result of the first apparition.
Act IV scene ii – Macbeth's murderers kill Lady Macduff and her children.
Act IV scene iii – Macduff and Malcolm discuss what it means to be kind. Macduff discovers his family's murder and, with Malcolm, leads an army to attack Macbeth.
Act V scene i – A doctor and Lady Macbeth's servant watch Lady Macbeth sleep walking and trying to wash an imaginary blood spot from her hands.
Act V scene ii – Malcolm's army is at Birnam Wood and hear reports that Macbeth's supporters are deserting him.
Act V scene iii – Macbeth is under siege and places all his hope in the predictions from the witches.
Act V scene iv – Malcolm orders his army to cut down branches from Birnam Wood to disguise the number of soldiers.
Act V scene v – Macbeth is told of his wife's death and about the news that Birnam Wood seems to be approaching. He resolves to die fighting.
Act V scene vi - ix – Macbeth is killed by Macduff (who reveals he was delivered by caesarean and so not properly 'born'). Malcolm becomes the new king of Scotland and order is restored.

Symbols

Blood – a symbol of guilt and violence

Sleep- a symbol of innocence. When Macbeth mentions that cannot sleep, Shakespeare is referencing his lack of innocence.

The supernatural – belief in witchcraft was widespread and Shakespeare uses prophecy, hallucinations, ghosts and magic to give the play a menacing, unnatural feel. The symbolise the perpetual threat to The great chain of being.

Darkness- symbolic of how the couple seek to conceal their evil crime from God and how they evoke evil.

Key themes:

Order and disorder: The natural world becomes chaotic when Duncan dies. As Macbeth's reign continues, social chaos is demonstrated.

Ambition: The Macbeth's ambition to be powerful drives the play and their downfall is directly linked to this.

Appearance versus reality: people and events are not always as they seem- 'fair is foul and foul is fair.'

Power and conflict: Many battles are fought- the play begins and ends with a battle as well as Macbeth's internal conflict between good and evil.

Kingship: What makes a good king compared to a bad one.

A Christmas Carol KO Lit Paper 1

Key characters

- **Ebeneezer Scrooge** Transforms from misanthropist to philanthropist
- **Bob Cratchit** Represents the noble poor, challenges perceptions of the poor
- **Ghost of Christmas Past** Shows us Scrooge was not always hard and cold, importance of memory
- **Ghost of Christmas Present** Shows Scrooge what Christmas spirit really is. Introduces Ignorance and Want to teach Scrooge the error of his ways
- **Ghost of Christmas Yet to Come** Shows Scrooge his dire fate unless he changes
- **Tiny Tim** Represents Christian values and is a symbol for the most vulnerable in society. He is a key character in Scrooge's transformation
- **Jacob Marley** Scrooge's dead business partner, the catalyst for Scrooge's transformation.
- **The Portly Gentlemen** An example of those members of society who were socially responsible.
- **Fezziwig** A shining example of how a boss could practice philanthropy

Key Themes

- **Redemption** Dickens shows Victorians it is possible to change their ways through the transformation of Scrooge
- **Family** Offers warmth and love – complete contrast to Scrooge's chosen life
- **Christmas** A time of love, hope, charity and kindness to show Dickens' moral message
- **Social Injustice** Dickens highlights the social injustice of Victorian England to bring about reform
- **Threat of Time** Scrooge needs to act quickly or he will walk in purgatory for all time.
- **Social responsibility** Dickens uses the novella to demonstrate the importance of generosity.
- **Generosity** The need to share and fulfil Christian obligations
- **Philanthropy** those characters who share this trait are much happier as a result of their behavioural choice.
- **Supernatural** A fashionable 1843 theme which is used to teach Scrooge how to change.

Key Vocabulary

- **Misanthropy** Dislike of humankind (Greek miso – hating Greek - Anthropos – man)
- **Philanthropy** Desire to help others, usually through charity (Greek – philanthopos – man-loving)
- **Stave** The parallel lines music is written on (English – staff, support)
- **Novella** A short novel (Italian – novel)
- **Avarice** Greed (Latin – avarus – greedy)
- **Penitence** Sorrow for committing sin (Latin – paenitent – repenting)
- **Industrial** Related to industry and factories (French – industriel – resulting from labour)
- **Revolution** A great change (Latin – revolve – turn, roll back)
- **Apparition** Supernatural appearance (Latin – appartionem – an appearance)
- **Benevolent** Wishing to do well, kindly (Latin – benevolentum – wishing someone well)
- **Covetous** Desiring to obtain and own (French – coveitos – desire, eagerness, ambition)
- **Ominous** An indication of coming evil (Latin – ominosis – full of foreboding)
- **Tremulous** Shaking (Latin – tremulus – shaking, quivering)

Top Tips for an extract question:

- ✓ Work through the novella chronologically – beginning, middle and end. Fit the extract into your plan and make sure you reference the whole novella
- ✓ Remember to explore the language in each quotation using appropriate subject terminology
- ✓ Identify the writer's purpose- Dickens wanted to change middle class attitudes towards poverty and make them more generous.
- ✓ Include a thesis statement to introduce your argument

Devices used

Omniscient Narrator Dickens makes use of a narrator that is not a direct part of the story. They provide us with an overview of the story but focuses specifically on Scrooge and his responses to what is happening. They do not offer a sympathetic portrait, often the style is one of mockery. It is clear we are meant to detest Scrooge at the beginning but the gradual unfolding of his story allows us to like him by the end.

Pathetic Fallacy A technique that links human emotion to the weather. Throughout the novella warmth is linked to community and love and coldness is linked to hard-heartedness and a lack of love. This is further emphasized with Scrooge when we find out that 'no warmth could warm, no wintry weather chill him.' Scrooge is the most extreme version of the effects of self-interested capitalism.

Antithesis The opposite of someone or something, antithesis is used throughout the novella to show that there is a better way. Fezziwig's form of business is an antithesis to Scrooge's, the first stave is the antithesis of the final stave, Bob is the antithesis of Scrooge...

Allegory A story that teaches a moral lesson, using the characters as symbols. In ACC Scrooge represents the Victorian businessmen that take advantage of the poor. Fred represents the ideal of the middle class. The Cratchits represent the noble poor. Tiny Tim represents children and their vulnerability. Fezziwig represents an alternative way of doing business.

Parallel **Stave** (1 and 5) Basically, the end is the reverse of the beginning- everything that Scrooge fails to do in Stave 1 is reversed in Stave 2 to symbolise his transformation.

Symbolism As an allegorical story, much of what is presented by Dickens is a device used to explore his message of generosity and benevolence.

Useful terminology
Satire- use of humour or ridicule to criticise
Asyndeton- list without conjunctions
Polysyndeton- list with conjunctions (and)
Simile- comparing using 'like' or 'as'
Metaphor- saying one thing is another
Personification- make object human
Pathetic fallacy- weather to create mood
Pathos- language to evoke pity
Allusion- reference to another literary work
Hyperbole- exaggerated statement
Connotation- associated meaning of word
Characterisation- built up description of character in text
Semantic field- words related in meaning
Imagery- visually descriptive language

Writer's purpose: social reform
Dickens is writing to influence the reader at a time when the middle classes took little social responsibility for the effects of the industrial revolution on the working classes. Workers were kept in servitude due to appalling pay and conditions. They were powerless to alter their situation until the middle classes, like Scrooge, chose to improve their situation.

Structure and form
Conflict- problem faced by characters
Resolution- point where conflict is resolved
Foreshadowing- clue about something later
Foreboding- sense that something will occur
Juxtaposition- two contrasted ideas
Backstory- insight into character's past
Exposition- revelation of something
Poetic justice- good rewarded bad punished
Melodrama- exaggerated characters/events
Motif- repeated image or symbol
Antithesis- contrast of ideas in same grammatical structure
Authorial intrusion- where author pauses to speak directly to reader
Allegory- characters/events represent ideas about religion, morals or politics
Polemic- a moral lecture versus novella- short novel
Parallel stave- many elements in the first stave is inverted in the final stave.
Malthusian economics – Reformation of the Poor Laws in 1834 left the poor destitute and reliant on workhouses. Malthusian economists supported the idea that the unproductive poor should work their way out of poverty and charity should not be given to those who were 'undeserving'. Scrooge is a supporter of Malthus- "If they would rather die they had better do it and decrease the surplus population." Dickens challenges these ideas continually through the novella.

Plot summary:
STAVE 1: • Christmas Eve and Scrooge is at work in his counting house. Despite the cold, he refuses to spend money on coals for the fire for himself or Bob Cratchit. Scrooge is miserable and alone. • Scrooge is visited by the Ghost of Marley, his dead business partner. Marley tells Scrooge because of his sinful, greedy life, he has to wander the Earth wearing heavy chains. Marley tries to stop Scrooge from doing the same. He tells Scrooge that three spirits will visit him during the next three nights. Scrooge falls asleep.
STAVE 2: • The Ghost of Christmas Past takes Scrooge into the past. Scrooge revisits: his childhood school days, his apprenticeship with Fezziwig, and his engagement to Belle, who leaves Scrooge as he loves money too much to love another human being. Scrooge sheds tears of regret before being returned to his bed.
STAVE 3 • The Ghost of Christmas Present. Scrooge watches the Cratchit family eat, enjoy and be thankful for a tiny meal in their little home. He sees Bob Cratchit's crippled son, Tiny Tim, whose kindness and humility warm Scrooge's heart. The spectre shows Scrooge his nephew's Christmas party. Scrooge asks the spirit to stay until the very end. At the end of the stave, the ghost reveals two starved children, Ignorance and Want.
STAVE 4 • The Ghost of Christmas Yet to Come takes Scrooge through a sequence of scenes linked to an unnamed man's death. Scrooge, is keen to learn the lesson. Scrooge learns the dead man is himself and is desperate to change his fate and promises to change his ways. He suddenly finds himself safely tucked in his bed.
STAVE 5 • Scrooge is a changed man. He rushes out onto the street hoping to share his newfound Christmas spirit. He sends a turkey to the Cratchit house and goes to Fred's party, As the years go by, he continues to celebrate Christmas with all his heart. He treats Tiny Tim as if he were his own child, gives gifts for the poor and is kind, generous and warm

KS4 AQA Modern Text Lit Paper 2 Lord of the flies KO

Key characters:

Ralph: Becomes leader, represents democracy, is hunted by the end.
Jack: Leader of the choir and hunters, represents totalitarianism.
Piggy: Supports Ralph, represents intellectualism, tries to create civilised island.
Simon: A visionary, he represents religion and is killed when others mistake him for the beast.
Samneric: Twins who lose their individuality, ending by following the masses .
Roger: One of the choir/hunters, represents sadism.
Littluns: The mass, they follow whoever they think is strongest.

Key Vocabulary

Civilisation: A law-abiding society
Democracy: A government where the leader is voted in
Totalitarianism: A government with one leader with absolute power
Dictatorship: A form of government that has total control
Savagery: Being untamed and ferocious
Microcosm: A small version of the wider world
Sadistic Obtains pleasure from inflicting pain – (Marquis de Sade, who wrote about the pleasure of inflicting pain on others)
Tyrant: An absolute ruler who is cruel and uses force to maintain power.
Oppressive: Cruel and unfair
Furtive: Stealthy, sly, secretive, underhand
Malevolent: Wishing evil on others
Inimical Unfriendly
Taboo:Banned on grounds of morality or taste

Context

William Golding

Part of the British Navy during WWII, Golding was the captain of a ship that assisted the D-Day landings. He said 'before the second World War I believed in the perfectibility of man...after the war I did not because I was unable to. After the war he felt that the breakdown of civilization was inevitable as all 'men' have the capacity for evil.

WWII

Golding had seen the effects of totalitarianism in the form of Hitler and others like him. In the 1950s the world became aware of the ways in which the Soviet Union treated political dissenters. This novel responds to a world that had been destroyed by powerful people through coercion and fear. After WW2, even Everyday' people had been proved capable of great evil through events such as the Holocaust.

Nuclear War

The first use of an atomic weapon in Hiroshima and Nagasaki in 1945. The threat of nuclear war in the Cold War of 1949 showed the world the that civilization could be entirely destroyed by a single conflict. The island is destroyed by the end of the novel, showing how conflicts escalate quickly and can destroy completely.

Charles Darwin/Evolution

Darwin's Theory of Evolution states man evolved from animals. Golding presents the idea that we are all ultimately animals. The only thing that separates us from this is civilization, rules and laws. Take these away and we quickly descend into our animal states.

Context continued:

Religion

The island can be thought of as the Garden of Eden. Once man gives in to temptation, it is quickly destroyed. Simon is portrayed as a Christ-like figure. He sees the beauty of the island, understands the evil of men and is then destroyed by man. Lord of the Flies translates into Beelzebub in Hebrew, another name for the devil.

The Coral Island/adventure story genre

Lord of the Flies is a parody of The Coral Island. The Coral Island (R.M. Ballantyne 1857) tells the story of 3 boys marooned on a pacific island. They encounter different types of evil, yet their friendship, courage, and determination aid their survival. Golding was unsatisfied with how it 'espoused myths' and sought to invert its meanings. (The evil is instead within the boys).

Robinson Crusoe/adventure story genre

A popular nineteenth century genre, taking its name from Defoe's 'Robinson Crusoe', a tale of a shipwrecked sailor who survives for several years before returning to England. Many writers decided to write about sea-faring adventures that pitted man against the elements. Golding subverts the heroic qualities explored in these novels to show the reality of human nature.

Key themes:

Civilisation vs savagery: Man's conflict between living by rules or giving into their immediate desires, resulting in the breakdown of civilisation

The Beast: The capacity for evil in all of us – the beast is a manifestation of fear and of how fear leads to chaos.

Innocence: The more the boys give in to urges the less innocent they become and the more evil they become.

Order and chaos: Golding explores the balance between discipline and freedom as we see how chaotic 'men' naturally are

Violence: The more the 'rules' are left behind, the more violent the boys become.

Nature versus nurture: We are all predestined to behave in a certain way- society merely masks this. Once society is removed, our natural state (of evil) emerges.

Democracy versus dictatorship: the forces of evil are all around and constantly pushing for power. Golding shows us how evil is more powerful than good and ultimately seeks to overtake and obliterate it.

Psychology of Lord of the Flies

Deindividuation:

The psychological term for when a person's identity and self-awareness is overcome by group and can lead to a mob mentality. This is seen when the boys kill Simon and also when Ralph is pursued at the end of the novel.

Maslow's hierarchy of needs:

Promotes the idea that there are 5 hierarchical levels of human need. In ascending order:

- Physical (e.g. food, shelter, warmth, sleep)
- Safety (security, health, resources, employment)
- Love and belonging (friendship, family, a sense of connection)
- Esteem (respect, strength, freedom)
- Self-actualisation (The dsire to be the most that one can be.)

Without each of these needs being met, the stage above cannot be fulfilled. We see how the boy's society fails to fulfil the basic requirements of food, shelter and warmth and is therefore doomed.

Freud: the id, ego and superego

According to Freud, **the Id** is the primitive, instinctive part of the mind that contains aggressive drives. This is best characterised through the character of Jack, who is predatory in nature and assumes the role of hunter.

The ego is the part of the id which is modified by social factors and the world in which we live. and works within reason, considering social realities and behavioural norms when deciding how to behave. The ego is presented through Ralph's character who appears to be rational and logical in his behaviours.

The superego's function is to control the id's impulses, in particular those which are seen as aggressive. It persuades the ego to turn to moralistic goals and to strive for perfection through the ideal self. The superego is presented through Piggy, who is prone to moralistic behaviour e.g. when using the conch.

Chapter	Synopsis
Chapter 1 The Sound of the shell	The boys land on the island. They elect a chief (Ralph) who select Jack to be the leader of the hunters. The boys attempt to replicate the society they have left behind and find a pig whilst exploring the island.
Chapter 2 Fire on the Mountain	The boys call an assembly. The littluns mention a 'beastie' which sends a fear through the group. Ralph decides to light a fire on the mountain to alert rescuers. The fire burns out of control and kills a littlun.
Chapter 3 Huts on the Beach	Jack becomes obsessed with hunting pigs and procuring meat. Ralph and Jack argue due to a difference in priorities. Ralph and Simon work on creating huts for shelter as Jack becomes more savage. Simon wanders off to find fruit for the littluns.
Chapter 4 Painted Faces and Long Hair	Roger and Maurice bully the littluns on the beach but are controlled by the rules of civiliation. Jack paints his face and leads the hunters out to kill a pig. Unfortunately, Jack lets the fire go out. He punches Piggys and breaks Piggy's glasses.
Chapter 5 Beast from the Water	Ralph tries to maintain order and re-establish rules. The arguing continues and the boys make fun of Simon when he says that they are the beast. Jack storms off with the hunters and Piggy longs for grownups.
Chapter 6 Beast from the Air	A plane is shot down whilst the boys sleep, ejecting a dead parachutist. The boys hunt unsuccessfully for the beast. Ralph notices the fire has gone out but nobody cares.
Chapter 7 Shadows and Tall Trees	The hunt for the beast continues. The boys find a pig run and Ralph is involved in the hunt and enjoys it. The boys then act out the spectacle of the pig as a game. The hunt for the beast continues- the boys mistake the parachutist for the beast and run away.
Chapter 8 Gifts for the Darkness	Jack calls a meeting, insults Ralph and says he should no longer be chief. Nobody else agrees and Jack is embarrassed. Jack leaves and goes into the forest. Roger, Maurice and Bill follow Jack. Simons disappears to his secret spot. The boys track and hunt a sow, slaughtering her and cuttings its head off as a sacrifice to the beast. Simon arrives afterwards and imagine the pigs head is speaking to him.
Chapter 9 A view to a Death	Simon passes out and whilst semi-conscious, discovers the truth about the beast. He goes to tell the boys. Meanwhile, at the camp many of the boys have left to join Jack's hunters for a 'feast' . in the ensuing storm and delirium, the boys mistake Simon for the beast and murder him, his body is washed out to sea.
Chapter 10 The Shell and the Glasses	Only Ralph, Pigg and Samneric are left. Piggy expresses horror at witnessing Simon's murder and despairs of ever returning home. Ralph is equally desultory. Jack and the hunters are all at the fort. Roger returns and reveals the savage treatment meted out by Jack. Jack and his hunters raid the camp for fire and steal Piggy's glasses
Chapter 11Castle Rock	Piggy and Ralph go to the fort and demand Jack returns Piggy's glasses with the conch. Ralph and Jack fight and Ralph demands the return of Piggy's glasses. Samneric are tied up by the hunters and Roger sends an enormous rock smashing down the hillside. It smashes the conch and knock Piggy off the cliff, killing him
Chapter 12 Cry of the Hunters	Jack threatens Ralph and he flees but returns at night to speak to Samneric. Ralph hides but is given away by Samneric. He runs for his life pursued by the hunters and the Island catches fire. At the last minute, Ralph is saved by a Naval officer, alerted to the presence of the boys by the fire.

Key vocabulary and terminology

Assonance – repetition of a vowel sound of emphasis
Atmosphere- mood or feeling
Couplet – 2 lines of rhyming poetry
Caesura- punctuation in the middle of a line for emphasis
Dramatic monologue- narrative told only from the narrator's viewpoint
Enjambement- overlapping sentence into the following the line.
Extended metaphor – metaphor running through the poem rather than singular reference
Form- the shape of a poem
Free verse- poem that does not have a regular rhyme structure
Half rhyme- partial rhyme scheme
Iambic pentameter – 10 syllables with 5 stressed syllables
Narrative- account of events
Oxymoron – contradictory placement of words – eg bitter sweet
Prose- any writing not in verse form
Rhyme scheme – pattern of rhyming eg ABAB
Simile – comparison to enhance understanding using like or as
Sonnet form- 14 lines in iambic pentameter. Either **Italian/Petrarchan** or **English/Shakespearean**
Octet – 8 lined stanza (posing the problem or question in a Patrarchan sonnet.
Sestet –(6 lines stanza, often presenting the answer or question to the octet)
Cinquain/quintet – 5 line stanza
Quatrain/quartet – 4 line stanza
Tercet- 3 line stanza
Volta- turning point of a sonnet between the octet and the sestet (Line 9)
Natural imagery – imagery inspired by nature

Love and Relationships Anthology

Poetry Knowledge organiser KS4

Love and Relationships Anthology key themes

- Love
- Loss
- Separation
- Parent/child
- Nature
- Distance
- Closeness
- Changing relationships
- Reconciliation/renewal
- Death of a relationship
- Parting
- Differences between generations

Structuring your response:

Your thesis statement introduction introduces your main argument and how each poem relates to the theme of the question.

3 points of comparison, where each point adds something new to your argument about the theme in the question and the poems are similar or different in this respect. Use what, how, why to develop your response

Conclusion which sums up your ideas about both poems and what the author is telling you about the them.

Language of comparison:

- Similarly, likewise, in the same vein.
- However, although, conversely.

The poems and suggested links between poems:

'When We Two Parted': compares well with Neutral Tones, Love's Philosophy, Sonnet 29
'Love's Philosophy': compares well with Neutral Tones, When We Two Parted, Singh Song, Sonnet 29
Porphyria's Lover: compares well with The Farmer's Bride, Love's Philosophy, Sonnet 29
Sonnet 29: compares well with Love's Philosophy, Porphyria's Lover, Neutral Tones
Neutral Tones: compares well with Winter Swans, When We Two Parted, Sonnet 29
The Farmer's Bride: compares well with Porphyria's Lover, Neutral Tones, Sonnet 29
Walking Away: compares well with Mother, any Distance, Follower
Letters From Yorkshire:
Eden Rock: Compares well with When We Two Parted, Walking Away, Follower
Follower: Compares well with Walking Away, Mother, any distance, Before You Were Mine
Mother, any Distance: compares well with Before You Were Mine, Follower, Walking Away
Before You Were Mine: compares well with Follower, Walking Away
Winter Swans: compares well with Neutral Tones, Sonnet 29, When We Two Parted
Singh Song!: compares well with When We Two Parted, Love's Philosophy, Sonnet 29
Climbing My Grandfather: compares well with Before You Were Mine, Mother Any Distance, Follower, Walking Away

Evaluative Verbs

Satirises – using satire (a way of criticising people or ideas in a funny way) to show that people or ideas have bad qualities and are wrong - usually political.

Presents – introduces an idea.

Demonstrates – provides a clear explanation or example.

Amplifies – emphasises using extra impact and returning to the same idea/point. It makes this idea/point seem very important.

Conveys- carries or presents

Contrasts – presents ideas in opposition

Insinuates – hints at, implies.

Alludes to- references or suggests

Language of comparison:

Similarly, likewise, additionally, also.

However, although, conversely, contrastingly.

Phrases to show writer's purpose:

The writer is inviting the reader...

The writer is perhaps suggesting...

The writer indicates that...

The writer has used this to...

Phrase to show comparison of effect on the reader: (8 mark question)

Similarly, this also makes the reader...

Conversely, the reader then feels...

Unseen poetry KO

AO1 = 12 marks	**You are being judged on how well you: Read, understand and respond to texts.** • maintain a critical style and develop an informed personal response • use textual references, including quotations, to support and illustrate interpretations.
AO2 = 12 marks	**You are being judged on how well you: Analyse the language, form and structure used by a writer to create meanings and effects.** • use relevant subject terminology where appropriate.

Strategic exam response tips:

Read the question- this will tell you what the poem is about

Read the title- This will help you to know what the poem is about

Read the poem through, annotating key ideas, techniques and language as you go.

What form does the poem take? This will further help to unlock meaning.

Where is the punctuation? - Can you identify where the enjambment and caesura are? Why are they there?

Look for patterns in language- are key words repeated? Is there a semantic field? Why has the writer chosen this?

Identify a key image- what does the writer use this to suggest about the theme of the poem?

How are the ideas structured- what stays the same or changes in the poem? (The first 2 and last 2 lines are good places to look.)

How to answer the 24 mark question:

You should spent 30 minutes in total on this question in the exam.

You should spend 5 minutes reading and annotating the poem using the checklist on the left hand side – language, form and structure.

Always ask yourself WHAT, HOW, WHY.

Identify and explore 3 ideas linking to your thesis statement. (preferably a combination of form, language, structure and techniques

Introduce these in your thesis statement introduction and then explore each of these ideas throughout the essay.

Remember to include a quotation with your summative idea about the poem and the theme.

How to answer the 8 mark question:

You should spend 15 minutes on this question in the exam. (3 minutes reading the second poem and planning, 12 minutes writing)

Unpick the second poem (3 mins).

Pick 3 METHODS(HOW) to compare – use words from the table on the left to compare them.

Start with the method and then analyse the WHAT and WHY (effect on the reader)

Compare the effect on the reader.

Year 11 Biology Knowledge Organiser – Homeostasis and Response

Box 1 - Homeostasis

Homeostasis is the regulation (control) of the internal conditions of the body. It is vital for proper enzyme functioning, and indeed all cell functions. Unless chemical and physical conditions in the body are kept within strict limits, cells die. Our bodies constantly and automatically regulate the internal conditions in the body to maintain optimum functions. Some factors that need controlling by homeostasis in the human body:

- Blood glucose concentration
- Body temperature
- Water levels
- Nitrogen levels

The regulation that takes place can be carried out by the **nervous system**, the **endocrine system** (which produces hormones), or a combination of the two. These automatic control systems we use for homeostasis all include:

- **Receptor cells** – these detect changes in the environment. These changes are called **stimuli**.
- **Coordination centres** – these receive information from receptor cells (electrical or chemical information) and process the information. Examples include the brain, spinal cord and pancreas.
- **Effectors** – these are muscles or glands, which carry out the responses as directed by the control centre. Muscles **contract** and glands release chemicals, such as hormones.

Box 2 - The human nervous system

The nervous system is a network of neurones (nerve cells), bundled into nerves. It includes the nerves all over the body and the **central nervous system**, which consists of the **brain** and **spinal cord**. The nervous system allows us to react to the surroundings and control our behaviour. It can act involuntarily (in **reflexes**) or voluntarily.

Information from receptor cells, in the form of electrical impulses, passes along neurones to the central nervous system (CNS for short); the CNS coordinates the response by transmitting electrical impulses to the effectors (muscles or glands).

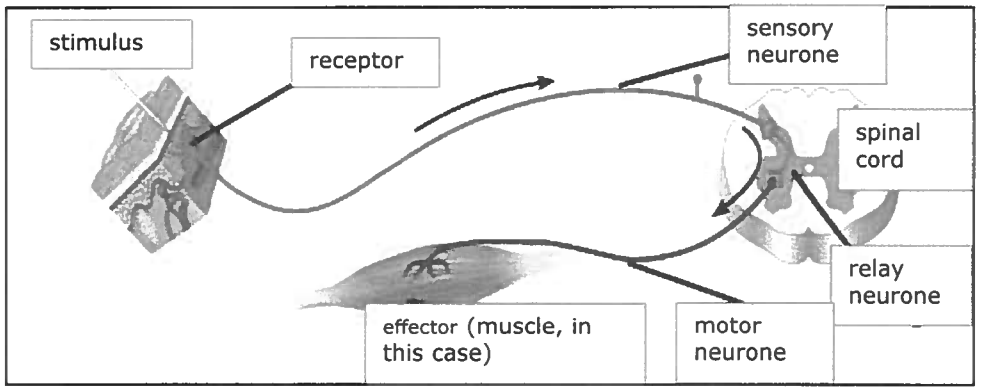
A reflex arc causes reflex actions, which are rapid and automatic (automatic because they don't involve the conscious part of the brain) and are designed to prevent harm from coming to the body.

Key Terms	Definitions
Homeostasis	The regulation of conditions inside the body (and cells) to maintain a stable internal environment in response to changes in both internal and external conditions.
Endocrine system	The network of hormone-producing glands in the body. Hormones are chemical messengers that travel in the bloodstream to their target tissues.
Stimulus	A change in the environment, detected by a receptor cell. E.g. light, sound, chemicals (smells and tastes), pressure, pain, temperature etc.
Nerve	A nerve is a collection of many nerve cells; nerve cells are called **neurones**. Neurones transmit (carry) information as **electrical impulses**.

Box 3 -The reflex arc and reflex actions

Reflex actions, for instance pulling your hand away from a pain stimulus, follow a simple pathway.

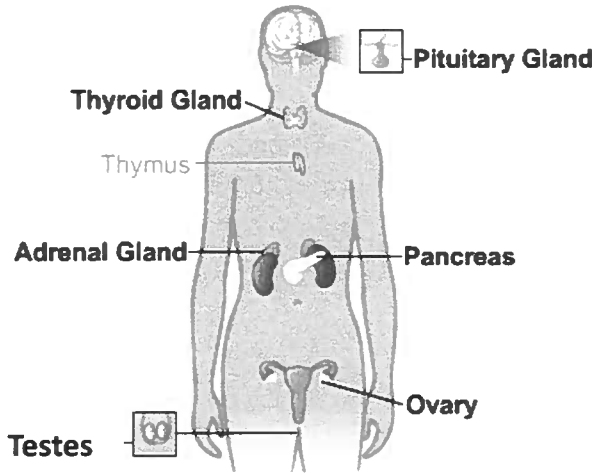
1. The **receptor** detects the **stimulus** and passes electrical impulses along the **sensory neurone** to the CNS (the spinal cord, in this case).
2. There is a junction (tiny gap) between the sensory neurone and the **relay neurone** called a **synapse**. Here, a chemical (neurotransmitter) is released that diffuses across the gap and causes an electrical impulse to pass along the relay neurone.
3. There is another synapse between the relay neurone and the **motor neurone**, again a chemical is released that causes the electrical impulse to pass along the motor neurone.
4. The impulse arrives at the **effector** – in this example, a muscle that contracts to pull your hand away from the source of pain.



Year 11 Biology Knowledge Organiser – Homeostasis and Response

Box 4 - The human endocrine system

Hormones are released by endocrine glands directly into the bloodstream so they can be transported to a target organ or tissue and cause an effect. In comparison with the nervous system, the effects caused by the endocrine system are slower but act for longer. The hormones themselves are large protein molecules.



Key Terms	Definitions
Hormone	A molecule released by an endocrine gland; hormones travel in the bloodstream to a target tissues/organs and produce an effect when they reach them.
Secrete	The proper term for 'release' of a chemical in the body, such as a hormone from an endocrine gland.
Glycogen	Large chemical, made from glucose, that acts as a store of glucose in liver and muscle cells.
Pituitary gland	The 'master gland' of the endocrine system, since, through its hormone release, it controls other endocrine glands, making them release hormones.

Box 5- Controlling blood glucose concentration

Blood glucose concentration is monitored and controlled by the **pancreas**. When blood glucose concentration rises (for instance, soon after eating), the pancreas detects this and releases the hormone **insulin**. Insulin causes glucose to move from the blood into cells (such as muscle and liver cells where it is converted it to **glycogen** for storage). This *lowers* blood glucose concentration back down to normal levels.

Higher Tier: when blood glucose concentration drops too low, the pancreas detects this and releases the hormone **glucagon**. Glucagon causes muscle and liver cells to convert glycogen back into glucose and release it into the blood. This *raises* blood glucose concentration back to a normal level. This is an example of a **negative feedback loop**.

Diabetes (FT & HT)

Diabetes is when blood glucose levels are not properly maintained.

Type 1: affects young people and is not linked to lifestyle. The pancreas does not produce enough insulin, leading to high blood glucose levels.

Treated with insulin injections.

Type 2 affects older people and is linked to obesity and lack of exercise. The body does not respond to insulin.

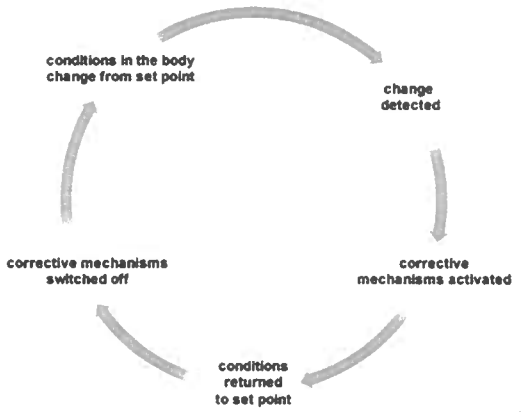
Treated with a carbohydrate controlled diet and exercise.

Box 6 - Negative Feedback - Higher tier

Negative feedback is an important concept in homeostasis. Secretion of correcting hormones is stimulated by a change from the normal level of a condition in the body. The hormone brings the condition back under control, so its release is no longer stimulated. The level of many hormones can be controlled in this way.

Thyroxine, secreted by the thyroid gland, is controlled by negative feedback. Thyroxine stimulates the **basal metabolic rate** – the baseline for the speed of chemical reactions in the body. This is important in growth and development.

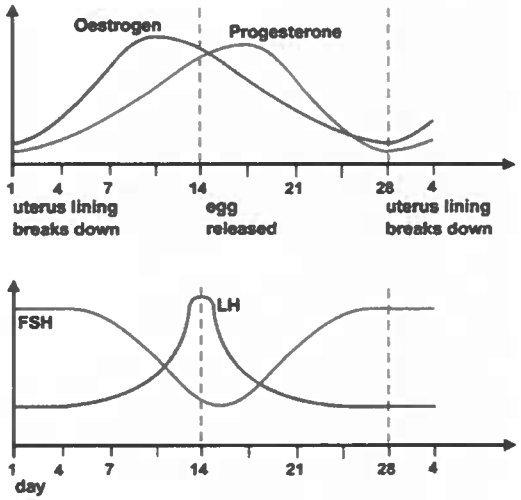
Adrenaline is released by the adrenal glands when a person is scared or stressed. It increases the **heart rate**, increasing the delivery of oxygen and glucose to the brain and muscles. This prepares the body for 'fight or flight' – combat or running away.



Year 11 Biology Knowledge Organiser – Homeostasis and Response

Box 7 - Reproductive Hormones

During puberty reproductive hormones cause secondary sex characteristics to develop.
Oestrogen is the main female reproductive hormone, it is produced in the ovary. **LH and FSH** are produced after puberty and play an important part in the **Menstrual Cycle.**
Testosterone is the main male reproductive hormone it is produced by the testes and it stimulates sperm production.



Box 8 - Reducing Fertility

Hormones can be used to reduce fertility; Contraception aims to prevent pregnancy. Natural methods are when sex is avoided during periods of fertility (abstinence). Sterilisation, where the sperm duct in the male or the oviduct in the female is cut, is a permanent method of preventing pregnancy.

Combined Pill	A pill taken daily that contains oestrogen and progesterone, preventing the production of FSH (oestrogen) and causing a thick mucus that prevents sperm from entering the uterus (progesterone). 99% effective, but can cause side effects like nausea and headache, no protection from STIs.
Progesterone only pill	This has fewer side effects than the combined pill but it is less effective.
Patches, implants and injections	These contain oestrogen or progesterone and release hormones continuously to maintain levels. They are effective as they don't rely on the person taking a tablet.
IUD	An intrauterine device, this T-shaped device is inserted into the uterus to kill sperm and prevent the implantation of the egg.
Barrier Methods	Condoms worn over the penis during intercourse prevent sperm from entering the vagina. A diaphragm is a shallow plastic cup that fits over the cervix, the entrance of the uterus forming a barrier, it is used with a spermicide gel to disable or kill the sperm.

Key Terms	Definitions
Menstrual Cycle	The 28 day female reproductive cycle where an egg is released every 28 days.
Oestrogen	It causes the lining of the uterus to grown, it stimulates (starts) the release of LH and inhibits (stops) the release of FSH.
FSH	Follicle-Stimulating Hormone - produced in the **pituitary gland** - causes an egg to mature in one of the ovaries & stimulates the ovaries to produce **oestrogen**.
LH	**Lutenising Hormone** - produced by the **pituitary gland** - stimulates the release of the egg at day 14 of the cycle.
Progesterone	Produced in the ovaries by the remains of the follicle after ovulation - maintains the lining of the uterus during the second half of the cycle. When the level of progesterone falls, the lining breaks down. (Menstruation – Period) Progesterone inhibits (stops) the release of LH and FSH.
Contraception	A method used to avoid pregnancy

Box 9 - The use of hormones to increase fertility/ treat infertility - HT

In some females the level of FSH and LH is too low to allow eggs to mature. They can be given FSH and LH to stimulate (start) ovulation. This allows females to conceive (get pregnant). It doesn't always work and may need to be repeated (making it expensive). The female may then have too many eggs produced causing multiple pregnancies.
In Vitro Fertilisation (IVF) can also be used if fertility hormones don't work, involving the fertilisation of an egg away from the body. This is an expensive process with a low success rate, this can also lead to multiple births.

1. A woman is given FSH and LH to stimulate egg maturation.
2. The eggs are collected from the mother and fertilised by sperm from the father in the laboratory.
3. The fertilised eggs develop into embryos, one or two embryos are inserted into the mother's uterus. Hopefully, they implant and the female will become pregnant.

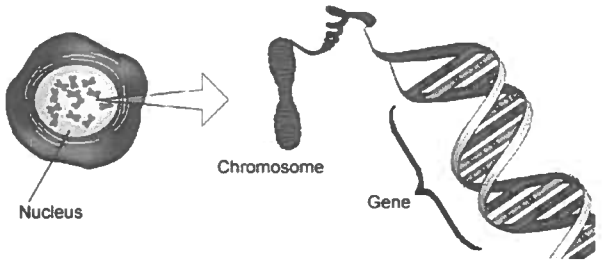
Year 11 Biology Knowledge Organiser
Inheritance, variation and evolution 1 page 1

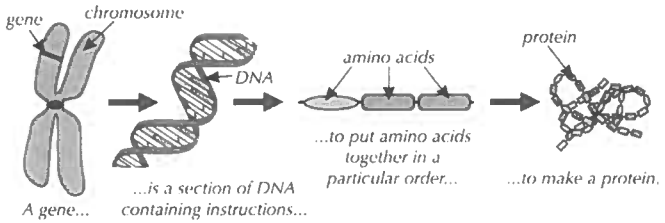
Box 1 - DNA

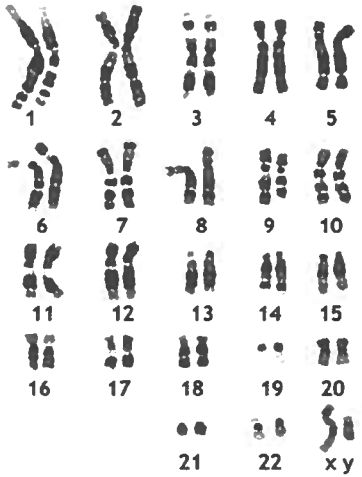
The genetic material in the nucleus of a cell is made of a chemical called DNA. It is a polymer (a very long molecule made up of monomer units that repeat over and over) with two strands that form a spiral called a **double helix.** The DNA contains coded information which are the instructions for the organism. This includes its structure, and all chemicals it needs to function.

DNA is contained in **chromosomes** which are located in the nucleus of cells. Most cells contain a pair of each chromosome. For example, human body cells contain 23 pairs of chromosomes – so 2 of chromosome number 1, 2 of chromosome number 2 etc.

A **gene** is a small section of DNA found on a chromosome. Each **gene** codes for (tells the cell to make) a particular sequence of amino acids which are put together to make a specific protein. There are 20 amino acids that can be used, but they can make up thousands of proteins depending on the order that they are assembled. For example, the **gene** or code for making the hormone insulin (a protein) is different to the **gene** or code for making the enzyme lipase (a protein). The two proteins contain different amino acids in different orders because the genes are different. The DNA in the gene determines the order that the amino acids are assembled when the cell makes new protein.







Key Terms	Definitions
DNA	The chemical that makes up the genetic material in all cells. DNA is a polymer and arranged as a double helix.
Double helix	A double-stranded spiral
Chromosome	Structure in cells containing DNA. Body cells contain two copies of each chromosome – one that originated from the mother and the other that originated from the father.
Gene	A section of DNA found in a chromosome that codes for a specific protein
Genome	The entire (whole) genetic material of an organism

Box 2 - The genome

A genome is the entire set of genetic material in an organism. The human genome has been fully sequenced, so we know exactly the order of genes on each chromosome.
The micrograph shows the 23 pairs of chromosomes found in human body cells, where pair 23 is the sex chromosomes (XY in this person).

Understanding the human genome is very useful for science and medicine for many reasons, including:

- Identifying genes in the genome linked to different types of disease
- Understanding which genes are linked to inherited diseases could help us to understand them better and help develop effective treatments for them
- Tracing human migration patterns from the past. All modern humans descended from a common ancestor who lived in Africa and now have tiny differences in their genomes which can be traced to understand when and how populations split off in a different direction.

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Box 3 - Types of reproduction

There are two types of reproduction: sexual and asexual.

- **Sexual reproduction** involves <u>two</u> parents. Mixing of genetic information occurs as the male and female gametes (produced during meiosis) fuse which leads to genetic variety in offspring. The offspring inherit 50% of the genetic information from each parent and will exhibit characteristics of both parents. The offspring is *genetically unique*.
- **Asexual reproduction** involves only one parent and there is **no** fusion of gametes. There is **no** mixing of genetic information. This leads to *genetically identical* offspring (they are **clones**). No meiosis takes place (since there are no gametes); only mitosis is involved.

Box 4 - Meiosis

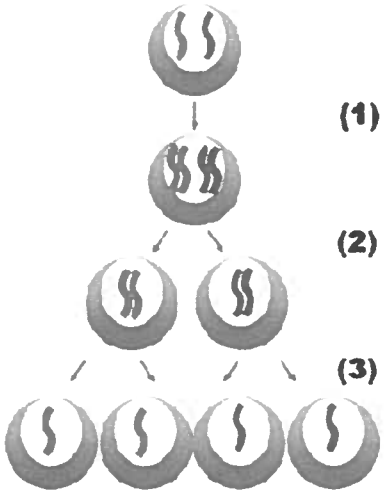
Meiosis and **mitosis** are both types of cell division. **Mitosis** is carried out by cells for growth and repair. Cells produced are genetically identical to the original (parent)

Meiosis takes place in **reproductive organs** and results in the formation of **gametes**. Gametes are sex cells. The female gamete is the **egg cell** (in animals and plants). The male gamete is the **sperm cell** in animals and **pollen** in plants. Cells produced are genetically different to the parent cell.

In all body cells, the chromosomes appear in pairs (in humans, there are 23 pairs, so 46 chromosomes altogether). Red blood cells are the exception as they have no nucleus and therefore no DNA.
Gametes contain **half** the number of chromosomes of body cells, since they contain one from each chromosome pair. In humans, this means that each gamete contains 23 single chromosomes.

When a cell divides to form gametes:

- Copies of the genetic information are made – each chromosome doubles (1)
- The cell divides twice (2) and (3) to form four gametes, each with a single set of chromosomes
- All gametes are genetically different from each other (3) and from the parent cell. They are non-identical.
- Each gamete contains half the number of chromosomes of the parent cell.

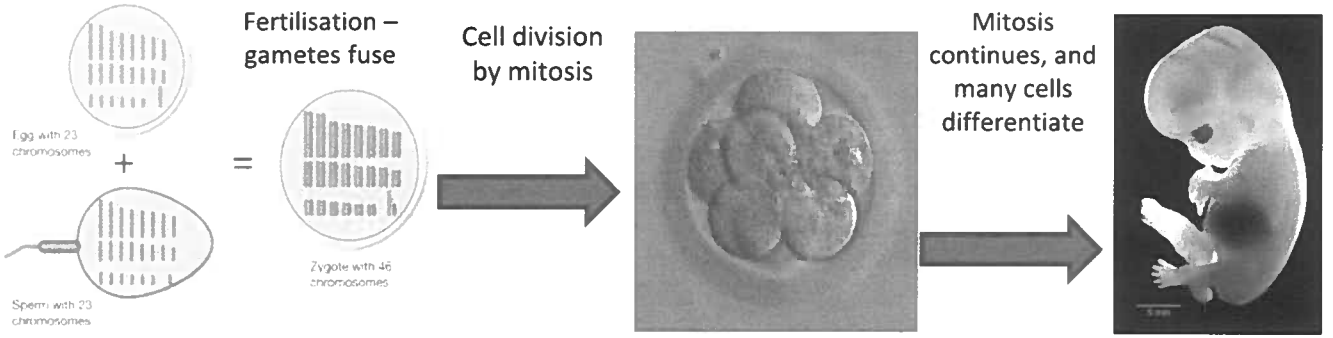


Gametes made during meiosis

Key Terms	Definitions
Reproduction	Making offspring. All organisms reproduce.
Reproductive organs	Meiosis to form gametes takes place in testes and ovaries in animals, and anthers and ovaries in flowering plants.
Offspring	Offspring is a generic term for children – it applies to any type of organism.
Gametes	Sex cells, such as pollen, egg cells, sperm cells. Gametes are produced by meiosis.
Meiosis	Type of cell division that produces gametes.
Fusion	The joining/fusing of gametes in sexual reproduction.
Differentiation	The process of becoming a specialised cell. Specialised cells are the result of differentiation of **stem cells**.
Clone	An organism that is genetically identical to another organism

Box 5 - Fertilisation

- The **fusion** (joining) of male and female gametes. When the gametes fuse, their nuclei (each containing half the number of chromosomes) join together into one and the genetic information is combined, so that the cell formed has a full set of chromosomes (in pairs again) – This is 46 chromosomes (23 pairs) in humans.
- The new cell divides by mitosis to make a copy of itself. Mitosis repeats many times to produce many new cells in an embryo. As the embryo develops, these cells start to differentiate into specialised cells that make up a whole organism.



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Box 6 - Genetic inheritance

The genes you inherit from your parents control what characteristics you develop. Different genes (on different parts of the chromosome) control different characteristics. Different versions of each gene are called **alleles**. During fertilisation, two gametes (each containing single chromosomes and therefore single alleles) fuse. The fertilised egg will have 2 alleles for each characteristic – one inherited from the mother and one from the father.
Most characteristics are determined by genes interacting, but some characteristics are determined by a single gene, or rather, the two alleles of a single gene. For example fur colour in mice and re-green colour blindness in humans. In genetic diagrams, letters are used to represent alleles.

The alleles present in an individual organism, or genotype, operate at a molecular level to develop characteristics that can be expressed as phenotype.

E.g. Cat fur length. Allele for short fur is dominant (F). The allele for long fur is recessive (f)
In picture 1, both parents are homozygous dominant (genotype: FF). This means all the gametes they produce will all contain the allele F for short fur. , At fertilisation the only possibility is for the offspring to have **genotype** FF. So all their offspring have the short fur **phenotype**.

In picture 2, both parents have long hair, so have the genotype ff (homozygous recessive). Gametes produced all have the f allele, so all their offspring must have long hair too. (ff)

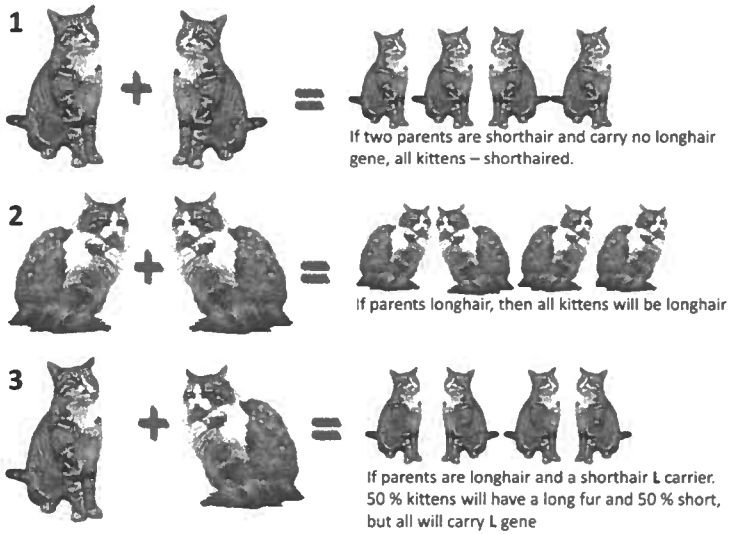
In picture 3, the first parent has short hair but is heterozygous (genotype: Ff) – so they produce gametes with either F or f allele. When they mate with a long hair cat (ff), the offspring will have genotypes either Ff or ff. Half of them will have short hair (with genotype Ff) and half will have long hair (with genotype ff).

Box 7 - Probability and ratios

Knowing the genotypes of the parents allows you to work out the **probability** of each genotype (and therefore phenotype) in the offspring. It does not guarantee, like in the bottom cat example, that they'll have four kittens, or that half will have long hair. What it tells us is: for each kitten, there is a 50% chance of it having long hair.

The other way of saying this is that the **expected ratio** of offspring genotypes is 1:1 for long:short hair. So if the bottom two cat parents had 50 kittens, we'd expect 25 of each hair length.

Key Terms	Definitions
Allele	A form or version of a gene. E.g. the gene for eye colour has 2 alleles, brown and blue
Express	In genetics, to 'express' a gene means for it to be used by the body to make a protein, causing a characteristic.
Dominant	A dominant allele is always expressed, even if only one copy is present. A capital letter is used to represent the allele e.g. D.
Recessive	A recessive allele is only expressed if two copies are present. A lower case letter is used to represent the allele e.g. d.
Genotype	The alleles present for a characteristic. Often represented with two letters: e.g. DD, Dd or dd.
Phenotype	The physical characteristic that results from a particular genotype.
Trait	Another word for characteristic.
Homozygous	Describes a genotype where both alleles are the same – e.g. DD is homozygous dominant; dd is homozygous recessive.
Heterozygous	Describes a genotype where the two alleles are different (one dominant, one recessive) – e.g. Dd.



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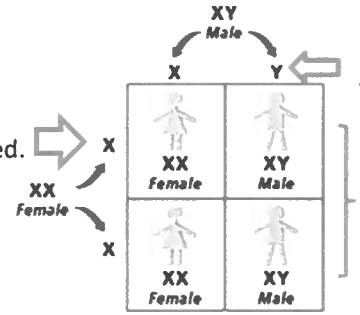
Box 8 - X and Y Chromosomes

There are 23 pairs of chromosomes in every human body cell. 22 pairs control body characteristics and the 23rd pair determines sex – whether the offspring is male or female. The 23rd pair can be XY or XX
Males have an X and a Y chromosome, XY – the Y chromosome causes male characteristics.
Females have 2 X chromosomes, XX.

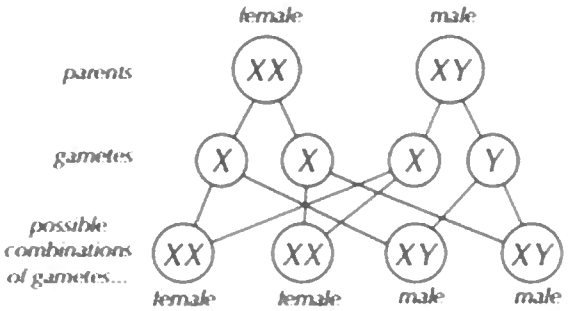
During meiosis to form gametes in males, the 23rd pair (XY) get separated. Half of the sperm cells formed by meiosis will carry single X chromosomes and the other half will carry single Y chromosomes. All eggs formed by meiosis in females will carry a single X chromosome.
On fertilisation when the gametes fuse and the chromosomes pair up, there is a 50% chance that the offspring will be male (XY) and a 50% chance the offspring will be female. The Punnett square diagram below shows this. The genetic diagram also shows possible offspring genotype.

On the side, the possible female gametes are placed.



On the top, the possible male gametes are placed.

The possible combinations are shown inside the squares. The ratio of female:male is 2:2, simplifying to 1:1.



Box 9 - Genetic crosses, Punnett Squares and Ratios

It is possible to calculate ratios of **possible** genotypes and phenotypes in specific genetic crosses by using Punnett squares. Possible offspring genotypes are shown in the highlighted coloured squares.
Using the fur length in cats from the previous page as examples, remember the allele for short fur is dominant, shown by F, and the allele for long fur is recessive shown by f

1. Genetic cross – one homozygous dominant parent and one homozygous recessive parent (FF x ff)

		Gametes	
		f	f
Gametes	F	Ff	Ff
	F	Ff	Ff

Genotype of offspring: 100% heterozygous
Phenotype of offspring: All short fur

2. Genetic cross – two heterozygous parents

		Gametes	
		F	f
Gametes	F	FF	Ff
	f	Ff	ff

Genotype of offspring: 25% homozygous dominant: 50% heterozygous: 25% homozygous recessive (1:2:1)
Phenotype of offspring: ratio of short fur to long fur:
75% : 25% or 3:1

3. Genetic cross – one homozygous dominant parent and one heterozygous parent

		Gametes	
		F	f
Gametes	F	FF	Ff
	F	FF	Ff

Genotype of offspring: 50% homozygous dominant: 50% heterozygous (1:1)
Phenotype of offspring: All short fur

<u>Don't forget:</u> Punnet squares allow us to make predictions – sometimes nature doesn't always follow maths! Practice yourself: genetic cross Ff x ff. What are the ratios?

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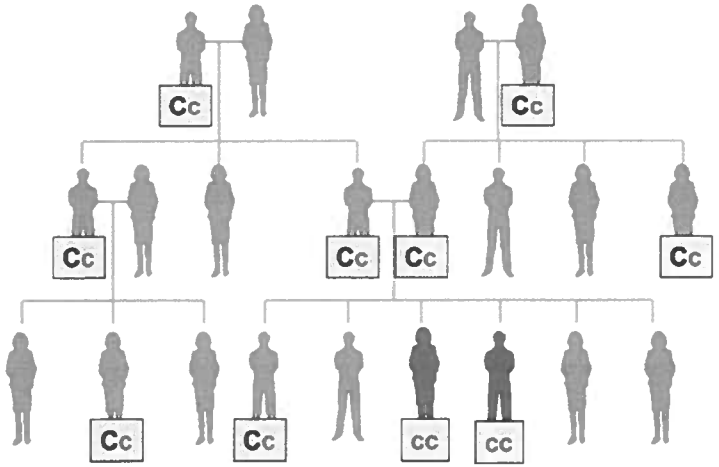
Box 10 - Inherited disorders

A genetic disorders is a disorder caused by the inheritance of certain alleles., which can be passed on to an individual's offspring.
Two examples to know:

- **Polydactyly**: a condition where people have extra fingers or toes. This is caused by a dominant allele, so only one copy of the allele is needed to have the condition.
- **Cystic fibrosis**: a disorder of cell membranes, leading to thick and sticky mucus being produced in the lungs and intestines. It is caused by a recessive allele (c), so individuals with cystic fibrosis are all homozygous recessive (cc). As the allele for cystic fibrosis is recessive, heterozygous individuals are healthy **carriers** of the allele. If both parents are carriers of the recessive allele (Cc), there is a 1 in 4 chance of the child having cystic fibrosis.

Studying family trees can help genetic scientists decide whether a disorder is caused by a recessive or dominant allele. In the family tree shown, C is the allele for healthy cell membranes, and c is the allele for disordered cell membranes (cystic fibrosis). Both parents must have at least one c to have children with cystic fibrosis, as the family tree shows



Cc – heterozygous carrier

cc – homozygous recessive – person with cystic fibrosis

CC – where no genotype is shown

Key Terms	Definitions
Screening	The practice of checking for a disease or an inherited disorder.
Carrier	An individual with one copy of the recessive allele that causes an inherited disorder (e.g. Cc for the cystic fibrosis genotype). As a result, they don't have the disorder, but they can pass one allele for it onto their offspring.
Genetic cross	A term given to mating between two individuals, producing offspring.
Punnett square	A tool used to predict the outcome of a genetic cross.

Box 11 - Embryonic Screening

Embryonic screening is a way of detecting inherited disorders, such as cystic fibrosis, by checking for the presence of these known alleles, either in embryos produced during IVF, before they are implanted, or from the placenta of an embryo already in the mother's uterus.
Screening can be used to inform whether an embryo should be implanted in the uterus (IVF), or, if used during pregnancy, to decide whether a termination should take place.
There are arguments for and against embryonic screening and can be divided into 3 groups, economic (£), social (S) and ethical (E).

For	Against
Helps to stop people suffering from certain disorders as if termination or non-implantation is chosen, less people will be born with inherited disorder (E)	Screening embryos is expensive (£), so no available to everyone because of cost (S)
Could reduce healthcare costs associated with treating disorders (£)	Risk of miscarriage when screening embryos already in the mother's uterus (E)
If an inherited disorder is diagnosed in a pregnancy, then the parents have the choice to have a termination (E)	Implies that people with genetic disorders are less desirable within society (S)

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Box 1 - Variation

Variation is the differences in the characteristics of individuals in a population. There are 2 types of variation:

- **Genetic variation** – In sexual reproduction, fusion of gametes results in the offspring inheriting genes from both the mother and the father. No two members of a species are genetically identical (except for identical twins!) Some characteristics are determined only by genes e.g. eye colour in humans, blood group, some inherited disorders. There is usually extensive (a lot of) genetic variation within a population of a species.
- **Environmental** variation - Some differences are only due to the conditions in which an organism developed and lives e.g. light intensity in plants. High light intensity results in good growth and a larger plant than one growing in low light intensity

Most characteristics are determined by a mixture **of genetic and environmental factors** e.g. health in humans. Some people are more likely to get heart disease because of their genes, but lifestyle choices (environmental) will affect the risk of getting heart disease.

Box 2 - Mutations and Variants

A mutation is a change in an organism's DNA that results in the gene being altered. A genetic variant is formed. Sometimes gene mutations lead to changes in the protein that the gene codes for. Overall:

- Mutations happen continuously;
- most mutations will not affect the phenotype at all;
- some will influence the phenotype (maybe change it a bit);
- very few mutations cause a total change leading to a new phenotype. This is rare.

If the new phenotype formed makes the organism better suited to the environment, it will lead to a relatively rapid change in the species, by **natural selection**.

Box 3 - Formation of new species

A species is a group of organisms that can breed together to produce **fertile** offspring.
Over long periods of time, the phenotype of different populations of an organism can change due to natural selection. This is usually because the two populations live in a different environment.
If two populations of one species become so different in phenotype that they can no longer interbreed (breed together) to produce fertile offspring, they have formed two new species.

Key Terms	Definitions
Variation	The differences in the characteristics of individuals in a population.
Genetic variation	Differences in the genome between individuals.
Genetic variant	Different versions of a gene that arise from a mutation
Mutation	A change in an organism's DNA. – so the gene is altered resulting in a genetic variant being produced.
Evolution	Change in the inherited characteristics of a population over time through **natural selection**, which may result in the formation of a new species.
Natural selection	The process that changes the inherited characteristics of organisms over time.
Species	A group of organisms that can breed together to produce fertile offspring
Fertile	An organism can reproduce to produce healthy offspring

Box 4 - Evolution

Evolution is the change in inherited (genetic) characteristics of organisms over time. Charles Darwin proposed **The Theory of Evolution by Natural Selection.**
It states that:

- All species of living things have evolved from simple life forms that first developed more than 3 billion years ago
- A population of organisms shows variation – there are **variants** in the population for each characteristic
- The organisms are in **competition** to survive
- Only the variants with the phenotypes best suited to the environment survive
- Surviving variants then reproduce
- The genes for the successful phenotype get passed to the offspring and become more common in the next generation. This continues from generation to generation.
- The changing of the inherited characteristics of a population over time is evolution

Darwin's theory was not widely accepted at first due to lack of evidence, lack of understanding of the mechanism of inheritance and widely held religious views that God was responsible for creation of life. Now, it is the most widely accepted theory of how life evolved.

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Box 5 - Evidence for evolution

Darwin's Theory of Evolution by Natural Selections is now widely accepted as more evidence has emerged to support it. Evidence for evolution includes:

1. The fossil record – used by Darwin when proposing his theory but more evidence has been discovered that supports his theory
2. Scientists now understand the mechanism of inheritance of characteristics by offspring through genes.
3. Scientists understand how resistance to antibiotics evolved in bacteria.

Box 6 - Fossils

Fossils are the 'remains' of organisms from millions of years ago, which are found in rocks.
Fossils may be formed:

1. From parts or organisms that have not **decayed** because one or more of the conditions needed for decay by microorganisms are absent. Microorganisms require oxygen, water, and the correct temperature & pH in order to decay dead organisms. E.g. of fossils include mammoths frozen in glaciers (too cold), insects in amber (no oxygen)
2. Bones, teeth and shells (hard parts of the animals) are replaced by **minerals** from the surrounding rocks as they decay leaving a rock-like substance shaped like the original part
3. Preserved **traces** of organisms – so not their actual bodies, but impression traces like footprints, droppings, burrows and the traces of roots.

Fossils can show how much or how little different organisms have changed as life has developed on Earth.

The Origins of Life on Earth

Scientists cannot be certain about how life began on Earth. There is a lack of valid evidence. Many early forms of life were soft-bodied (without hard parts), and so have left very few traces behind.
What traces there were have been mainly destroyed by geological activity (movements of tectonic plates and volcanic activity. This means the fossil record is **incomplete.**

Box 7 - Extinction

Extinction is when no living individuals of a species remain. The fossil record contains many species that are now extinct. Species become extinct because:

- The environment changes too quickly e.g. destruction of habitat so the species does not evolve quickly enough to survive.
- A new predator kills them all
- A new disease kills them all
- They can't compete with another (new) species for food
- A catastrophic event kills them all (e.g. volcanic eruption or meteor

Key Terms	Definitions
Fossil	The remains of organisms from millions of years ago, found in rocks. They are formed in different ways – see main text.
Mutation	A change in the DNA of an organism. Occurs continuously.
Strain	A variant of microorganism within a species – so they are not a different species to other variants, but have a key difference in their phenotype (e.g. being resistant to an antibiotic). New strains are produced by **mutations**.
Resistant strain	Describes a variant form of bacteria with resistance to a specific antibiotic.
MRSA	An example of a resistant strain of bacteria. that can cause increased surgical recovery times in hospitals
Extinction	When there are no remaining individuals of a species still alive.

Box 8 - Antibiotic resistant bacteria

Bacteria can evolve rapidly because they reproduce at a rapid rate – every 20 minutes if conditions are favourable.
Mutations in the DNA of bacterial pathogens produce new **strains** (see keywords)
Some strains of bacteria might be **resistant** to an antibiotic. When a person is infected by bacteria of a certain species, and is treated for the infection using antibiotics, resistant strains are NOT killed. They survive and reproduce, passing the gene for resistance to their offspring. The population of resistant strain increases. The resistant strain will then spread because people are not immune to it and there is no effective treatment. An example of one such antibiotic resistant strain of bacteria is MRSA.

To reduce the rate of development of antibiotic resistant strains

- doctors should not prescribe antibiotics for non-serious or viral infections (antibiotics don't kill viruses)
- Patients need to **finish the course** of antibiotics they get prescribed, so all bacteria are killed and none survive to mutate and form resistant strains.
- Agricultural use of antibiotics in **agriculture** should be restricted

Development of new antibiotics is slow and is unlikely to keep up with the emergence of new resistant strains of bacteria.

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Box 9 - Selective breeding

During selective breeding, domesticated animals or plants are bred for particular **genetic** characteristics that are desirable or beneficial to humans. Humans have been carrying this out for thousands of years since they first bred food crops from wild plants and **domesticated** animals.

1. Parents with the desired characteristic are chosen from a mixed population
2. They are bred together (allowed to reproduce)
3. Offspring with the desired characteristic are bred together.
4. This continues over many generations until all the offspring show the desired characteristic.

Some examples of characteristics that selective breeding is used to obtain: Disease resistance in food crops, Animals which produce more meat or milk, Domestic (pet) dogs with gentle natures, Large or unusual flowers.

Selective breeding can result in **'inbreeding'** where some breeds are particularly prone (susceptible) to disease or inherited defects. This is because by selecting for particular characteristics (therefore alleles), there is a reduction in the number of different alleles in the population and a higher chance of inheriting alleles that cause defects.

Box 10 - Genetic engineering

Genetic engineering is the process of transferring a gene responsible for a desired characteristic from one organism's genome into another organism's so that it also has the desired characteristic. This is done by 'cutting out' the desired gene and transferring it into the cells of another organism.

Genetic engineering has been used to:

- Produce genetically modified bacteria that make human insulin to treat diabetes
- Produce sheep which make drugs in their milk to treat human diseases
- Produce plant crops which are resistant to diseases or which can produce bigger better fruits.

Box 12 - HT: Genetic engineering – the steps

The summary is given left. The steps in more detail:

1. **Enzymes** are used to cut out, or *isolate*, the required gene.
2. This gene is placed in a **vector**, usually a bacterial plasmid or a virus.
3. The vector is used to insert the gene into cells of the second organism (e.g. the food crop).
4. Genes are transferred to the cells of animals, plants or microorganisms at an early stage in their development so the organism develops with the desired characteristic.

Key Terms	Definitions
Selective breeding	The process by which humans breed plants and animals for particular genetic characteristics (also known as artificial selection)
Domesticated	Animals/plants used in agriculture (or for pets) are called domesticated species.
Inbreeding	The result of selective breeding can be inbreeding, where limited genetic variation can make organisms more prone to disease or inherited defects.
Genetic engineering	Modifying the genome of an organism by introducing a gene from another organism, giving a desired characteristic.
Genetically modified	GM for short. Describes organisms (especially crops) that have had their genome modified by genetic engineering.
Yield	The amount of useful product you get from a plant or animal used in agriculture (e.g. mass of fruit).
Vector (HT)	In genetic engineering, a vector is a piece of genetic material used to transfer a gene. It is usually a bacterial plasmid or virus.

Box 11 - Genetic engineering – the benefits and risks

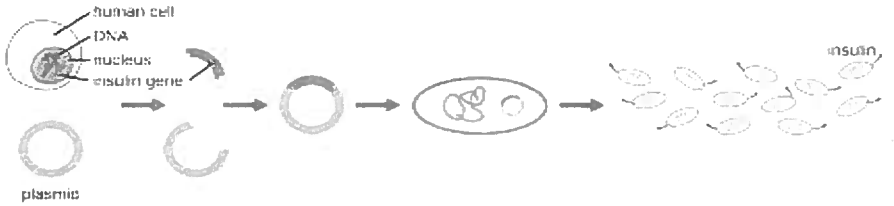
Benefits:

Has the potential to treat disease and modify the human genome to overcome some inherited disorders. **Genetically modified (GM)** crops can produce higher yields of food or can be modified to produce certain nutrients, be resistant to insect attack or herbicides.

Risks/Concerns

Genes from the chromosomes of humans and other organisms can be 'cut out' and transferred to cells of other organisms. This may cause unforeseen problems in the long term.

GM crops may affect the populations of wild flowers and insects. Some people believe that the effects of eating GM crops on human health have not been fully explored.



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Box 13 - Classification

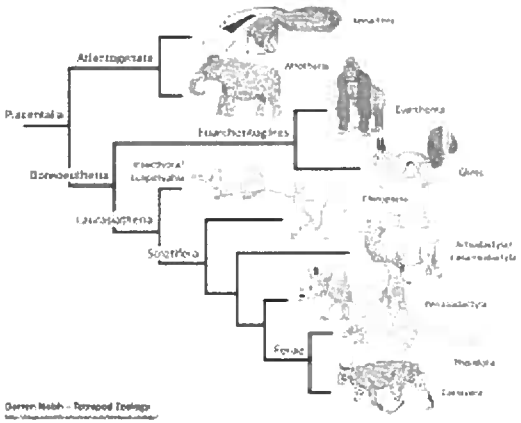
Classification is the sorting of living things into groups to aid identification.
Two methods: The Linnaean system and the three-domain system:

The Linnaean System: Described by Carl Linnaeus in the 1700s. The traditional system sorts according to their **structure** and **characteristics**. Living things are first divided into kingdoms containing all organisms, then sub-divided into smaller and smaller groups.
These groups, in order of size (based on how many organisms fit in each one) are called: **kingdom, phylum, class, order, family, genus** and **species**. You need to remember this (see mnemonic below)

The Three-Domain System: Described by Carl Woese (1990). As evidence of internal structures became more developed due to improvements in microscopes, and the understanding of biochemical processes progressed, new models of classification were proposed. Chemical analysis led Woese to propose the Three-Domain System where all organisms are classified into only 3 groups: **Archaea** (primitive bacteria), **Bacteria** ('true bacteria') and **Eukaryota** (includes eukaryotes – living things with a nucleus, including animals, plants, fungi and protists)

Naming organisms: Uses the Binomial system. Every organism has its own two part name. The first part refers to the **Genus** that the organism belongs to, and the second part is the **species**. See below for the domestic cat, *Felis catus*, and the lion, *Panthera leo*.

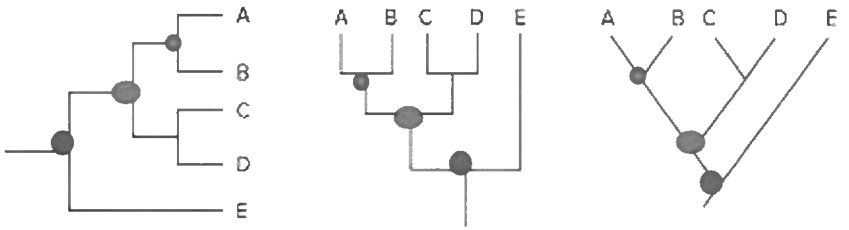
Linnaean system	Domestic cat	Lion	Mnemonic
Kingdom	Animalia	Animalia	King
Phylum	Chordata	Chordata	Prawn
Class	Mammalia	Mammalia	Curry
Order	Carnivora	Carnivora	Or
Family	Felidae	Felidae	Fat
Genus	Felis	Panthera	Greasy
Species	catus	leo	Sausages



Key Terms	Definitions
Classification	The sorting of living things into groups to aid identification. groups. Two methods: The Linnaean system and the three-domain system.
Kingdom	The largest group in the Linnaean system. All organisms are grouped into 5 kingdoms: animals, plants, fungi, bacteria and protists
Biochemistry	The study of chemicals in living organisms, such as DNA, proteins, carbohydrates and lipids.
Three-domain system	A modern model of classification, based on the genetic differences between organisms, builds on Linnaeus' system.
Archaea	**Primitive bacteria** usually living in extreme environments e.g very hot water around volcanic geysers, salt lakes.
Bacteria	'**True bacteria**' e.g. *E.coli, Staphylococcus*. Look similar to Archaea but have many biochemical differences
Eukaryota	All organisms with a **nucleus**: plants, fungi, protists and animals. Includes multicellular organisms and unicellular organisms (that are not bacteria)
Evolutionary tree	A method used by scientists to show how they believe organisms are related. They use current classification data for living organisms and fossil data for extinct organisms.

Box 14 - Evolutionary Trees

These show how scientists think different species are related to each other. They show common ancestors and relationships between species. The more recent the common ancestor, the more closely related the two species – and the more characteristics they're likely to share.
An evolutionary tree starts with one 'trunk' – the **common (distant) ancestor** ● for all species shown (A, B, C, D, E). A and B are closely related as they share a common ancestor ● . They are not as closely related to C and D as their common ancestor is older ● . E is the most distantly related species



Y11 Biology Knowledge Organiser - Ecology 1

Box 1 - Interdependence and competition

Ecology is the study of organisms and their interactions with the environment around them.
All the organisms in the ecosystem depend on each other for survival. This is called **interdependence**.
Ecosystems are made up of communities. These are all of the living organisms within that ecosystem. The community is made up of populations. These are groups of organisms of a particular species within that ecosystem.

Organisms will compete with each other for resources within an environment. They will compete with organisms of the same species and organisms of different species.

Animals will compete for:

- Space (territory)
- Food
- Water
- Mates

Plants will compete for:

- Light
- Space
- Water
- Mineral ions

A stable community is one where all the species and the environmental factors are in balance; as a result, population sizes stay relatively constant.

Box 2 - Adaptations

ALL organisms are adapted to survive their natural environment. Adaptations can be:

- **Structural**: adaptations in terms of body form and shape. This would include examples like: streamlined shape for speed; long stem
- **Behavioural**: adaptations of behaviour – for instance, hunting behaviours.
- **Functional**: adaptations in terms of how the body works. For instance: being able to digest a certain food.

Some organisms are adapted to live in extreme environments – for instance, very high temperatures, high pressures, high salt concentration. The organisms that can survive in these kinds of conditions are called **extremophiles**. Bacteria that live in deep sea hydrothermal vents are extremophiles.

Key Terms	Definitions
Ecosystem	Interaction of a community of living organisms (biotic parts) with the non living parts of their environment (abiotic parts).
Community	All of the populations of different species living within a habitat or ecosystem.
Habitat	The place where an organism is adapted to live.
Population	The organisms of one species living in a habitat or ecosystem.
Interdependence	All organisms in a community rely on one another for food, shelter, pollination, seed dispersal, nutrient recycling
Biotic factors	Living factors affecting a community.
Abiotic factors	Non-living factors affecting a community.

Box 3 - Biotic and abiotic factors affecting organisms

These factors may affect the distribution of organisms (i.e. how they are spread out in the environment), their population size, their growth, behaviour or anything else really.

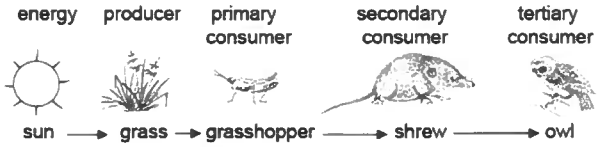
Abiotic factors – non living factors	Biotic factors – living factors
light intensity	food availability
temperature;	new predators arriving
moisture levels	new pathogens
soil pH and mineral content	competition between species
wind intensity and direction	
carbon dioxide level for plants	
oxygen levels dissolved in water for aquatic animals.	

Y11 Biology Knowledge Organiser - Ecology I

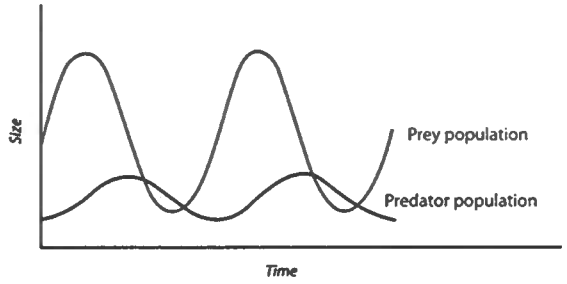
Box 4 – Food chains

Apart from some ecosystems in deep sea vents, ALL biomass on Earth is produced by **photosynthetic** organisms (plants and algae) so these organisms are called **producers**. **Food chains and food webs** represent the feeding relationships in a community..

The producers are eaten by **primary consumers**, which might be eaten by **secondary consumers**.
The secondary consumers may be eaten by **tertiary consumers**.

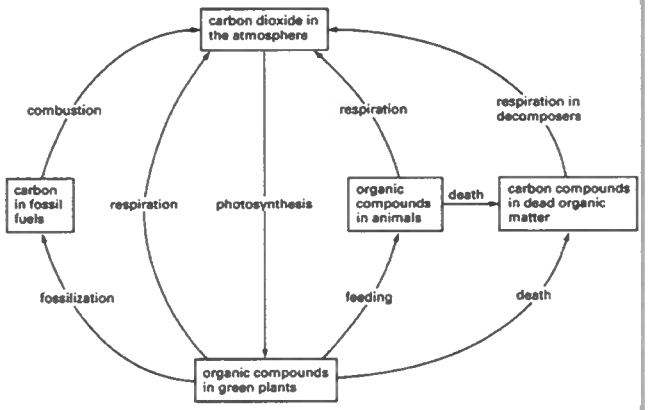


Predators are consumers that kill and eat other animals.
The animals eaten by predators are their **prey**.
In a *stable* community, the population size of predators and their prey rise and fall in Cycles.



Box 5 - Cycling of materials and the carbon cycle

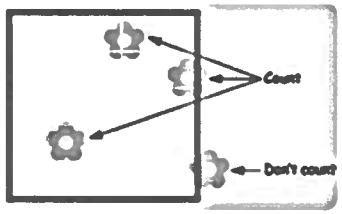
All materials have to be cycled Through the biotic and abiotic components of the ecosystem – e.g. water, carbon, minerals. Microorganisms (bacteria and fungi) play a key role in cycling materials by returning carbon to the atmosphere and mineral Ions to the soil.
Carbon is found in the carbohydrates, Lipids and proteins that living Organisms are built from. Carbon is cycled by the processes below:



- **Photosynthesis** – takes carbon from the atmosphere (in the form of CO_2) and converts it to biomass
- **Respiration** – all living organisms, including plants and microorganisms, respire, which returns carbon dioxide to the atmosphere. While decay is taking place, carried out by microorganisms, they respire, which releases CO_2.
- **Feeding** – when consumers eat other organisms, the carbon in the other organism's biomass is transferred to the consumer.

Key Terms	Definitions
Biomass	The materials that living things are made from: proteins, carbohydrates and lipids.
Distribution	How organisms are spread through an ecosystem.
Quadrat	A square frame of known area used for sampling in an ecosystem.
Transect	Sampling method along a line. This is used to measure the change in distribution of organisms.

Box 6 - Measurements of ecosystems



Sampling techniques are used to measure the population size or distribution of organisms in an ecosystem..

Estimating population size – Quadrat survey

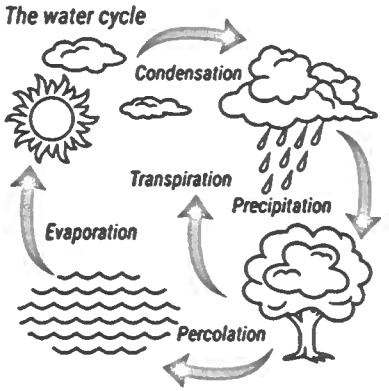
- Measure area being sampled.
- Place quadrat at a number of random positions in the area being sampled. Organisms within the quadrat are counted.
- A mean number organisms is then calculated and then multiplied up by the area being sampled..

Measuring distribution – Transect survey

- A long tape measure is laid down across the area being surveyed.
- A quadrat is laid at regular intervals along the line and the number of organisms being sampled counted each time.
- Other factors (e.g. light intensity) can be measured along the transect line to look for correlation.

Box 7 - The water cycle

Water is constantly cycled in ecosystems.
Water is released in aerobic respiration by all organisms. Water is constantly evaporated from the surface of land and water and from Plants (transpiration) Water vapour then condenses and precipitates (rain). Water precipitated provides fresh water for organisms on land before draining into the sea.



Y11 Biology Knowledge Organiser - Ecology II

Key Terms	Definitions
Biodiversity	The variety of all the different species of organisms on earth, or within an ecosystem.

Box 1 - Biodiversity

Biodiversity, the variety of all the species of organisms on Earth or within an ecosystem.

A great/high biodiversity increases the stability of ecosystems, because it reduces the dependence of one species on another, for instance for food. So, for example, if a species has only one food source (e.g. pandas and bamboo shoots), it may be easily threatened by environmental changes.

Our future as a species on Earth depends totally on maintenance of a good level of biodiversity. Many human activities threaten biodiversity. Indeed, in many ecosystems, we have already significantly reduced biodiversity and we have only recently taken measure to try and stop this reduction

Box 2 - Land use

Humans reduce the amount of land available for other organisms, which reduces biodiversity as habitats and food sources are removed. They do this by:

- Building
- Quarrying
- Farming
- Dumping waste (e.g. landfill).

Peat Bogs

Peat bogs are made of peat, a type of fossil fuel formed from the very slow dead plants.
Peat can be used as a fuel and is used to produce garden compost, so peat bogs are being destroyed.

Destruction of pest bogs reduced biodiversity.
Using peat as a fuel produces CO_2, so contributing to global warming

There is conflict between our need for cheap, available compost and the need to conserve peat bogs and peatlands for biodiversity and to reduce carbon dioxide emissions.

Box 3 - Waste management

The human population is growing at a rapid rate and people's living standards are going up.
This means humans are using more and more resources and producing more and more waste. Our waste causes pollution, which can occur:

- In water, thanks to sewage, fertilisers running off farmland, or toxic chemicals used in industry. Fertilisers cause algae populations to grow rapidly. This blocks light and causes the death of algae and plants. The subsequent decay of these dead organisms causes the oxygen levels in the water to drop. This causes the death of fish and other freshwater invertebrates and biodiversity decreases.
- In the air, from smoke, waste gases and acidic gases (e.g. sulphur dioxide)
- On land, from landfill (rubbish dumps) and from toxic chemicals.

Pollution kills living organisms so therefore it can reduce biodiversity.

Box 4 - Deforestation

Deforestation is the removal of large areas of forest, particularly in tropical areas.

Large scale deforestation happens in tropical areas to:

- to provide land for raising cattle
- to provide land for rice fields
- to grow crops that can be made into biofuels.

Deforestation significantly reduces biodiversity

Deforestation contributes to global warming because:

- It increases the carbon dioxide released into the atmosphere as trees are burnt to clear the land.
- Micro-organisms break down dead plant material and release carbon dioxide when they respire.
- Less carbon dioxide is taken in, as when there are fewer trees, less photosynthesis occurs.

Y11 Biology Knowledge Organiser - Ecology II

Box 5 - Global warming

Since the industrial revolution, human activities (burning fossil fuels, deforestation) have dramatically increased the levels of greenhouse gases in the atmosphere. The main greenhouse gases are carbon dioxide and methane.
The molecules of these gases absorb infrared (heat) radiation and re-radiate it. More of these molecules means more infrared radiation absorbed and re-radiated. This is causing gradual but measurable increases the atmospheres, and therefore Earth's, temperature.

Global warming as caused by humans used to be controversial; now, thousands of peer-reviewed publications later, the global scientific consensus is that humans are causing global warming and climate change .

The consequences of global warming are:
- Rising sea level leading to habitat loss.
- Changes in the distribution of organisms.
- Changes to migration patterns of organisms.
- Reduction in biodiversity.

Key Terms	Definitions
Breeding programme	Producing offspring, especially of endangered species to protect their population.
Field margin	The area around the edge of a field between the crop and the barrier (fence/hedge/wall.)
Hedgerow	The barrier at an edge of a field made of growing plants, as opposed to a fence or wall.

Box 7 - Conflicting pressures

The following factors are conflicting pressures that make global action to tackle problems difficult:
- Costs
- Political agreement
- Need for food and resources for increasing populations and living standards.
- Complex actions needed.

Box 6 - Maintaining biodiversity

As the scale of our negative influence has become more and more apparent, scientists and concerned citizens have brought in programmes to try to reduce our negative impacts on ecosystems and biodiversity.
Examples include;
- **Breeding programmes** for endangered species. For instance, tigers and pandas are bred in captivity to ensure they do not become extinct.
- **Protection** and **regeneration** of rare habitats. This includes passing laws to ensure people leave certain areas alone (e.g. parts of the Great Barrier Reef). Regeneration means activity trying to bring a habitat back to its more former state, which is usually more diverse.
- **Reintroduction of field margins** and **hedgerows** in agricultural areas where farmers only grow one kind of crop. Field margins and hedgerows provide habitats and food sources for more biodiversity in plant and animal life.
- **Reduction of deforestation and carbon dioxide emissions** by some governments. There have been numerous attempts, not always totally successful, to get governments of countries around the world to agree to specific targets for how much carbon dioxide they emit. e.g. Paris Climate agreement.
- **Recycling** resources rather than dumping in landfill.

Field margin, and hedgerow on the left and crop on the right.

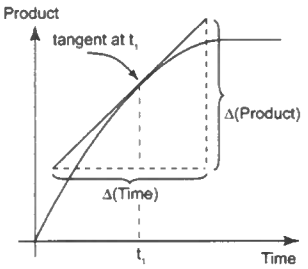
Year 11 Chemistry Knowledge Organiser
The rate and extent of chemical change page 1

Box 1 - Rate of Reaction

The rate of reaction is the speed at which a chemical reaction is happening. This can vary hugely from reaction to reaction.

The rate of reaction can be calculated either by measuring the quantity of **reactant used or the quantity of product made in a certain length of time**. The quantity can either be a volume measured in cm^3 , a mass measure in grams (g) or an amount measured in Moles (mol).

Box 2 - Measuring Rate of Reaction-Higher Tier

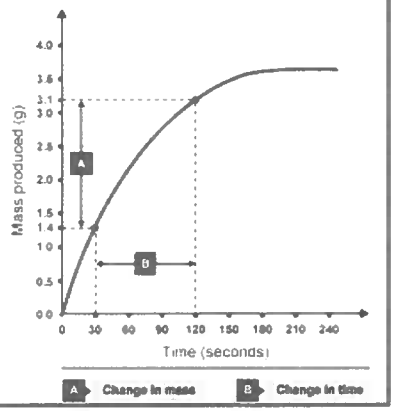


The gradient of a volume or mass/time graph will give you the rate of reaction at a specific time. However when the line is a curve you need to draw **a tangent** to measure the gradient. To draw a tangent follow the following steps

1. Line you ruler up across your graph, so that it touches the line on the point that you want to find out the gradient
2. Adjust the ruler until the space between the ruler and the curve is equal on both sides
3. Draw the line and pick two easy points that will allow you to calculate the gradient of the line.

Box 4 - Calculating the Mean Rate of Reaction - Higher Tier

To calculate the mean rate of reaction in a given time period using a graph you need to pick two y values on the graph and two x values, calculate the difference (subtract the small values from the large value) and the divide the value on the y axis by the valued on the x axis.



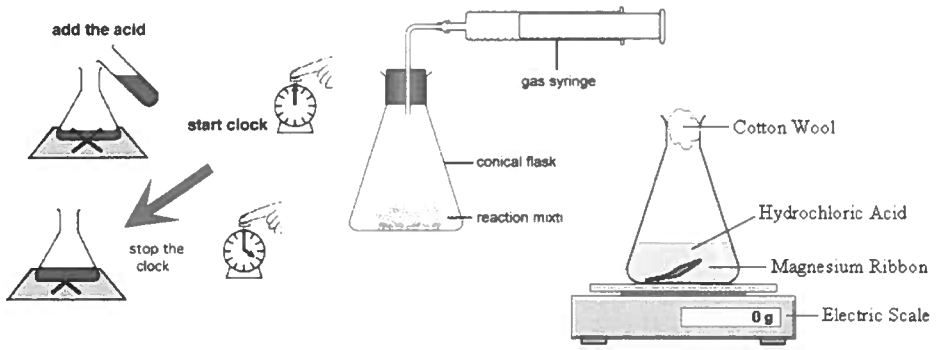
Key Terms	Definitions
Rate of Reaction	The rate at which reactants are being turned into products
Reactant	What is used in a chemical reaction
Product	What is made in a chemical reaction
Catalyst	A substance which speeds up a chemical reaction without being used up
Tangent	A straight line that touches a curve at a point

Equation	Meanings of terms in equation
Rate of Reaction= $\frac{Reactant\ used}{time}$	*Reactant used can either be measured in Moles, grams or cm^3 depending on whether it is a solid or gaseous reactant*
Rate of Reaction= $\frac{Product\ Made}{time}$	*Reactant used can either be measured in Moles, grams or cm^3 depending on whether it is a solid or gaseous product*

Box 3 - Measuring the Rate of Reaction

There are several experiments that can be used to measure the rate of a chemical reaction.

1. Measuring the mass lost in a chemical reaction (marble chips and hydrochloric acid is a good example)
2. Measuring the volume of gas produced (decomposition of hydrogen peroxide is a good example)
3. Time taken to make an X disappear, due to formation of a precipitate (sodium thiosulphate and hydrochloric acid is a good example)

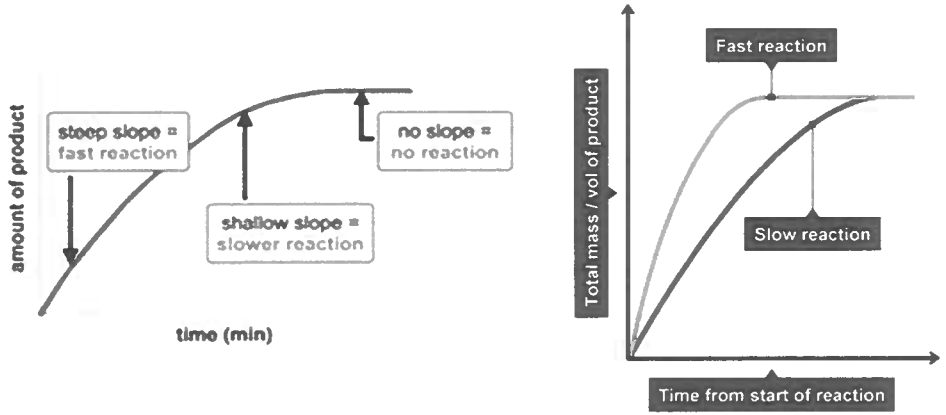


Year 11 Chemistry Knowledge Organiser
The rate and extent of chemical change page 2

Box 5 - Interpreting Rate of Reaction Graphs

The results from rate of reaction experiments can be plotted on a line graph. For example how the mass changes against time or how much gas is made against time. Different lines can be plotted for different conditions, the **steeper the gradient, the faster the reaction.**

It is important to remember that the graphs flatten off (plateau) at the same point as the same amount of reactant is being used.



Box 6 - Collision Theory

Collision Theory: reactions occur when particles **collide** with a certain amount of **energy**.

The minimum amount of energy needed for the particles to react is called the **activation energy**, which is different for each reaction.

The rate of a reaction depends on two things:

· the **frequency** of collisions between particles. The more often particles collide, the more likely they are to react.

· the **energy** with which particles collide. If particles collide with less energy than the activation energy, they will not react.

Key Terms	Definitions
Activation Energy	The minimum energy required for a chemical reaction to take place
Collision Theory	The theory that states for a chemical reaction to happen, particles must collide with sufficient energy
Gradient	The measurement of how steep a line is on a graph
Frequency	The amount of times something happens in one second
Concentration	The number of particles in a given volume

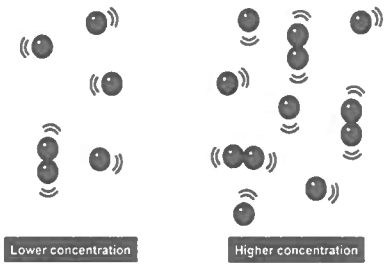
Box 7 - Factors which affect Rate of Reaction

Being able to slow down and speed up chemical reactions is important in everyday life and in industry. We can change the rate of a reaction by:

· Changing temperature
· Changing pressure (gaseous reactions)
· Changing the concentration of a solution
· Changing the surface area
· Adding a catalyst

Box 8 - Collision Theory - Concentration

If the concentration of a solution is increased then there are more particles in a given volume, therefore collisions are **more frequent** and the chemical reaction is faster. Concentration **is directly proportional** to rate of reaction (if you double the concentration you double the rate).



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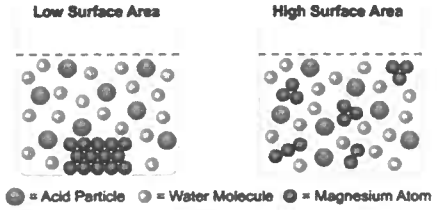
The rate and extent of chemical change page 3

Box 9 - Collision Theory - Temperature

When you increase the temperature of something the particles will move around faster, this increases the **frequency of the collisions.** As well as that, as the particles are moving faster the particles collide with more energy making it more likely that collisions exceed the **activation energy.**

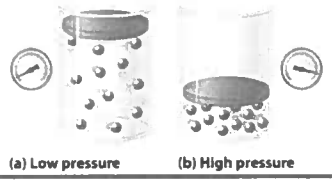
Box 10 - Collision Theory - Surface Area

When you increase the surface area of a solid (you cannot increase the surface area of a liquid or gas). You increase the number of particles that are available for collision, therefore increasing the frequency of collisions therefore increase the rate of reaction.



Box 11 - Collision Theory - Gas pressure

If the reaction is carried out in the gaseous state, then increasing the pressure will increase the rate of reaction. If there are more particles in a given volume of gas, then collisions will be more frequent and therefore the reaction will be faster.

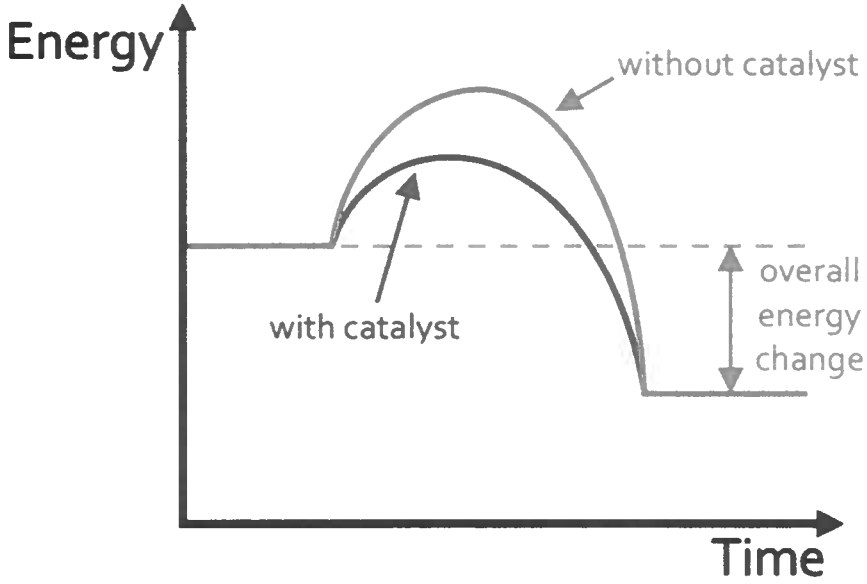


Key Terms	Definitions
Enzymes	A biological catalyst
Reaction Profile	A graph which show the energies of the reactants and products at different stages of the chemical reaction

Box 12 - Collision Theory - Catalysts

A catalyst is a substance which speeds up a chemical reaction without being used up. It speeds up a reaction because it **lowers the activation energy** needed for the reaction, by providing an alternative reaction pathway and this means that there are more **successful collisions and a faster reaction.**

The effect of a catalyst is shown on the reaction profile below:



Catalysts are not included in a chemical equation as they are not used up in a chemical reaction.

Box 13 - Enzymes

Enzymes **are biological catalysts**, they speed up chemical reactions in biological systems for example in digestion in animals. Unlike catalysts enzymes have an optimum temperature where they work best, this is usually around 37.

Year 11 Chemistry Knowledge Organiser
The rate and extent of chemical change page 4

Box 14 - Reversible reactions

In some chemical reactions, the products of the reaction can react together to produce the original reactants. These reactions are called reversible reactions. They can be represented in the following way:

$$A + B \rightleftharpoons C + D$$

The symbol ⇌ has two half arrowheads, one pointing in each direction. It is used in equations that show reversible reactions:

- the forward reaction is the one that goes to the right
- the backward reaction is the one that goes to the left

The reaction mixture may contain reactants and products, and their proportions may be changed by altering the reaction conditions.

Box 15 - Ammonium chloride

Ammonium chloride is a white solid. It breaks down when heated, forming ammonia and hydrogen chloride. When these two gases are cool enough, they react together to form ammonium chloride again.

This reversible reaction can be modelled as:

ammonium chloride ⇌ ammonia + hydrogen chloride

$$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$$

Box 16 - Energy changes in reversible reactions

If a reaction is exothermic in one direction, it will be endothermic in the other direction. The same amount of energy is transferred in both the forwards and reverse reaction.

Copper sulfate

Blue copper sulfate is described as hydrated. The copper ions in its crystal lattice structure are surrounded by water molecules. This water is driven off when blue hydrated copper sulfate is heated, leaving white anhydrous copper sulfate. This reaction is reversible:

hydrated copper sulfate ⇌ anhydrous copper sulfate + water

$$CuSO_4.5H_2O(s) \rightleftharpoons CuSO_4(s) + H_2O(l)$$

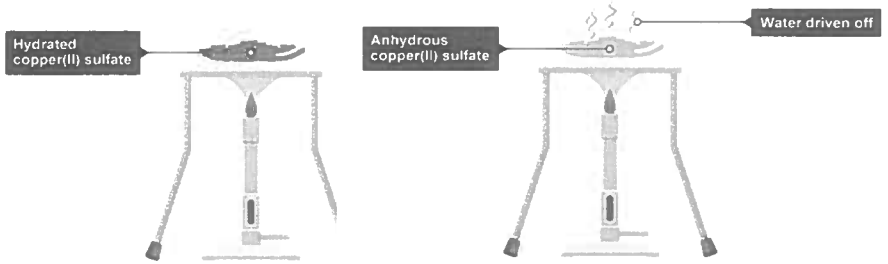
The forward reaction is endothermic and the reverse reaction is exothermic.

Key Terms	Definitions
Reversible	A chemical reaction which can go both ways.
Anhydrous	A substance containing no water.
Hydrated	Containing water of crystallisation, which can be removed by heating strongly.

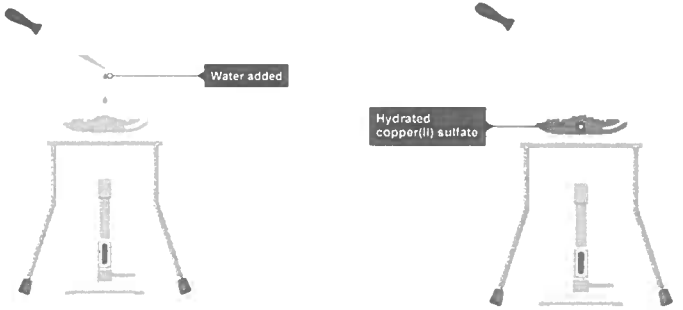
Box 17 - Dynamic equilibrium

When a reversible reaction happens in a closed container, it reaches a dynamic equilibrium. At equilibrium:

- the forward and backward reactions are still happening
- the forward and backward reactions have the same rate of reaction
- the concentrations of all the reacting substances remain constant



1. Hydrated copper sulfate is heated.
2. Water is driven off



3. Water is added to anhydrous Copper sulfate
4. Hydrated copper sulfate reforms

Year 11 Chemistry Knowledge Organiser
The rate and extent of chemical change page 5

Box 18 - Chemical reactions are reversible and may reach a dynamic equilibrium in a closed system. The position of equilibrium of a reversible reaction can be altered by changing the reaction conditions. The equilibrium position of a reversible reaction is a measure of the concentrations of the reacting substances at equilibrium.

Box 19 - Background to the Haber process

Nitrogen gas is reacted with hydrogen gas to make ammonia gas. The forward reaction is exothermic.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The equilibrium position is:

- to the left if the concentrations of N_2 and H_2 are greater than the concentration of NH_3
- to the right if the concentration of NH_3 is greater than the concentrations of N_2 and H_2

Key Terms	Definitions
Equilibrium	In chemical reactions, a situation where the forward and backward reactions happen at the same rate, and the concentrations of the substances stay the same.
Equilibrium position	A measure of the relative concentrations of substances in an equilibrium, showing if there are more reactants or products at equilibrium.

Box 20 - Le Chatelier's principle

The equilibrium position changes due to the following reaction conditions:

- changing the pressure
- changing the concentration
- changing the temperature

When a change is made to a system at equilibrium, **the position of equilibrium moves to counteract the change that was made**.

For example, if the **temperature is increased**, the position of equilibrium moves in the direction of the endothermic reaction, **reducing the temperature**.

Box 21 - Changing the concentration

If the concentration of a reactant (on the left) is increased, the equilibrium position moves in the direction away from this reactant, and so more of the products are produced (on the right). If one of the products is removed from a reaction (on the right), then the position of equilibrium moves to the right to make more of that product.

Box 22 - Changing the pressure

If the pressure is increased in a reaction involving gases, the equilibrium position moves in the direction of the fewest molecules of gas, to reduce the pressure. There are fewer molecules on the right-hand side of the equation for the Haber process:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

$$1 + 3 = 4 \text{ molecules} \qquad 2 \text{ molecules}$$

If the pressure is increased, the equilibrium position moves to the right.

Box 23 - Changing the temperature

In a reversible reaction, if the reaction is exothermic in one direction, it is endothermic in the other direction. If the temperature is changed, the dynamic equilibrium position moves in the direction of the reaction that will reverse the change.

For example, in the Haber process:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

(forward reaction is exothermic, reverse reaction is endothermic)

If the temperature is increased, the endothermic reaction is favoured – here, the reverse reaction, so the equilibrium position moves to the left and the temperature is reduced (endothermic reactions absorb energy). This means that less ammonia (NH_3) is produced.

Year 11 Chemistry Knowledge Organiser
Organic Chemistry page 1

Box 1 - Crude Oil

Crude oils is a mixture of chemicals called hydrocarbons.

- These are compounds that contain **hydrogen and carbon atoms only. It is made from ancient sea creatures, mainly plankton.**
- Crude oil straight out of the ground is not much use.
- Crude oil is a mixture of different hydrocarbons, called **fractions**.
- Crude oil is separated into the different fractions that each has its own use.
- The process of separating crude oil into fractions is called fractional distillation, which is possible because the different hydrocarbons (fractions) in crude oil each have **different boiling points**.

How does fractional distillation work?

- Crude oil is heated so it vaporises/boils/turns to a gas.
- The vapours rise up the column, which is cooler towards the top.
- The vapours gradually cool as they rise and condense at their boiling points.
- Hydrocarbons with different size molecules condense at different levels/temperatures.
- The crude oil is separated into a series of fractions with similar numbers of carbon atoms and boiling points. These are called fractions.

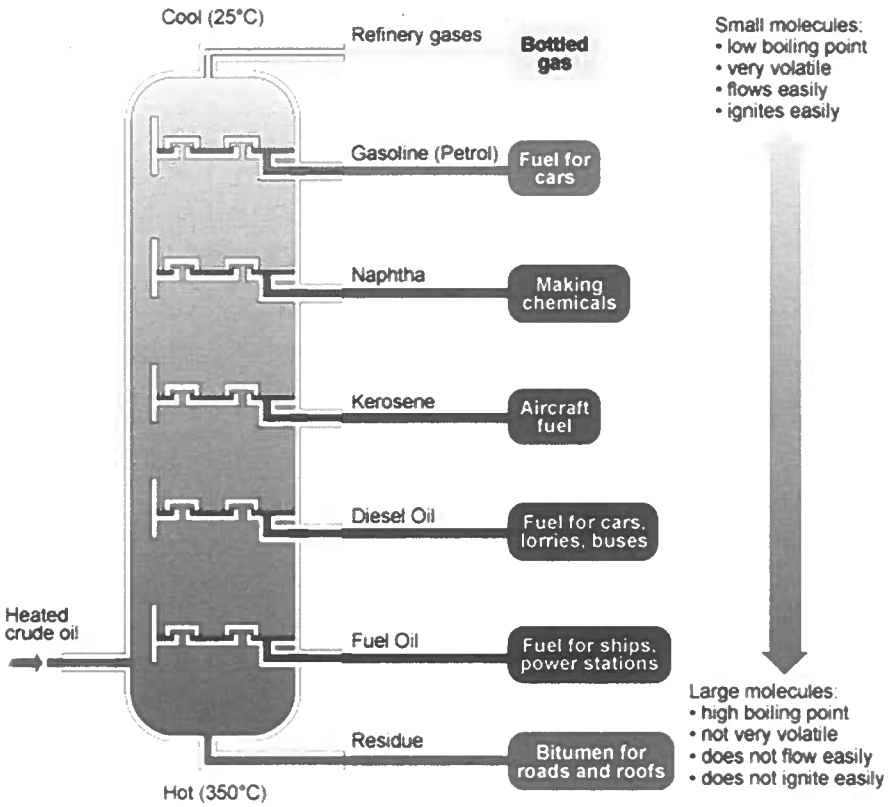
As the number of carbon atoms increases:

- The chains become longer
- Boiling point increases
- Flammability decreases (catches fire less easily)
- Viscosity increases (liquid becomes thicker)

Key Terms	Definitions
Hydrocarbon	A compound which contains only hydrogen and carbon (covalently bonded)
Fractional Distillation	The process where crude oil is separated into different compounds through evaporation
Viscosity	The ability of a liquid to flow

Box 2 - Fractional Distillation Column

Below is a diagram of a fractionating column; you need to know the uses but not the names of each fraction:



Year 11 Chemistry Knowledge Organiser
Organic Chemistry page 2

Box 3 - Alkanes

Crude oil is largely made up of a family of hydrocarbons called alkanes

- Alkanes are saturated hydrocarbons - these contain only a single covalent carbon to carbon bonds.
- General formula for an alkane - C_nH_{2n+2}
- you can either represent alkanes with a **molecular formula**:

CH_4 C_2H_6 C_3H_8 C_4H_{10}

or a **displayed formula**:

Methane Ethane Propane Butane

C – carbon, H – hydrogen, the lines indicate covalent bonds

Box 4 - Cracking

- Shorter hydrocarbons are useful as fuels, however crude oil contains fewer of these molecules than is needed. Longer chain hydrocarbons have uses, but crude oil contains more of these longer chain hydrocarbons than is needed.
- The solution to this **supply and demand** issue is to break longer chain hydrocarbons down into short ones using a process called **cracking.**
- **Cracking** is a thermal decomposition reaction that uses heat to break down the longer chain hydrocarbons.

How Cracking Occurs

EITHER: Long chain hydrocarbons are **heated**, turned into a vapour and passed over a hot catalyst in catalytic cracking

OR: Long chain hydrocarbons are mixed with **steam** and heated to very high temperatures

Cracking produces two products:

1. Shorter alkane(useful as a fuel) 2. An alkene (used to make polymers).

Summary

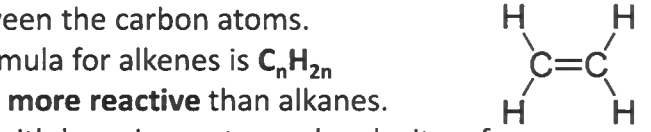
Long Chain Alkane → Short Chain Alkane + Alkene

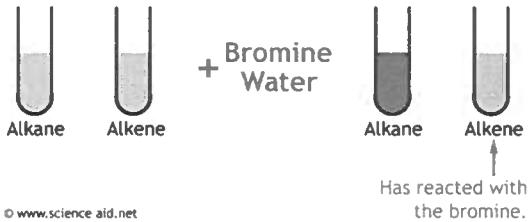
$C_{10}H_{22}$ → C_8H_{18} + C_2H_4

Key Terms	Definitions
Alkane	A hydrocarbon that contains only carbon to carbon single bonds
Cracking	A process where longer chain hydrocarbons are broken down into smaller more useful ones. There are 2 ways - by catalytic cracking or steam cracking.
Alkene	A hydrocarbon that contains at least one carbon to carbon double bond.

Box 5 - Alkenes

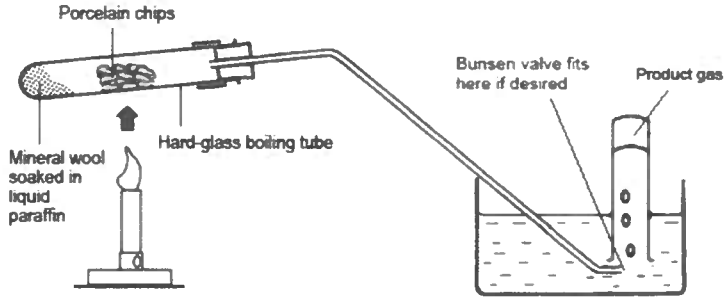
- Alkenes are unsaturated hydrocarbons have at least one double bonds between the carbon atoms.
- General formula for alkenes is C_nH_{2n}
- Alkenes are **more reactive** than alkanes.
- They react with <u>bromine water</u> and make it go from orange to colourless.
- Alkanes do not have a double bond so the bromine water stays orange.





Box 4 - Cracking Reaction Diagram

Experimental set up for catalytic cracking:



Y11 Chemistry Knowledge Organiser - Chemical Analysis

Box 1 - Pure and Impure Substances

- In everyday life, a pure substance is something that has nothing added to it, so it is unadulterated – e.g. pure milk, pure honey. In terms of chemistry, these are mixtures.
- In chemistry, pure substance contains only one type of element or compound.
- An impure substance is a mixture.

Box 2 - Melting Point and Boiling point

- A chemically pure substance will melt or boil at a very specific temperature.
- Impurities decrease the melting point and increase the range of temperatures over which a substance will melt.
- Impurities increase the boiling point of a substance and increase the range of temperatures over which a substance will boil.

Box 3 - Formulations

- Formulations are mixtures that are designed as useful products. They are often complex mixtures with lots of different components (parts).
- Formulations are made by mixing the components in carefully measured quantities so the product has the correct properties.
- Examples of formulations include paint, fuels, cleaning agents, medicines, alloys, fertilisers, food.

Box 4 - Gas Tests

:

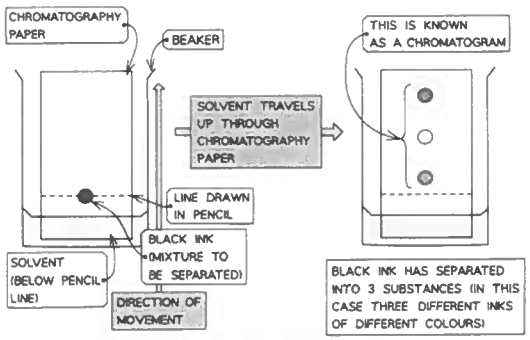
Hydrogen - Place a lit splint into the gas and there is a squeaky pop.

Oxygen – Place a glowing splint in to the gas and the splint relights.

Chlorine – Place damp litmus paper into the gas and the litmus paper bleaches.

Carbon dioxide – Bubble the gas through limewater and the limewater turns cloudy.

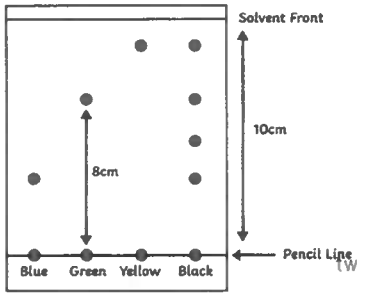
Box 5 – RP: Chromatography



Key Terms	Definitions
Pure substance (chemistry)	A substance made of a single element or compound and not mixed with any other substance.
Melting point	The temperature at which a substance melts or freezes/solidifies.
Boiling point	The temperature at which a substance boils or condenses
Formulations	Complex mixtures that are designed as useful products.
Chromatography	A technique where mixtures can be separated based on their solubility.
Stationary phase	The phase that doesn't move (i.e. the filter paper)
Mobile phase	The solvent (normally water) which moves up through the stationary phase.
Rf value	The ratio between the distance travelled by the substance and the distance travelled by the solvent.

Box 6 - Chromatography and Rf values

- Chromatography can be used to separate mixtures and can be used to identify substances.
- Chromatography involve two phases:
  - stationary phase where particles can't move (the filter paper in most cases).
  - mobile phase - the solvent (for example water) which moves up the paper.
- Separation depends on the distribution of substances between the stationary phase and the mobile phase.
- The ratio of the distance moved by the spot and the distance moved by the solvent is called the Rf value. It is always a value <1
- Rf= $\frac{Distance\ travelled\ by\ the\ substance}{Distance\ travelled\ bu\ the\ solvent}$
- Different compounds will have different R_f values in different solvents.
- A pure substance will produce a single spot in all solvents.



Rf green = 8 ÷ 10 = 0.8

Y11 Chemistry Knowledge Organiser
Chemistry of the Atmosphere

Box 1 - The Atmosphere

For 200 million years, the amount of different gases in the atmosphere have been much the same as they are today:

- 78% nitrogen
- 21% oxygen
- The atmosphere also contains small proportions of various other gases, including carbon dioxide, water vapour and noble gases.

Box 2 - The Evolution of the Atmosphere

Scientists are not sure about the gases in the early atmosphere, as it was so long ago (4.6 billion years) and due to the lack of evidence.
Many scientists believe the early atmosphere was made up of mainly carbon dioxide, water vapour and small amounts of methane, ammonia and nitrogen, released by **volcanoes. There was little or no oxygen around at this time.**

Oceans - The early Earth was very hot, but as it cooled the water vapour in the atmosphere condensed and **formed the oceans.**

Decreasing carbon dioxide - As the oceans formed, carbon dioxide dissolved in the ocean. The carbon dioxide formed carbonates which precipitated out (formed solids). This process reduced the amount of carbon dioxide in the atmosphere.

Decreasing carbon dioxide and increasing oxygen - Approximately 2.7 billion years ago algae evolved and soon after this oxygen appeared in the atmosphere. Over the next billion years plants evolved. This decreased the amount of carbon dioxide in the atmosphere and increased the amount of oxygen in the atmosphere as they carried out photosynthesis

When sea animals evolved they used the carbon dioxide in the ocean to form their shells and bones (which are made of carbonates). When these sea creatures died their shells and bones became limestone (calcium carbonate), which is a sedimentary rock.

Once enough oxygen was in the atmosphere, it allowed animals to evolve.

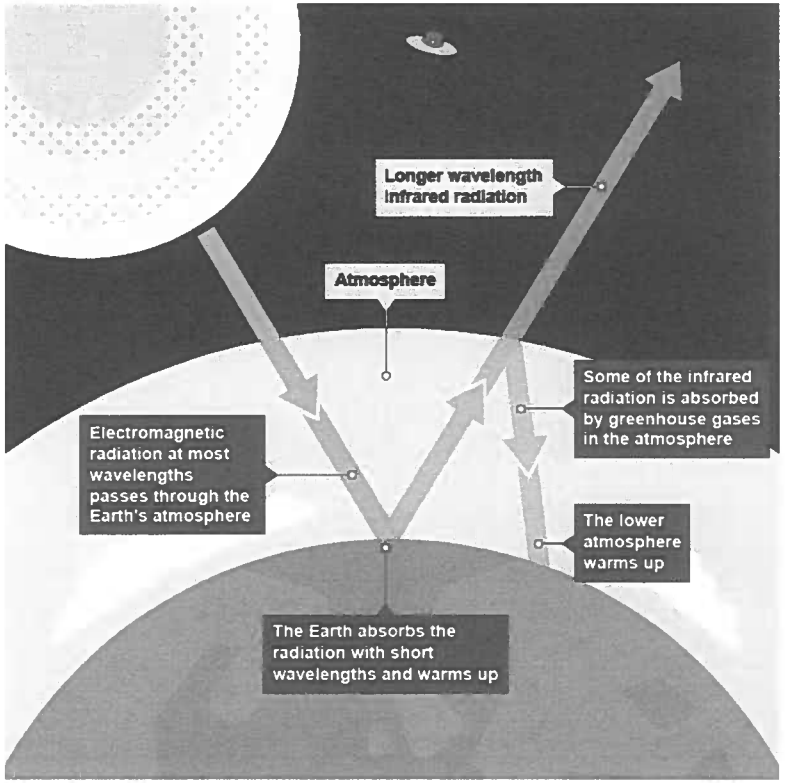
Box 3 - The Greenhouse Effect

The Earth's atmosphere contains greenhouse gases. These gases, which include carbon dioxide, methane and water vapour, maintain the temperature on Earth high enough to support life.

The greenhouse gases allow the short wave infrared radiation emitted by the Sun to pass through it but absorbs the long wave infra red radiation which is emitted by the Earth. This is how it insulates the Earth.

Some human activities increase the amounts of greenhouse gases in the atmosphere. These include:

- combustion (burning) of fossil fuels
- deforestation
- methane release from farming and destruction of peat bogs.
- more animal farming (digestion, waste decomposition)

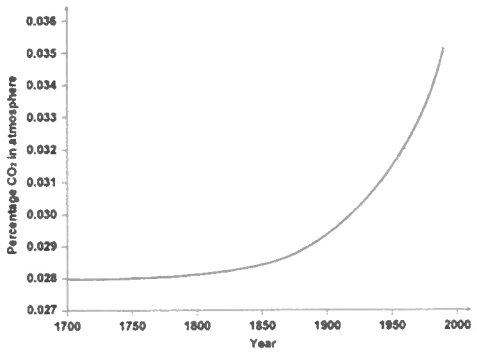


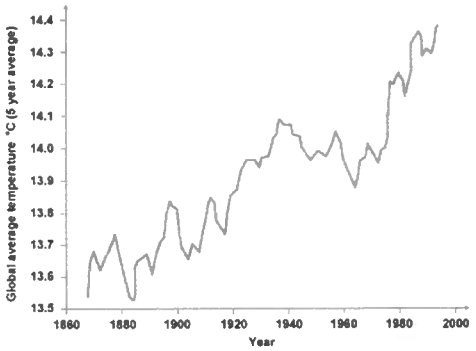
Y11 Chemistry Knowledge Organiser
Chemistry of the Atmosphere

Key Terms	Definitions
Peer reviewed evidence	This is evidence that has been scrutinised by other independent scientists to check for bias, inaccuracy and any flaws in the design of the investigations or data gathering.

Box 4 - The Enhanced Greenhouse Effect

Humans activities have enhanced the greenhouse effect through combustion of fossil fuels, increased farming and deforestation and destruction of peat bogs.
There is correlation between the increased levels of greenhouse gases in the atmosphere and the global average temperature. Based on peer reviewed evidence, many scientists believe this has lead to a **rise in global temperature.**





However, this is such a complex system and it is very difficult to model. When simplified models are presented, it can lead to **inaccurate or biased** opinions being reported in the media.

Box 5 - Consequences of Climate Change

An increase in average global temperature is a major cause of **climate change.**
The potential effects of global climate change include:
- melting of polar ice caps and sea level rise, which may cause flooding and increased coastal erosion
- more frequent and severe storms
- changes in the amount, timing and distribution of rainfall
- water shortages for humans and wildlife
- changes in the food producing capacity of some regions
- changes to the distribution and migration patterns of wildlife species.

Box 7 - Carbon Footprint

The **carbon footprint** is the total amount of carbon dioxide and other greenhouse gases released over the life of a product. Many people or businesses look to reduce their carbon footprint by:
- increased use of alternative energy supplies
- energy conservation
- carbon capture and storage
- carbon taxes and licences

People also try to **offset** their carbon by planting trees.
If something is carbon neutral, this means that there is no net increase in **carbon dioxide in the atmosphere** when it is used.

Box 8 - Other atmospheric pollutants

The combustion of fuels is a major source of atmospheric pollutants. When burning fuels, other pollutants are made. The effects of these pollutants are summarised below.

Gas	How are they made?	What is the affect?
Sulphur dioxide	Fuels contain a small amount of sulphur. This reacts with oxygen to form sulphur dioxide	Respiratory problems and acid rain
Nitrous oxides	Oxygen reacts with nitrogen in the air	Respiratory problems and acid rain
Carbon particulates	Is made during incomplete combustion	Can cause global dimming and health problems
Carbon monoxide	Is made in incomplete combustion of a fuel	Is a toxic gas. It is also colourless and odourless

Y11 Chemistry Knowledge Organiser: Using Resources

Box 1 - Water

Water of appropriate quality is **essential for life**. For humans, drinking water should have low levels of dissolved **salts and microbes.** Water that is safe to drink is called **potable water**.

The methods used to produce potable water depend on available supplies of water and local conditions.

In the United Kingdom (UK), rain provides water with low levels of dissolved substances (fresh water) that collects in the ground and in lakes and rivers, and most potable water is produced by:

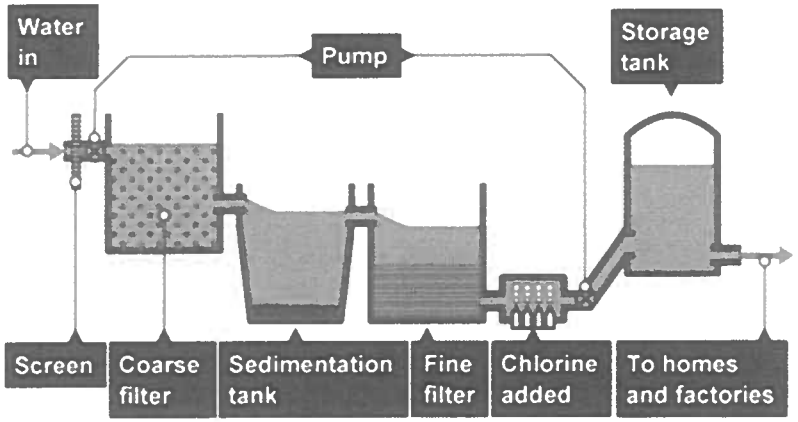
- passing the water through filter beds to remove any solids
- sterilising to kill microbes, using chlorine or UV light

In some parts of the world there is not enough fresh water so the salt has to be removed from water. This process is called **desalination.**

Desalination can be done by distillation or reverse osmosis. This requires a **large amount of energy.**

Box 2 - Waste water and Sewage

Humans are now creating a huge amount of waste water: Water from houses and farming needs to **be treated** before it can be released into rivers and lakes. It is firstly filtered to remove large particles and is then left so that the sediment drops to the bottom. The "sludge," this is the name given to the sediment at the bottom, is then anaerobically digested (broken down by bacteria) to make methane gas. Any remaining **effluent** is broken down by aerobic respiration. The water is then released back into the rivers and lakes.



Key Terms	Definitions
Potable Water	Water which is safe to drink
Phytomining	A copper extraction process using plants
Bioleaching	A copper extraction process using bacteria
Natural resources	Resources that form without human input
Renewable resources	A resource that can be made at the same or similar rate as it is being used
Finite (non-renewable) resource	A resource that isn't being replaced at a quick enough rate to be considered replaceable

Box 3 - Resources

Natural resources form without human input. They include anything that comes from the earth, sea or air. We use them to provide energy for things like heating or travelling, as well as for building materials and food. E.g. , wind is a natural resource used to generate electricity by wind turbines and metals mined from the ground can be used to make metallic objects.

Some of these natural products can be replaced by synthetic products.

e.g.

1. Rubber is extracted from the sap of a tree, but man-made polymers can replace rubber in tyres
2. Wood has been replaced by plastic in many applications e.g. laminate flooring and window frames
3. Cork is produced by trees but has been replaced in wine bottles by a synthetic plastic cork

Agriculture provides conditions where natural resources are enhanced for our needs. E.g. Development of fertilisers has enabled a high yield of crops.

Box 4 - Sustainable development

Sustainable development is an approach to development that takes account of the needs of the present society while not damaging the lives of future generations.

As finite resources run out it is unsustainable to keep using them. Extracting resources uses a great deal of energy and produces large amount of waste. Reducing the use of finite resources, recycling resources and advances in chemistry to develop more sustainable processes in agriculture and industry will preserve more finite resources.

Y11 Chemistry Knowledge Organiser: Using Resources

Box 5 - LCAs

Life cycle assessments (LCAs) are carried out to assess the environmental impact of products in each of these stages of a products life:

1. extracting and processing raw materials
2. manufacturing and packaging
3. use and operation during its lifetime
4. disposal at the end of its useful life, including transport and distribution at each stage.

Some things for example the energy required to make the product are easy to measure. However some things like how much pollution it releases are hard to measure and therefore difficult to give a value to.

Example of an LCA

	Plastic Bag	Paper Bag
Raw Material	Crude Oil	Timber
Manufacturing and Packaging	Made form crude oil by fractional distillation, then cracking and polymerisation, high energy process. Little waste as other fractions are used for other things	Made by pulping timber. Lots of waste, high energy process
Use of product	Has multiple uses, can be reused	Usually only used once
Disposal	Can be recycled but are not biodegradable	Can be recycled and are biodegradable

Key Terms	Definitions
LCA	An evaluation of the environmental impact a product had over its lifetime

Box 6 - Recycling

Many of the Earth's resources are finite: for example, metals and crude oil. It is therefore vital we recycle resources. The processes for extracting these materials are often high energy and damaging to the environment.

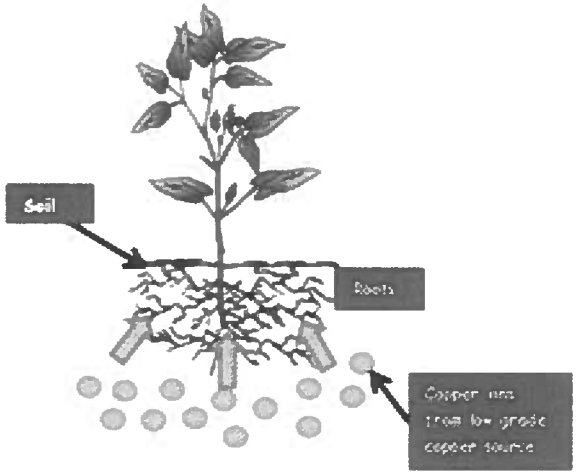
Metals can be recycled by melting and **recasting or reforming** into different products.

Some products, such as glass bottles, can be reused. Glass bottles can be **crushed and melted t**o make different glass products. Other products cannot be reused and so are recycled for a different use.

Box 7 - Higher tier: Other methods of copper extraction

There are new methods to extract copper from low grade ores. These are:

Phytomining uses plants to absorb copper from the soil, the plants are then burnt and the copper extracted from the ashes.



Bioleaching involves using bacteria to make a **leachate** that contains metal compounds. Scrap iron can also be used to **displace copper** from a solution. These methods do not require large scale removal of waste rock, like in other extraction processes.

Year 11 Physics Knowledge Organiser
Forces I page 1

Box 1-Scalar and vector quantities

Scalar quantities have **magnitude** (size) only.

Vector quantities have **magnitude and direction**. Vector quantities are represented using arrows.

Scalar quantities (units)	Vector quantities (units)
Distance (m)	Displacement (m)
Speed (m/s)	Velocity (m/s)
Temperature (°C)	Momentum (kg m/s)
Mass (kg)	Acceleration (m/s^2)
	Forces (N)

Box 2 - Contact and Non-contact Forces

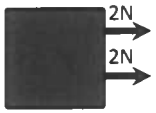
Forces are always the result of objects **interacting** with each other. All forces can be classified as contact or non-contact forces.

Contact forces – forces act when interacting objects are touching.
Non-contact forces – forces act when interacting objects are not touching

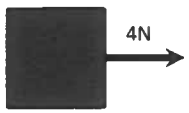
Contact forces	Non contact forces
Friction	Gravity
Air resistance	Electrostatic force
tension	Magnetic force
Normal contact force	

Box 3 -The Resultant Force

In real life, there are usually several forces acting on any given object. The resultant force is the term used for the overall force, when all the forces are taken into account. It's used to determine how an object will move (see Newton's 1st and 2nd Laws). All the forces are shown with vectors (arrows – see above), the resultant force replaces multiple force arrows with just one arrow, which has the same effect on the object as all the other forces acting at once:



Two forces are acting in the same direction:
resultant force is determined by adding the two forces
eg 2N right + 2N right = 4N right



Two forces are acting in opposite directions:
resultant force is determined by subtracting one force from the other
eg 6N left – 2N right = 4N left

Key Terms	Definitions
Scalar quantity	Describes quantities that only have a magnitude (size). E.g. speed (how fast something is moving).
Vector	A quantity with both a size (magnitude) and a direction; vectors can be represented with arrows. E.g. velocity (how fast in a given direction)
Force	Forces are pushes or pulls that act on an object. Forces have size and direction so are vector quantities. Forces are the result of objects interacting with each other.
Contact forces	For these forces to act, the interacting objects have to be physically touching.
Non-contact forces	For these forces to act, the interacting objects don't have to be touching (they are physically separate).
Resultant force	The single overall force acting on an object. It has the same effect as all the forces acting on the object all together.

Box 4 - Resultant Force continued

If the forces acting on an object are equal in magnitude and opposite in direction, then the resultant force is ZERO. You can say the forces are balanced.

Resultant force = '0' (the forces cancel out), the object will keep doing what it was doing – either stationary (not moving at all), or moving along at a constant (steady) speed. Zero resultant force means the direction can't change.
If there is a resultant force, the object's speed will change; or the shape of the object will change; or the direction of the object will change.

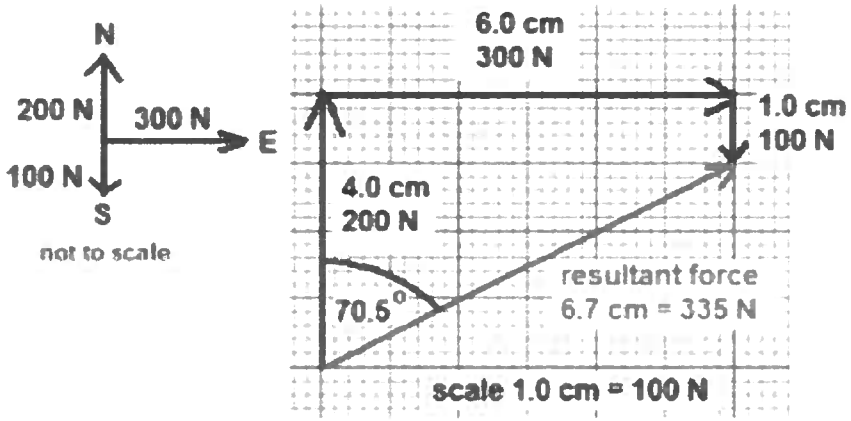
HT – You also need to be able to resolve forces – see higher tier – next page

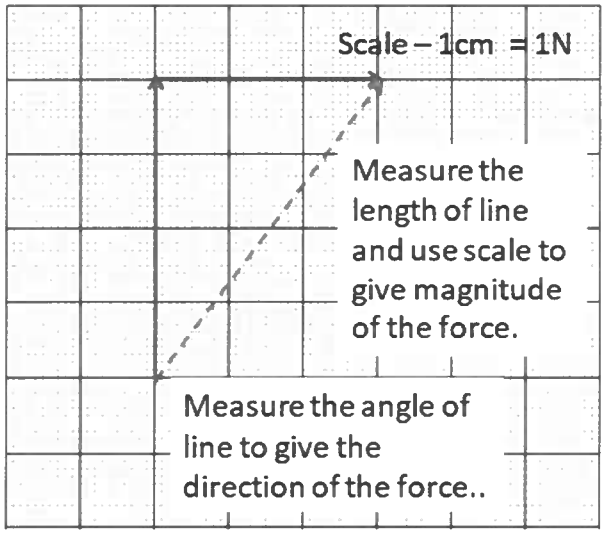
Year 11 Physics Knowledge Organiser
Forces I page 2 (Higher Tier only)

Box 5 – Resolving forces

- The resultant force is easy to calculate where the individual forces are in the same plane (i.e. individual forces are all horizontal or all vertical): add the forces up, considering the signs of the forces – See page 1, Box 3

- Example 1 and example 2 – The force arrows are drawn tail to tip. The shape is completed by the resultant force (dotted arrow in example on the left and and pink arrow in example 2 on the right)

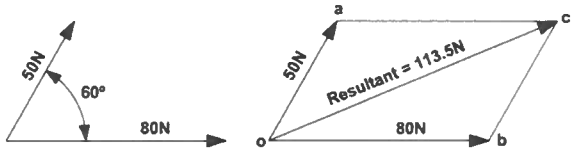




Key terms	Definitions
Vector	A quantity with both a size (magnitude) and a direction; vectors can be represented with arrows.
Force	An interaction between two objects that leads to the objects pushing or pulling on one another
Resultant force	The single overall force acting on an object, which has the same effect as all the individual forces combined. Resultant force is the sum of the individual forces.
Parallelogram	A quadrilateral with two sets of parallel sides (including rectangles)
Resolve	To carry out the process of splitting a force vector that acts at an angle into vertical and horizontal components

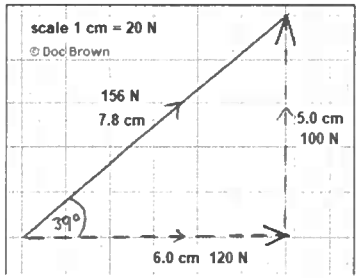
Box 6 – Resolving forces

- If the individual forces are at any angle to each other besides 180°, the **parallelogram rule** is useful: draw a parallelogram using the force arrows; the resultant force is the **diagonal** of that parallelogram.



Parallelogram of Forces

- You can also go the other way: if a resultant force is shown at some angle from the horizontal/vertical, it can be **resolved** into a vertical component and a horizontal component. See example below.



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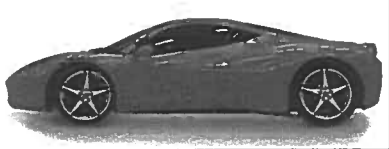
Forces I page 3

Box 7 - Work Done and Energy Transfer
Whenever work is done, it means that energy has been transferred (in other words, energy has transferred from one store to another store). Work is always done when a force acting on an object causes an object to move a distance.
The amount of work done can be calculated using the equation:
Work done = Force x Distance - See equation

For example, a force of 1000 N makes this car move 200 m to the left

The work done is calculated by: $W = 1000 \times 200 = 200\,000$ J
This means 200 000 J of energy was transferred.



Box 8 - Work Done Against Frictional Forces
When objects move, they are almost always moving *against* frictional forces – so the friction arrow is opposite to the direction of motion.
Doing work against frictional forces causes an energy transfer to the thermal store of the object, which raises the temperature of the object (and the surrounding air!). For example, brakes get hotter when used to slow down a car.

Remember, there are frictional forces even when an object moves through the air – often this is called air resistance (but it's just a type of friction).

Box 9 - The Joule
The joule (J) is the unit for energy, and also the unit for work done. It has a particular definition, based on the equation for work done. 1 Joule = 1 Newton metre.
This means that 1 J is the amount of work done when a force of 1 N causes an object to move 1 m.
This is because ***Work done = Force x distance***, so 1 J = 1 N x 1 m

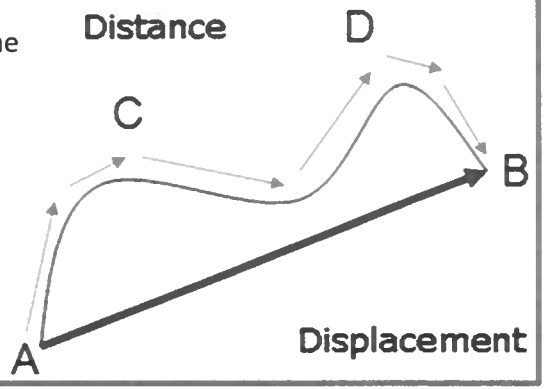
Box 10 - Distance vs. Displacement
Distance is a measure of how far an object moves. It is a **scalar** quantity.
Displacement is a **vector** quantity and is always measured in a straight line from start to end of a journey and includes the direction the object travelled, often given as a compass bearing in degrees. See the diagram in Box 11.

Key Terms	Definitions
Work done	The measure of how much energy is transferred when a force makes an object. You can say: 'a force does work on an object when it makes it move'. Doing work always involves the transfer of energy. This is a scalar quantity.
Distance	How far an object moves. It does not include direction , so distance is a scalar quantity.
Displacement	The distance and direction an object moves in a straight line from where it started to where it stops. This is measured in metres. It is a vector quantity, because it includes the direction an object moved.
Friction	A contact force that results when two objects move past each other. They have to be touching.

Equation	Meanings of terms in equation and units
Work done = force x distance W = F s	*W = work done (joules, J)* *F = force (newtons, N)* *s = distance (metres, m) – aka displacement*

Box 11 - Distance vs. Displacement Diagram
Displacement = straight line from A to B.
e.g. 50m Direction NE. (North East)

Distance is the total length of the journey, with visits to C and D during the journey.
e.g. 85m



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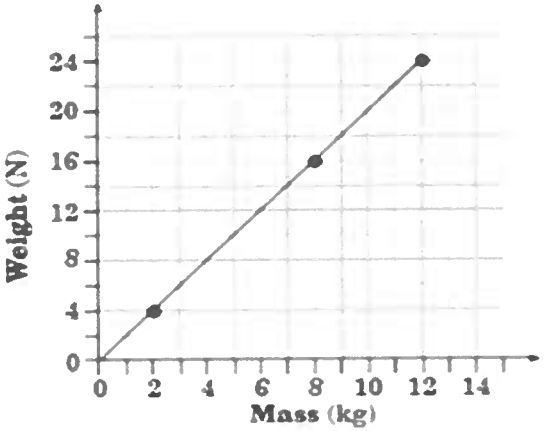
Forces I page 4

Box 12 - Weight

Mass measures how much material there is (in kg) in an object.

Weight measures the **force** acting on an object due to gravity. The force of gravity close to Earth is due to Earth's **gravitational field.**

The weight of an object depends on the gravitational field strength at the point where the object is.



Weight can be calculated.

Weight = mass x gravitational field strength

W = m g

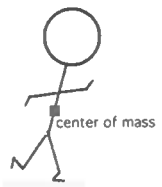
Weight and mass are directly proportional.

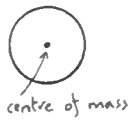
We can show this as:

$W \propto m$, using the symbol for a directly proportional relationship.

Box 13 - Centre of Mass

When drawing force diagrams we show the weight (or other forces) acting on just a single point on the object. This is the exact centre of a symmetrical object (it will be more complicated for an asymmetrical object), and is called the **centre of mass**. Centre of mass is the point where we consider weight to act: as a result, force arrows should start on the centre of mass.





Key Terms	Definitions
Weight	Weight is a **force** (hence, it is a vector quantity), caused by gravity acting on a mass. Since it is a force, it is measured in newtons.
Mass	Mass measures the amount of material in an object, and is measured in kilograms (kg).
Gravitational field strength	The measure of how strong the gravitational field of a large object is. For instance, the gravitational field strength on Earth is about 10 N/kg. This means that a weight of 10 N acts on each kg of mass on Earth.
Centre of mass	The point at which the weight of an object is considered to act – the 'middle' of the object's mass.
Newtonmeter	A device to measure weight. It simply consists of a spring and a calibrated scale.

Equation	Meanings of terms in equation
Weight = Mass x Gravitational field strength W = m g	*W = weight (newtons, N)* *m = mass (kilograms, kg)* *g = gravitational field strength (newtons per kilogram, N/kg) – on Earth, this is 9.8 N/kg*

Box 14 - Measuring Weight

Weight can be measured using a **calibrated** spring balance – a **newtonmeter.** This can be a mechanical or digital newtonmeter.

A calibrated spring is a spring with a scale to show how much it has stretched.

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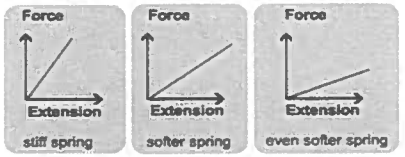
Forces I page 5

Box 15 Forces and Elasticity

Elastic objects are objects that return to their original shape when a deforming force is removed.
Elastic potential store is the energy stored by an object that is under **elastic deformation**. Think of a stretched rubber band – it isn't doing anything, but if you release it the stored energy is transferred to kinetic store, so you can fire it at someone.

Box 16 - Force and Extension/Compression

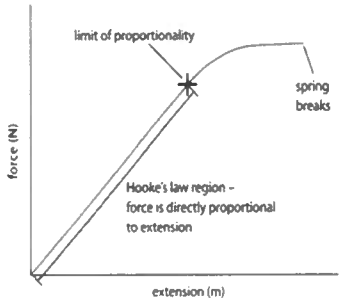
The extension of an elastic object, like a spring, is directly proportional to the force applied to it, provided the limit of proportionality of the spring is not exceeded. This also works with the compression of an object –'*e*' just means the amount of compression.
The **spring constant** measures how much extension you get for your force. A large spring constant means it won't stretch far compared to a spring with a small spring constant, if the same force is applied (see examples above). The spring constant can be calculated from the gradient of a graph of force against extension.



When force is applied to a spring, it moves a distance, so **work is done.** In other words, energy is transferred. The energy gets stored in the spring (or elastic object) in the **elastic potential store *(E_e)***. The amount of elastic potential energy is calculated by the equation shown on the right. If an object has been elastically deformed, the work done on the object and the energy store by the object are the same.

Box 17 – Limit of Proportionality

On graph showing force against extension, you can see when the limit of proportionality is reached by looking at where the graph starts to curve. (Labelled x on this example).



Key Terms	Definitions
Elastic deformation	Deformation (bending, stretching or compressing an object) is elastic if the object returns to its original shape once the force is removed
Deformation	Bending, stretching or compressing an object
Extension	The change in length of an object such as a spring. Subtract length when NO force is applied from the length when a force is applied.
Directly proportional	This term describes a type of relationship between two variables. It is shown by a straight line on a graph that goes through the origin.
Limit of proportionality	The limit of a directly proportional relationship. It can be shown on a graph if the line is straight to being with (indicating a directly proportional relationship) then curves.
Linear relationship	Simply, a relationship between two variables that is graphed as a straight line.
Non-linear relationship	A relationship between two variables that is shown with a curved line on a graph.
Gradient	The gradient of a graph is how steep it is. Calculate gradient by dividing the change in the variable on the y-axis by the change in the variable on the x-axis.

Equation	Meanings of terms in equation
Force = spring constant x extension $F = k e$	*F = force (newtons, N)* *k = spring constant (newtons per metre, N/m)* *e = extension (metres, m)*
Elastic potential energy = 0.5 x spring constant x extension² $E_e = 0.5\ k\ e^2$	*E_e = elastic potential energy (joules, J)* *k = spring constant (newtons per metre, N/m)* *e = extension (metres, m)*

Y11 Physics Knowledge Organiser – Forces II

Box 1 - Speed

Speed is a scalar quantity. It does not involved a direction. The speed of a moving object is rarely constant. The speed a person walks runs or cycles at depends on many factors including age, terrain, fitness and distance travelled.

Typical speeds:

- Walking - ~ 1.5m/s
- Running - ~3.0m/s
- Cycling -~6.0m/s
- Speed of sound in air - ~330m/s

Box 2 - Velocity

Velocity a vector quantity. It is the speed in a given direction, so we can show velocity with an arrow.

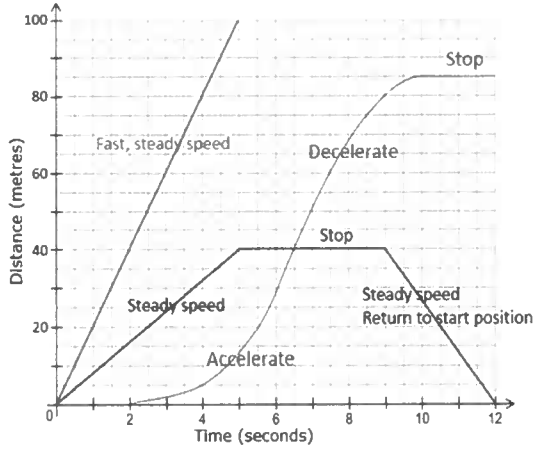
Box 3 - Acceleration

Acceleration is the measure of how quickly velocity changes. It is a vector quantity, because direction is included. Acceleration occurs if there is a change of speed and/or a change of direction. Acceleration can be calculated.

Box 4 - Distance-time Graphs

A distance-time (DT) graph shows how far an object has gone from its starting point at a certain time.

Finding the speed of the object = Calculating the gradient (steepness of the slope) tells you the speed of the object.

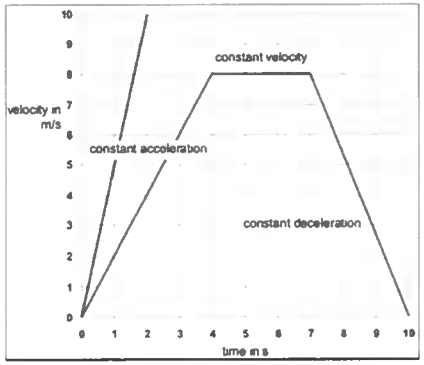


Box 4 - Velocity-time Graphs

A velocity-time (VT) graph shows the velocity of an object at any particular time on its journey.

Finding the acceleration of the object = Calculating the gradient of a slope.

Finding the distance travelled by the object = Calculating the area under the graph.

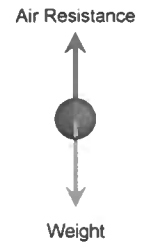


Key Terms	Definitions
Velocity	Velocity is a vector quantity. Like speed, it is a measure of how quickly distance changes BUT it includes the direction of movement. It is measured in m/s
Gradient	Gradient means slope. The gradient of a line on a graph is found by dividing the vertical (y-axis) change by the horizontal (x-axis) change.
Acceleration	Acceleration is the rate of change in velocity. You must recall that objects in freefall near Earth's surface have an acceleration of 9.8 m/s^2.
Deceleration	A **negative** acceleration – slowing down.

Equation	Meanings of terms in equation and units
s = vt	***Distance = Speed x time*** *s = distance (m)* *v = speed (m/s)* *t = time (s)*
$a = \frac{v-u}{t}$	**Acceleration =<u>Final velocity-initial velocity (change in velocity)</u>** **Time taken** *v = final velocity (m/s)* *u = initial (starting) velocity (m/s)* *a = acceleration (m/s^2)* *t=time*

Box 5 - Freefall through a fluid (gas, like air, or a liquid)

A freefalling object initially accelerates due to gravity, but friction (/air resistance) increases with speed until the forces are balanced (resultant force = 0 N). Then, the object is falling at a constant speed called its **terminal velocity**.



Box 6 – Circular motion – Higher tier only

An object that is moving in a circle can have a constant speed, but a constantly changing velocity. This is because even if speed is the same, the object constantly changes direction.

Y11 Physics Knowledge Organiser - Forces II

Box 7- Newton's First Law

Newton's First Law
The law says that if the resultant force on an object is zero:
- Stationary objects stay stationary
- Moving objects keep moving at the same velocity (same speed and direction)

Newton's first law tells us:
- Objects moving at a constant speed in the same direction have a driving (push) force exactly equal to the resistive forces (like friction);
- Velocity (speed and direction) will only change if there is a resultant force acting (so the resultant force is NOT zero).
- If an object changes direction, it must have a resultant force acting upon it (i.e. the resultant force is not zero).

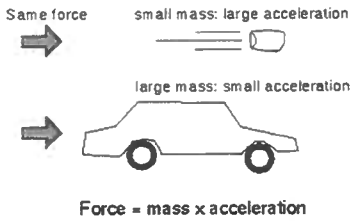
Box 8 - Newton's Second Law

Objects accelerate if there is a resultant force acting on them. The amount of acceleration is proportional to the magnitude of the resultant force and inversely proportional to the mass of the object. (see equation)

This means that when the resultant force on an object increases, the acceleration will increase by the same proportion. E.g. Double the resultant force and the acceleration will double.

When the mass of an object increases, the acceleration of the object decreases.

Newton's second law is summarised by the equation F=ma



Box 9 - HT only: Inertial mass

Inertial mass measures how difficult it is to change the velocity of an object. It is defined as the ratio of force over acceleration.

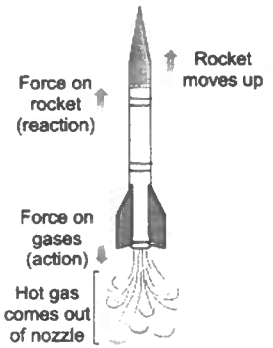
For instance, it requires more force to slow down (change the velocity) a lorry compared to a bike. It also requires more force to make a lorry accelerate compared to a car.

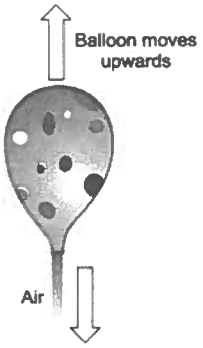
Key Terms	Definitions
Stationary	Not moving. The velocity is 0.
Newton's First Law	The law says that if the resultant force on an object is zero: ➢ Stationary objects stay stationary ➢ Moving objects keep moving at the same velocity (same speed and direction)
HT inertia	Inertia is the tendency of objects to continue in their state of rest or of uniform motion (.i.e. remain stationary or keep moving at a constant speed)
Equation	**Meanings of terms in equation and units**
F=ma	*F = resultant force (N)* *m = mass (kg)* *a = acceleration (m/s^2)*

Box 10 - Newton's Third Law

This law says that when objects interact, the forces they cause to act on each other are equal and opposite.
This law is often written as: 'for every action, there is an equal and opposite reaction'. In this version, action means the force exerted by object A on object B, and reaction means the force exerted by object B on object A.

This law explains why pushing **down** with your legs makes you jump **up** (the ground pushes back with the same size force as your push). It also explains why rockets can fly through space: the gases pushing out the back cause the rocket to move forward.





Y11 Physics Knowledge Organiser Topic - Forces II

Box 11 Forces and Elasticity

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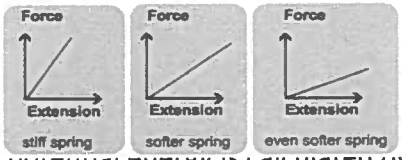

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Box 13 – Limit of Proportionality

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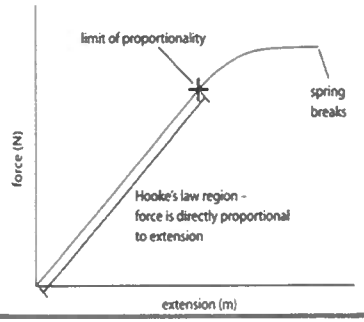

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Gradient	The gradient of a graph is how steep it is. Calculate gradient by dividing the change in the variable on the y-axis by the change in the variable on the x-axis.

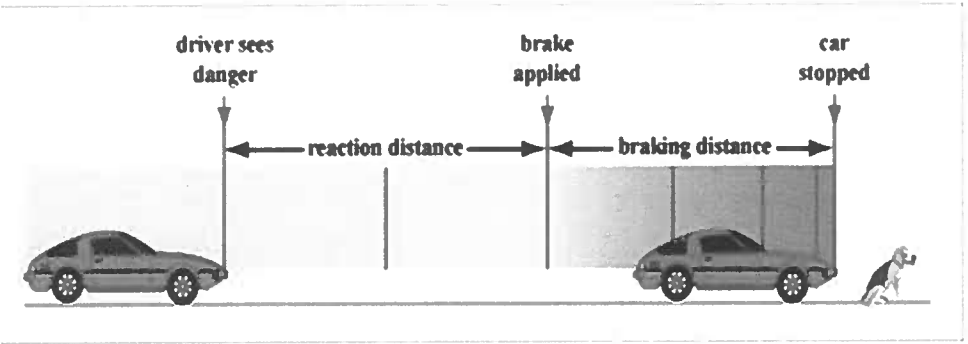
Equation	Meanings of terms in equation
F=ke	*F = force (newtons, N)* *k = spring constant (newtons per metre, N/m)* *e = extension (metres, m)*
$E_e = 0.5ke^2$	*E_e = elastic potential energy (joules, J)* *k = spring constant (newtons per metre, N/m)* *e = extension (metres, m) – this is **squared** in this equation*

Y11 Physics Knowledge Organiser Topic - Forces II

Box 14 - Forces and Braking

.The **stopping distance** of a vehicle depends on two factors, which add up to make the stopping distance. These are the **thinking distance** (distance travelled while the driver reacts also called reaction distance) and the **braking distance** (distance travelled under the braking force).

Stopping distance = Thinking distance + braking distance.



For a particular braking force, the greater the speed of the vehicle, the greater the stopping distance. This is because going from a higher speed to 0 m/s is a bigger change in speed than going from a lower speed to 0 m/s. The thinking distance is longer at a higher speed.
Typical reaction times vary from 0.4 s to 0.9 s.

Different factors affect the thinking and braking distances – these are shown in the table below. Speed is a factor that affects both the thinking distance and the braking distance.

Thinking Distance	Braking Distance
Intoxication (consumption of alcohol or drugs)	**The condition of the vehicle** (worn tyres or poor brakes)
Distractions (e.g. using a mobile phone)	**The condition of the road and weather** (e.g. a wet or icy road)
Tiredness (Reaction times increase when tired)	**The mass of the vehicle** (A heavy vehicle takes longer to stop)

Key Terms	Definitions
Stopping distance	The distance a vehicle travels after the driver spots a danger and decides to stop. It is the sum of the thinking distance and braking distance.
Thinking distance	Distance travelled during a driver's reaction time.
Braking distance	Distance travelled while the driver is applying the brake (i.e. distance travelled under the braking force).
Kinetic energy	The form of energy of any moving object. Since the equation uses speed, not velocity, this is a scalar quantity.
Thermal energy	The form of energy associated with heat. The thermal energy of an object is proportional to its temperature.
System	An object or group of object, and its/their interactions.
Conservation of energy	A fundamental concept in physics. In a system, total energy is always conserved (it cannot be created or destroyed). However, it can be transferred from one store of energy to another.
Equation	**Meanings of terms in equation and units**
$E_p=mgh$	E_p = *gravitational potential energy (joules, J)* m = *mass (kg)* g = *gravitational field strength (newtons per kilogram, N/kg)* h = *height (metres, m)*
$E_k=0.5\ m\ v^2$	E_k = *kinetic energy (joules, J)* m = *mass (kg)* v = *speed (m/s) – this is* ***squared*** *in this equation*

Box 15 - Braking Force and Work Done

When force is applied to the brakes, work is done by the friction force between the brake pads and the wheel. The **kinetic energy** of the vehicle is transferred to **thermal energy** – this is why brakes get hot.

To stop a vehicle in a certain distance, the faster the vehicle the larger the force needed, since a larger deceleration is needed ($F = ma$ again). However, this can lead to overheating of the brakes and/or loss of control of the vehicle.

Y11 Physics Knowledge Organiser
Topic : Forces II - All Higher tier only

Box 16 - Momentum – Higher tier only

Momentum is a property that any moving object has. It is defined as the product of mass and velocity of the object. so if the velocity is 0 m/s (stationary), the momentum is also 0.

Momentum = Mass x Velocity

Since momentum is calculated using **velocity**, which has a direction, momentum is a vector quantity. Just like with velocity, you can show the momentum of objects moving in opposite directions by using a '+' sign for one of them and a '–' sign for the other.

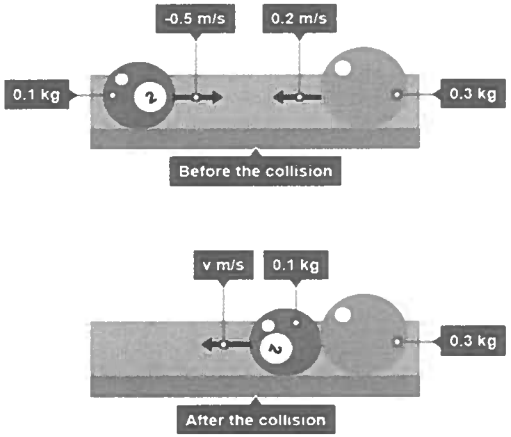
Box 17 - Conservation of Momentum – Higher tier only

Momentum is a property that is conserved in closed systems. Momentum is conserved in collisions , when objects push away from each other and in explosions.
This means the total momentum before an event is exactly equal to the total momentum after the event. This is called **conservation of momentum**.

Conservation of Momentum in a Collision

Look at the diagram far right. The '2' ball has a negative velocity because it is moving in the opposite direction of the other ball. The total momentum before they collide = (0.1 x -0.5) + (0.2 x 0.3) = 0.01 kg m/s. According to the rule of conservation of momentum, the total momentum after the collision is also 0.01 kg m/s. Also, by looking at the diagram, you can see that both balls are now moving to the left, together. The total mass is 0.1 + 0.3 = 0.4 kg.

Rearranging to make velocity the subject, $v = \frac{p}{m}$,
v = 0.01/0.4 = 0.025 m/s is the velocity after the collision.



Key Terms	Definitions
Momentum	A property of any moving object, Momentum = Mass x velocity. Measured in kg m/s.
System	Systems are how physicists divide up the universe. Systems involve an object or objects and their interactions. They can be very simple (e.g. a falling object) or very complicated (e.g. our whole galaxy).
Closed system	A system where objects are not thought to be affected by external forces or other objects outside the system. We only think about the objects inside the system, which means the quantities *momentum* and *energy* are **conserved**.
Conservation	Simply means 'keeping the same.' To add detail, conservation of a quantity means that the total amount of it is the same before and after an event. In any closed system, the total amount of energy and momentum before and after an event is equal.

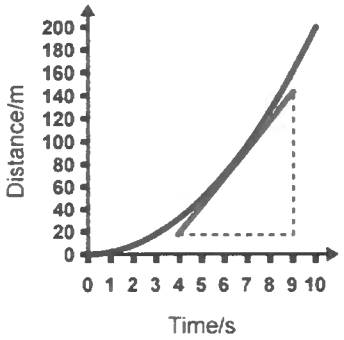
Equation	Meanings of terms in equation and units
p=mv	*p = momentum (kilogram metres per second, kg m/s)* *m = mass (kg)* *v = velocity (m/s)*

Y11 Physics Knowledge Organiser
Topic : Forces II - All higher tier

Box 18 - Using tangents on Distance-Time and Velocity-time graphs

Distance-Time graphs - To be able to calculate the speed at a particular point, draw a tangent on the graph and calculate the gradient of the tangent line.

Speed at 7s =
y = distance = 120m
x = time = 5s

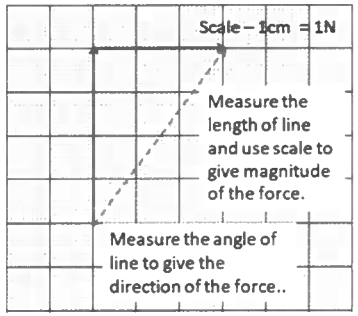


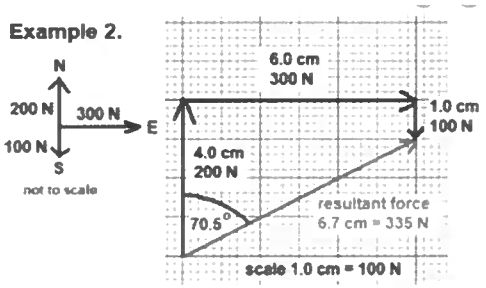
Velocity-time graphs – To be able to calculate the acceleration at a particular time, draw a tangent line on the graph and calculate the gradient.

Box 19 – Resolving forces

- The resultant force is easy to calculate where the individual forces are in the same plane (i.e. individual forces are all horizontal or all vertical): add the forces up, considering the signs of the forces – See section 1, Box 2

- Example 1 and example 2 – The force arrows are drawn tail to tip. The shape is completed by the resultant force (dotted arrow in example on the left and and pink arrow in example 2 on the right)

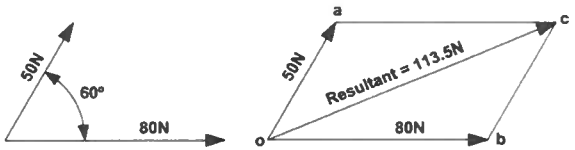




Key terms	Definitions
tangent	A straight line that touches a curve at only one point; tangents tell you the gradient of a curved graph at a particular coordinate
vector	A quantity with both a size (magnitude) and a direction; vectors can be represented with arrows.
force	An interaction between two objects that leads to the objects pushing or pulling on one another
resultant force	The single overall force acting on an object, which has the same effect as all the individual forces combined. Resultant force is the sum of the individual forces.
parallelogram	A quadrilateral with two sets of parallel sides (including rectangles!)
resolve	To carry out the process of splitting a force vector that acts at an angle into vertical and horizontal components

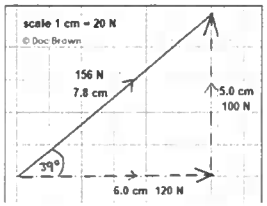
Box 20 – Resolving forces

- If the individual forces are at any angle to each other besides 180°, the **parallelogram rule** is useful: draw a parallelogram using the force arrows; the resultant force is the **diagonal** of that parallelogram.



Parallelogram of Forces

- You can also go the other way: if a resultant force is shown at some angle from the horizontal/vertical, it can be **resolved** into a vertical component and a horizontal component. See example below.



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Waves page 1

Box 1 - Types Of Wave

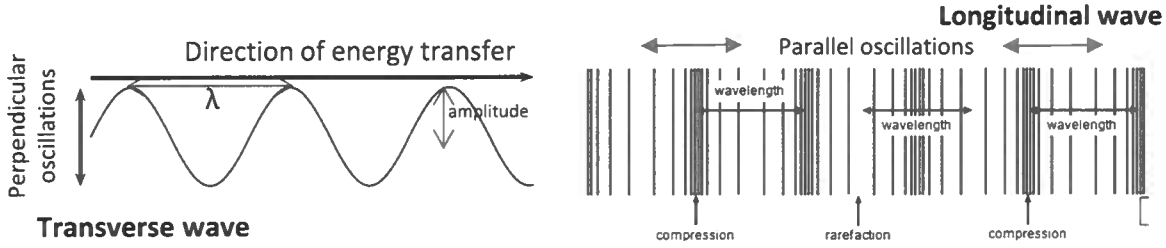
Waves can be **mechanical**, which means they involve particles moving, or **oscillating**, such as waves in the sea or sound waves in the air. Or, they can be **electromagnetic**, which don't involve any particles oscillating – instead, EM waves involve vibrations or oscillations of the electromagnetic field. **All waves involve the transfer of energy**.

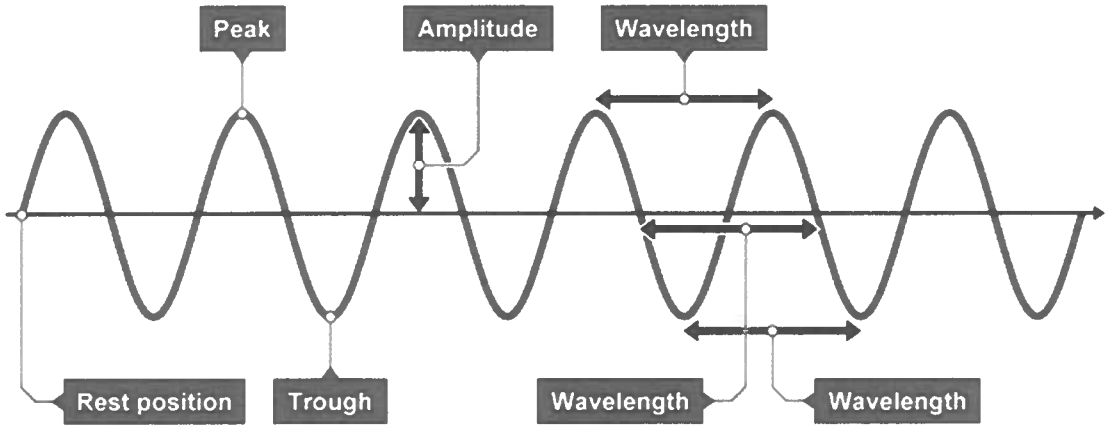
The other way of defining types of wave is whether they are **longitudinal** or **transverse**. Which one they are depends on the direction of the oscillations compared to the direction of energy transfer by the wave.

- In **transverse waves**, the oscillations are **perpendicular** to the direction of energy transfer.
- In **longitudinal waves**, the oscillations are **parallel** to the direction of energy transfer. They show areas of compression and rarefaction – see diagram.

Only the energy transferred moves forward, the particles or the field oscillate, meaning they move backwards and forwards or up and down.

Examples: ALL electromagnetic waves for example radio waves and light are transverse. Mechanical waves which involve the oscillation of particles can be either longitudinal or transverse. For instance: sound waves are mechanical and are longitudinal. Ripples in water are mechanical waves and are transverse.





Key Terms	Definitions
Wave	A wave is an oscillation (vibration) that transfers energy without transferring any matter, by making the particles of the substance (or fields) that it is travelling through oscillate.
Oscillations	Vibrations or movements. These movements are of particles in **mechanical** waves, or of the electromagnetic field when it comes to **electromagnetic** waves.
Perpendicular	At right angles to.
Displacement	The distance travelled from the rest point by a particle or field during an oscillation.
Amplitude	The amplitude of a wave is the maximum displacement of a point on the wave from the rest point.
Wavelength	The distance from a point on one wave to the equivalent point on the next wave along. This is easiest to measure at the distance from the centre of one area of compression to the next (longitudinal waves) or the distance from peak to peak (transverse waves). Symbol: λ
Frequency	The frequency of a wave is the number of complete waves that pass a point per second. Symbol: f
Period	The period, or time period, of a wave is the time it takes to complete a full wave. Symbol: T
Rest point	This is a point shown in the middle of the wave diagram for a transverse wave, it may be called the mid-line or undisturbed position.

Box 2 - The Wave Equation – the equations below are used to calculate the number of waves that pass a point a second and the speed of a wave.

Equation	Meanings of terms in equation
Period = 1 / frequency $T = \frac{1}{f}$	*T = time period (seconds, s)* *f = frequency (hertz, Hz)*
Wave speed = frequency x wavelength $v = f\lambda$	*v = wave speed (m/s)* *f = frequency (Hz)* *λ = wavelength (metres, m)*

Year 11 Physics Knowledge Organiser
Waves page 2

Box 3 - Electromagnetic Waves (EM Waves)

EM waves are always **transverse waves**. They transfer energy from the source of the waves to an **absorber** – an object that absorbs the energy of the wave. These waves are an oscillation in a magnetic and electrical field and can transfer energy through a vacuum (an area without particles). EM waves occur all over the universe naturally, and we can produce them ourselves for all sorts of uses.

EM waves all travel at the **same velocity** through empty space (a vacuum) – at what we call the speed of light. However, the wavelength of EM waves varies from a few kilometres to wavelengths even smaller than an atom. The EM waves form a **continuous spectrum**, but for convenience we've grouped the infinite types of waves into seven groups of wavelengths, based on their properties. Learn the order of EM waves in the EM spectrum. Notice that a *longer* wavelength equates to a *lower* frequency and vice versa – this is clear from the wave equation.

Long wavelength → Short wavelength

Radio waves	Microwaves	Infrared	Visible light	Ultraviolet	X-rays	Gamma rays

Low frequency → High frequency

understand examples of how EM waves transfer energy. If you are standing in front of a fire, you feel the warmth thanks to infrared. Getting sunburn is due to the transfer of energy by ultraviolet waves from the Sun. Using Wi-Fi means a transfer of energy by radio waves and microwaves.

Box 4 - Properties Of EM Waves

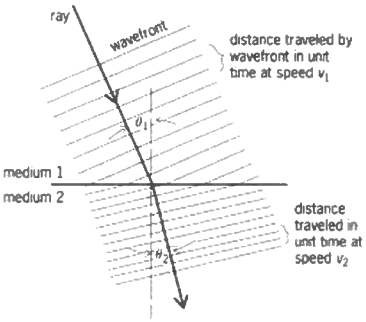
All EM waves can be **reflected**, **refracted**, **absorbed** or **transmitted** *depending* on the wavelength of the EM wave and the **medium** they are travelling through, or surface they are reaching.

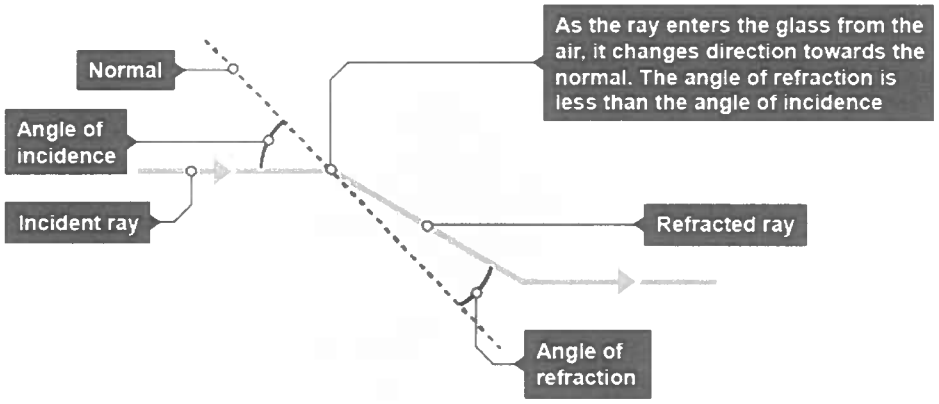
Refraction occurs when a wave changes the medium it is travelling through. Refraction is a change in direction of the wave, and it happens at the boundary, or junction, between the media – for instance, the surface of a sheet of glass would be the boundary between the glass and the air. You need to be able to draw diagrams to show refraction, like the example opposite. Notice that the light ray refracts *towards* the normal as it enters the glass (this is because it slows down), and refracts *away* from the normal as it leaves the glass (it speeds back up), ending up parallel to the original ray in air. If the light ray enters the block along the normal line, no refraction occurs but the wave speed still reduces.

Key Terms	Definitions
Reflection	Rebounding of a wave from a surface. The angle between the **incident** (in-going) wave and the **normal** is the same as the angle between the reflected wave and the normal.
Refraction	Changing direction of a wave due to a change in the **medium** it is travelling through.
Absorption	'Taking in' energy from a wave and transferring it to another form, usually heat. For instance, you warming up if you lie in the sunshine (revising science, of course).
Transmission	A wave travelling through a material. Right now, visible light waves are being transmitted through the air to your eyes.
Media	*Singular 'medium'*. The medium is the material through which a wave travels.
Normal	A 'construction line' (made up line to help with diagram drawing) at right angles to a surface at the point where the wave hits the surface.

Box 5 - HT: More On Refraction

Refraction is due differences in the velocity of the waves in difference media. The diagram shown here represents the **wave fronts**. The wave slows down as it enters medium 2, but the near edge slows first. The other end is faster, as it is still in medium 1. This is what causes the 'bending' of the wave towards the normal.





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Waves page 3

Box 6 - Electromagnetic Waves (EM Waves): Producing Them

EM waves can be generated by changes in atoms or the nuclei of atoms. For instance, gamma rays are produced during nuclear decay.

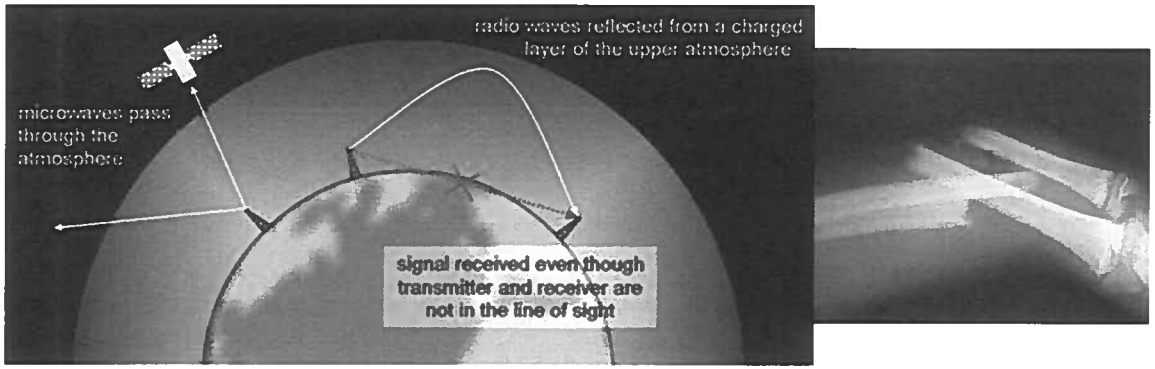
HT – Humans produce radio waves by using an alternating current , this is a flow of charge that changes direction a set number of times a second (set to the frequency of the wave that needs to be transmitted). The change in direction of the current causes an oscillation in an electron and magnetic field, this creates a radio wave. The wave then passes into the air and can be received by a receiver which absorbs the energy of the radio wave. This energy is then transferred to the electrons in the material of the receiver, these oscillate generating an alternating current at the same frequency as the transmitted wave. These are used to communicate information.

Box 7 - Dangers Of EM Waves

Ultraviolet waves, X-rays and gamma rays are potentially dangerous types of EM waves, since they can have hazardous effects on human tissues. How severe the effects are depends on the type of radiation and the size of the **dose** received.

Doses of radiation are measured according to how great the risk of harm to the body is. The radiation dose, or danger due to **exposure** to radiation, is measured in **sieverts** (Sv).

A specific risk due to exposure to ultraviolet waves: they cause skin to prematurely age and increase the risk of skin cancer as the DNA within the nucleus of a cell can mutate when exposed to UV.
X-rays and gamma rays are **ionising** types of radiation. This means they can damage DNA, causing mutations and therefore increasing the risk of cancer.



Key Terms	Definitions
Radiation dose	The risk of harm due to exposure to radiation.
Exposure	Receiving and absorbing radiation (by the body).
Sievert	The measure of radiation dose. As with the usual prefix: 1000 millisieverts (mSv) = 1 sievert (Sv)
Ionising	Describes radiation that forms ions by 'knocking' electrons off atoms to make ions. An ion is a charged particle.
Cancer	Type of disease caused by specific mutations to DNA, resulting in cells dividing out of control (making a tumour).

Box 8 - Applications Using EM Waves

It is not exaggerating to say that EM waves dominate our technology and our lives. Here are some examples of the practical applications of EM waves:

- **Radio waves**: used for *television*, *radio* and Bluetooth. A signal carried by radio waves can get from a transmitting mast to a receiver by being reflected off a layer in the atmosphere. (see the diagram below)
- **Microwaves**: The type of wave is used in satellite communication, the waves can pass through the atmosphere, allowing satellites to pass signals around the curve of the Earth. Microwave ovens use a specific frequency of wave, this frequency is absorbed by water molecules, causing them to vibrate and increase their internal energy store and in turn increase the temperature of food.
- **Infrared**: electrical heaters, cooking food, infrared cameras. All objects emit infrared, but hotter objects emit more. An infrared camera detects infrared instead of visible light, so it can see hotter objects in the dark – night vision.
- **Visible light**: *fibre optic communication* (like the best broadband). Optical fibres reflect pulses of light all the way along their length. The pulses of light transmit the information.
- **Ultraviolet**: This type of radiation is used in tanning salons to provide an artificial tan. Some chemicals absorb UV light and emit, give out light energy, we call these chemicals fluorescent. Regularly used for invisible security markings and labelling to help police identify the owners of stolen property.
- **X-rays**: both medical imaging for *diagnosis* (like broken bones) and medical *treatments*. X-rays can pass through soft tissue (like muscle), but not bone. That's why an X-ray image works to show up bones, and any breaks.
- **Gamma rays**: used in medical treatments such as radiotherapy. These have the highest level of energy transfer due to their high frequency.

Y11 Physics Knowledge Organiser – Magnetism and Electromagnetism - Magnets and Magnetic Fields

Box 1 - Magnets

Magnets are substances that have a magnetic field. Magnets can be classified as **permanent** or **induced** (temporary).

Permanent magnets: when the magnetic field is always there and doesn't go away.

Induced magnets: are made when a material made of a magnetic metal (iron, nickel or cobalt) is placed in a magnetic field. Induced magnets are always **attracted** to the magnet that turned them into a magnet – this is why you can pick up paper clips or nails with a bar magnet: the paper clip becomes an induced magnet with poles that are aligned so there is a force of attraction. See the poles labelled on the diagram. Induced magnetism is quickly lost when the material is removed from the magnetic field that induced it.

The ends of a magnet are called the **poles** and this is where the magnetic forces are strongest. This is because the magnetic field lines are *most concentrated* at the poles, as you can see on the diagram to the right.

Magnets exert forces on one another when they are brought together – these forces are **non-contact** forces.

- When like (the same) poles (N-N or S-S) are brought together, the force is of repulsion (pushing away).
- When unlike (not the same) poles are brought together (N-S), the force is of attraction (pulling together).

Box 2 - Magnetic fields

Magnetic fields are around all magnets (permanent or induced). The **direction** of the magnetic, as the diagram shows, is from **north** to **south.** The north pole of a magnet is properly defined as: *the pole that causes a force **away** from it, if a north pole is placed at that end.*

Remember that like poles repel. So you can decide which end in north on an 'unknown magnet' by looking at the direction of the force that acts if a north pole (on another magnet) is brought to one end of your magnet. Repulsion (force away) means that end must be a north pole.

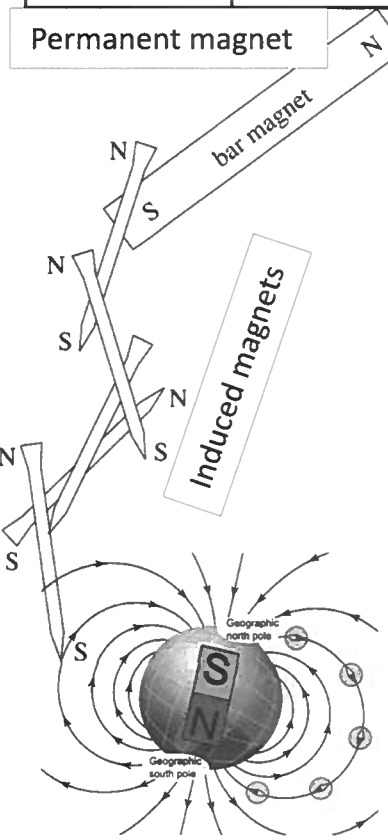
Sometimes the north pole is called the **north seeking pole**, because it will point north on Earth if left freely suspended. The south pole is also called the s**outh seeking pole**.

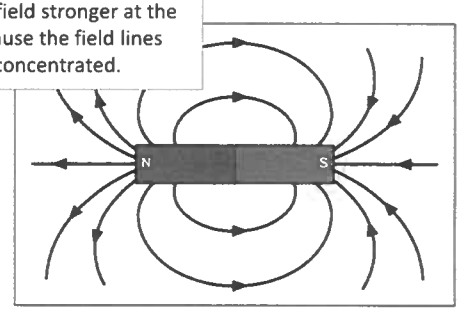
Magnetic fields are *strongest* at the poles and get weaker as the distance from the magnet increases. Using a **magnetic compass** (sometimes called a plotting compass), we can find out the direction of a magnetic field – the diagram shows how to do this.

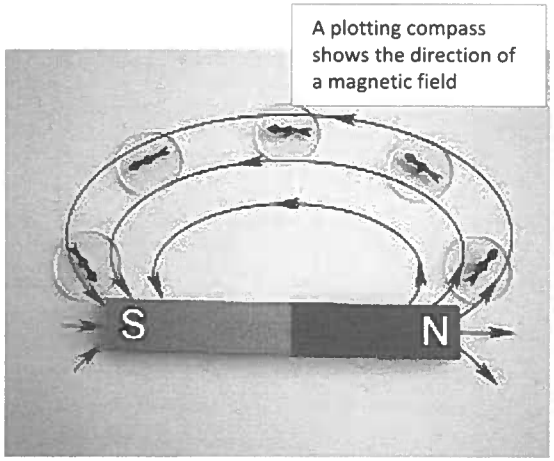
The diagrams opposite show the magnetic field pattern of a bar magnet, showing the direction and strength of the force. The diagram below shows how a plotting compass can be used to identify the magnetic field around a bar magnet. Placing the compass within the magnetic field causes the needle to align with the field. Pencil dots show the position of the compass N and S points, and the compass is moved along, and the process repeated.

Earth has a **magnetic field.** Using a compass, you can tell that the magnetic field points towards the north pole, so this actually means that the geographic north pole of Earth is a south pole of a magnet! See diagram.

Key Terms	Definitions
Permanent magnet	A magnet that always has its own magnetic field. Attracts magnetic materials, and can attract or repel other magnets.
Induced magnet	A temporary magnet: make one by putting a suitable material in a magnetic field.
Poles	The ends of a magnet. Named north and south, based on which way on Earth they'd point if suspended freely. The other name is 'north seeking' or 'south seeking' as a result.
Magnetic field	The region around a magnet where a force acts on other magnets or on magnetic materials. (3D, unlike diagrams usually show)
Magnetic compass	A small bar magnet balanced on a pin so it can spin around. Points towards Earth's magnetic north due to Earth's magnetic field, but can also be used to find the direction of a magnetic field for another magnet.







Y11 Physics Knowledge Organiser – Magnetism and Electromagnetism: Magnets and Magnetic Fields

Box 3 - Electromagnetism – current and magnetic fields

A wire that is carrying a current has a magnetic field around it. No current means no magnetic field; when it is switched on a magnetic field is generated. This is how **electromagnets** are made.

Fleming's Right Hand Rule

Diagram A shows the relationship between the current in the wire and the direction of the magnetic field in a straight wire. In a straight wire, the magnetic field is **circular**. The direction of the magnetic field depends on the direction of the current in the wire. Switching the direction of the current switches the direction of the magnetic field. The magnetic field gets stronger the closer to the wire carrying the current – this is shown by the field lines getting closer together (more concentrated).

Increasing the strength of the magnetic field

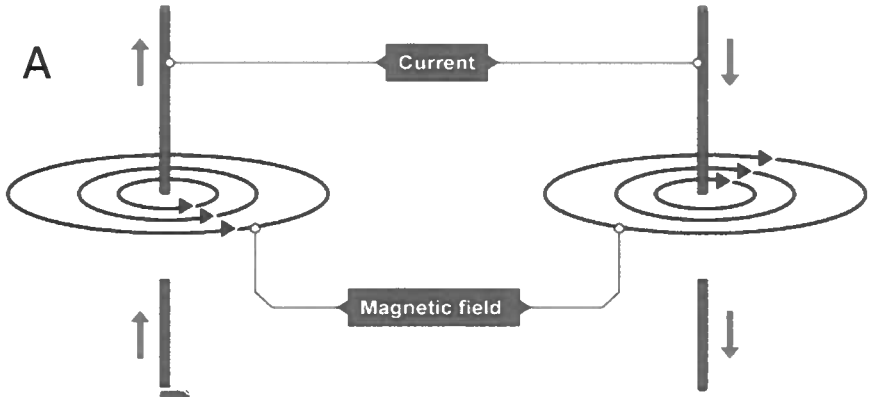
- **increasing the current** increases the strength of the magnetic field.
- **winding the current-carrying wire into a coil** called a **solenoid (diagram B)** - the magnetic field is similar in shape to the magnetic field of a bar magnet – it has a north and south pole, and it strongest at the poles. The magnetic field is also strong *inside* the coil – as the concentrated field lines show.
- putting a magnetic (e.g. iron) **core** in the solenoid – literally a cylinder of iron. This is an **electromagnet** (diagram C)

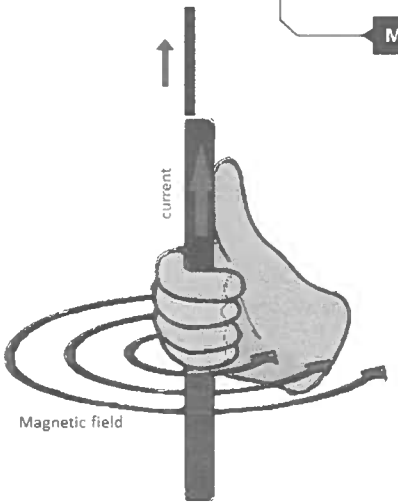
You can make an electromagnet **stronger** by:

- Increasing the **current** in the wire (probably by increasing the potential difference of the power supply)
- Increasing the **length** of wire in the solenoid – perhaps by adding more turns to the coil of wire.

Key Terms	Definitions
Current	The rate of flow of charges in a circuit. If a current is flowing in a component, charges (e.g. electrons) are flowing through it.
Solenoid	A coil of wire, when current flows the magnetic field is strong and uniform.
Iron core	A piece of iron placed in the middle of a solenoid.
Electromagnet	A coil of wire with an iron core

A



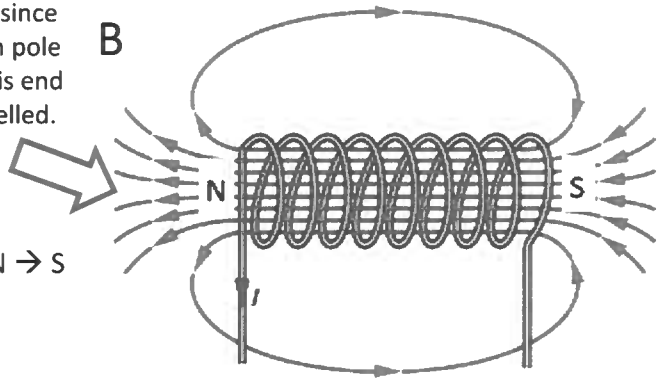


Your right hand can be used to model the direction of current and field.

- Thumb: current, + → -
- Fingers: magnetic field, N → S

A north pole, since another north pole brought to this end would be repelled.

B

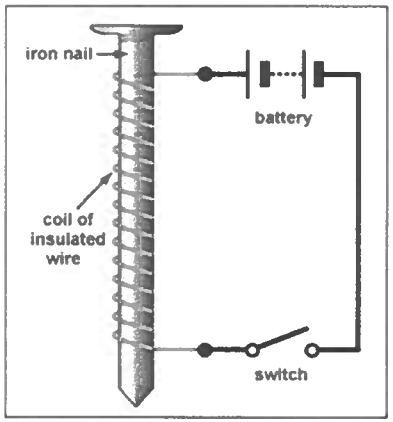


Solenoid

This time the right hand is different:

- Thumb: magnetic field in the coil, N → S
- Fingers: electric current, + → -

C



This practical set up allows us to increase the strength of an electromagnet by increasing the number of coils around the wire and by increasing the current.

Y11 Physics Knowledge Organiser
Electromagnetism (Higher Tier Only)

Box 4 - Fleming's left hand rule and the motor effect

If you have a current-carrying wire and a permanent magnet, each have their own magnetic fields. This means that if you put them near each other, they exert a force on each other. This is called **the motor effect**.

You can work out the direction that the force acts if you know the direction of the magnetic field and the direction of the current – we use **Fleming's left hand rule**. Diagram A shows the direction of the Field, Magnetic Field and Current, direct you hand with the values that you position your hand to the know value – be prepared to twist your hand at the wrist to get it right – confirm using the example of the wire cutting through the magnetic field in the diagram – field from N to S with first finger, current with middle finger pointing downwards, meaning force must be out of the page towards you, like the diagram shows.

Now, the size (or *magnitude*) of the force on the conductor (the bit of wire) depends on three factors:

1. The **length** of the wire in the magnetic field, measured in metres
2. The **strength** of the magnetic field (formally, the **magnetic flux density**, in teslas, T)
3. The **size** of the **current** (A, as usual).

As the equation shows, increasing any or all of these factors will increase the size of the force on the conductor, if you need to use this equation in the exam it is found on the equation sheet.

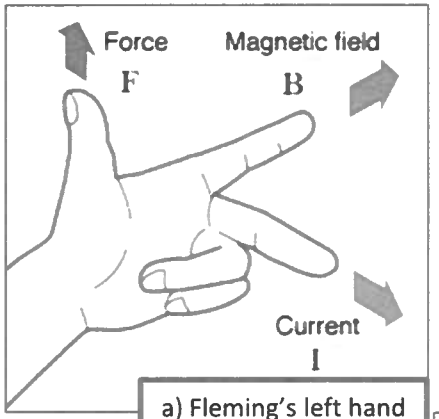
Box 5 - Electric motors

Electric motors make use of the motor effect. A coil of wire carrying a current is placed in a magnetic field; as you know, the magnetic fields interact to exert force on each other. If the coil is set up so it can spin, it most certainly will. In fact, it will spin round and round (**rotate**). This is thanks to the force acting **up** on one side of the coil, and **down** on the other – see the diagram and use Fleming's left hand rule to understand why...

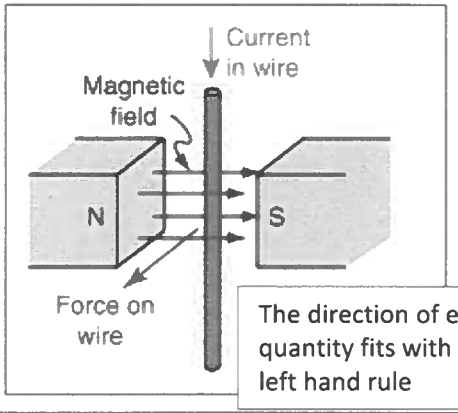
The magnetic field goes from N to S of course, and the arrows on the coil show the direction of the current. So, the left side of the coil has a force **upwards** exerted on it (use the left hand rule). The right side of the coil has a force **downward** exerted on it, so it rotates as shown. The commutator is a ring that has graphite brushes that pass current to the ring, the spinning coil and commutator can move freely as the current passes to the split ring preventing the need for fixed wires which would get tangled. The ring is split into 2, allowing current to flow into the coil rather than flowing to the other side of the ring.

Key Terms	Definitions
Motor effect	The forces exerted on each other by a wire carrying a current and a magnetic field, thanks to the two magnetic fields interacting.
Magnetic flux density	A measure of the strength of a magnetic field – think of it as the number of magnetic field lines going through a set area – see diagram to help explain.
Electric motor	Device that causes rotation of a coil of wire carrying a current when it is placed in a magnetic field.

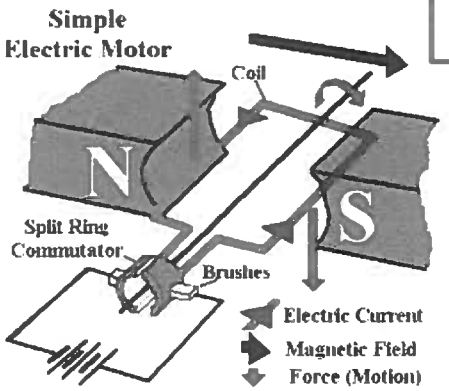
Equation	Meanings of terms in equation
$F = B\,I\,l$	*F = force (newtons, N)* *B = magnetic flux density (tesla, T)* *I = current (amps, A)* *l = length (m)*

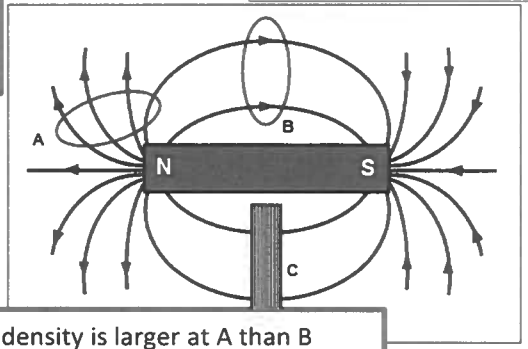


a) Fleming's left hand rule. FBI – easy to remember!



The direction of each quantity fits with the left hand rule





Magnetic flux density is larger at A than B since more magnetic field lines cut through a given area (shown by the oval).

Y11 Physics – Space Topic (Separate Science Only)

Box 1

The Solar System

Our star the sun is orbited by planets, dwarf planets, asteroids and comets. Moons orbit the planets. These are all natural satellites.

The sun was formed from a nebula pulled together by gravity 5 billion years ago.

Order of the Planets
in Our Solar System

1. Mercury
2. Venus
3. Earth
4. Mars
5. Jupiter
6. Saturn
7. Uranus
8. Neptune

Making Elements

Box 3

All elements up to iron are made through the fusion of smaller elements in the cores of stars. The larger and hotter the star the heavier the elements it can fuse.

All elements heavier than iron are fused during a supernova explosion. This then distributes these elements across the Universe.

Life-cycle of a star

Box 2

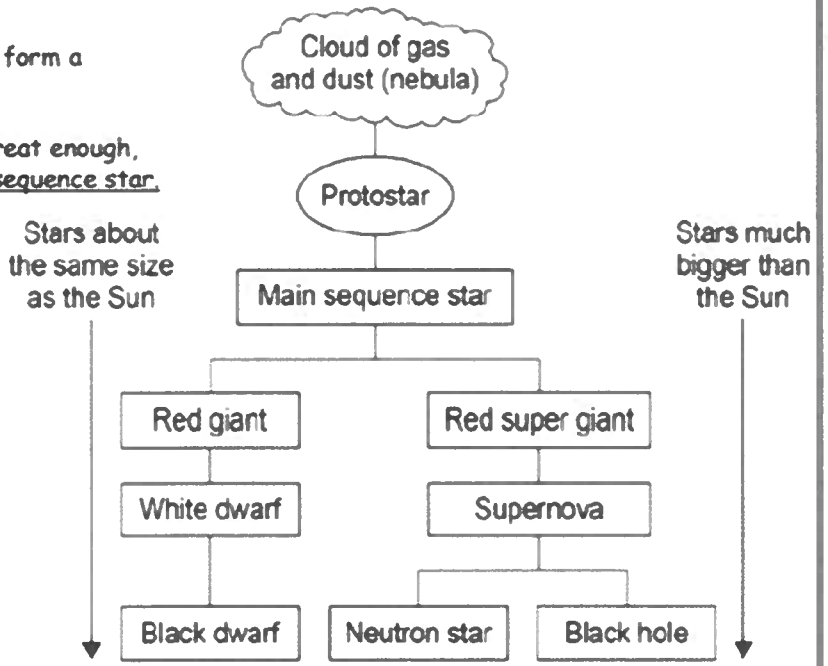
* Gravity pulls dust together in a nebula to form a Protostar.

* When the temperature and pressure is great enough, nuclear fusion begins turning it into a mainsequence star.

* When the hydrogen runs out the star collapses as gravity is greater than the pressure from fusion. Heavier elements start to fuse expanding the star to form a red giant.

* When the heavier elements run out the star becomes either a white dwarf or explodes in a supernova depending on its size.

* The very largest mainsequence stars will eventually become black holes. Slightly smaller stars become neutron stars

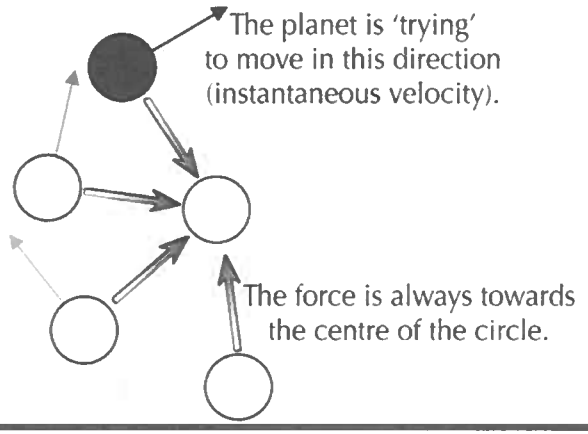


Objects in orbit

Box 4

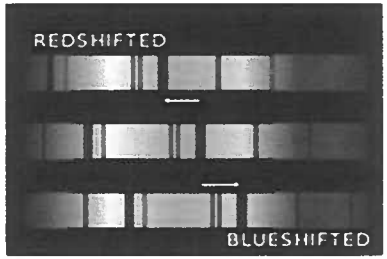
All objects in orbit are accelerating as they are constantly changing direction, however the speed will remain constant. Gravity is the force that causes acceleration, this acts towards the centre of the circle. The instantaneous velocity is at 90 degrees to the force that causes the acceleration.

An object orbiting close to a star or planet experiences a stronger gravitational pull, this means that the object must have a higher speed in order to remain in a stable orbit.



Box 5

Redshift



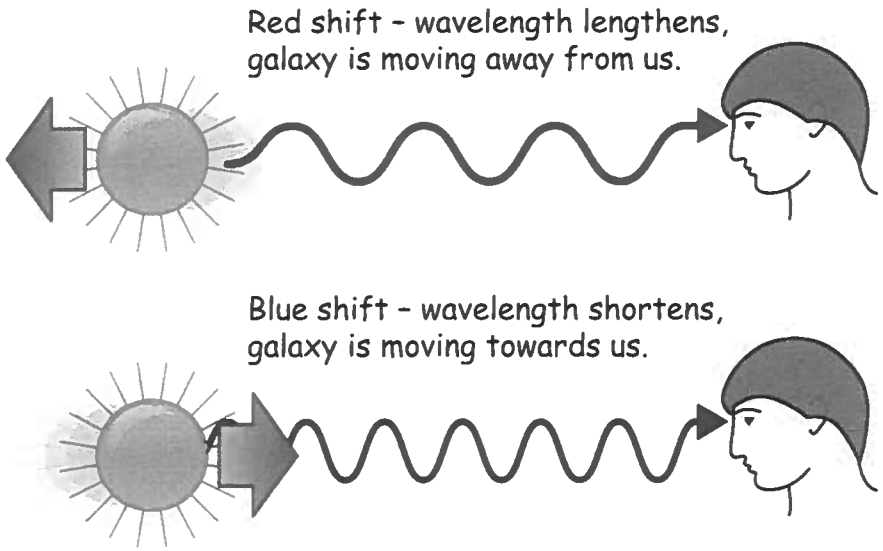
Light from a star or galaxy can be used to produce an absorption spectrum. This includes absorption lines, Which indicate the elements present.

If a star or galaxy is moving towards us then the light from it shows a blueshift.

If the star or galaxy is moving away from us then it shows a red-shift.
ALL GALAXIES SHOW RED-SHIFT

The further away a galaxy is the faster it is moving away from us. We know this as it shows more redshift.

This proves that the universe is EXPANDING, this provides evidence for the BIG BANG theory.



Box 6

The Big Bang theory

The Big Bang Theory suggests that the Universe started with a very small hot, dense region and has been expanding ever since.

This is supported by evidence from the red-shift of galaxies, observations of certain types of supernova and CMBR.

Cosmic Microwave Background Radiation (CMBR) is the left over radiation from the Big Bang and provides further evidence for the theory.

Evidence

Measurements have shown that the expansion of the Universe is increasing in speed.

Theories about Dark Mass and Dark Energy help to explain these observations, however more evidence is needed to confirm these ideas.

Key Terms	Definitions
Instantaneous velocity	Velocity at a single moment (remember it is vector quantity, with both direction and magnitude).
Red shift	The observed increase in wavelength of light emitted by objects moving away (receding) from an observer.
Big Bang theory	The theory, which is by far the dominant scientific theory for the origin of the universe, that states that the whole universe was once tiny and very hot and dense.
Recessional velocity	How fast something (like a galaxy) is moving away from an observer.
Dark matter	Aka dark mass. A mysterious type of matter that is known to exist (from observations of other galaxies), but no-one knows what it is made of.
Dark energy	The name given to the mysterious energy driving the acceleration in the expansion of the universe.

Year 11 Short course RE Paper One –Buddhist belief and teaching

Key terms:

Theravada	**Oldest form of Buddhism, found in southern Asia**
Mahayana	**Found in Tibet, China, Taiwan, Japan, Korea, and Mongolia. Mahayana Buddhism is not a single group but a collection of Buddhist traditions: Zen Buddhism, Pure Land Buddhism, and Tibetan Buddhism**
Pure Land	**Mostly found in Japan – a form of Mahayana Buddhism. Based on faith in Amitabha**
Bodhisattva	**An enlightened person who chooses to remain in samsara to teach others**
Arhat	**A 'perfected person' who has overcome the main sources of suffering**
Five Aggregates (Skandha)	**Theravada Buddhists are taught that the human personality is made up of five parts**
Sunyata	**Mahayana Buddhism0 This means 'emptiness'.**
Six perfections	**The practices/characteristics of a Bodhisattva**

KPI 8- To analyse the different features and beliefs amongst schools in Buddhism

https://www.bbc.co.uk/bitesize/guides/zr7ck2p/revision/5

Theravada	**Mahayana**
Theravada Buddhists are taught that the human personality is made up of five parts- **Five Aggregates/ Skandha's Form, Sensation, Perception, Mental formation and Consciousness**	**Sunyata -** This means **'emptiness'**. This idea can be understood as meaning that everything depends upon something else. All things lack an intrinsic nature. Basically, everything is empty. Sunyata can be understood as being very similar to **anatta** (one of the Three Marks of Existence).
In Theravada Buddhism, a person who has achieved **nibbana** is known as an **arhat**. A Buddhist who has taken this path will follow the Noble Eightfold Path. They may also join a Buddhist community in order to focus their attention on achieving enlightenment with others who are on the same path.	**Everyone can achieve enlightenment.** Mahayana Buddhists believe that all humans have the nature of the Buddha within them already. **Buddha Nature**
Theravada Buddhism teaches that the ideal Buddhist is an **Arhat** (a 'perfected person'). An Arhat has become free from the three poisons (ignorance, greed and hatred) and will not be reborn when they die. A person becomes and Arhat by following the **Eightfold Path**	Mahayana Buddhism teaches that the ideal Buddhist is a **Bodhisattva**. Bodhisattvas choose to **remain in samsara** to help others become enlightened. A person becomes a bodhisattva by developing the **Six Perfections.**
	Pure Land Buddhists believe it is impossible to become enlightened in this realm and so aim to be reborn into the Pure Land to be taught by Amitabha Buddha. Their main practice is chanting **Amitabha** Buddha's name

KPI6- Explain Buddhist teachings on how to end suffering

The path end suffering is the Middle Way and consists of eight practices (**the Eightfold Path**) that are sometimes grouped into three sections (the Threefold Way).

Ethics- right speech, action, livelihood

Meditation- right effort, mindfulness, concentration

Wisdom- right understanding, intention

KPI7- To describe the different schools in Buddhism

Theravada Known as the 'lesser vehicle' as only male monks achieve enlightenment. Oldest form of Buddhism, found in southern Asia
Mahayana Known as the 'greater vehicle' as anyone can become enlightened. Teaches sunyata or emptiness – nothing as a separate soul or self
Pure Land Mostly found in Japan – a form of Mahayana Buddhism. Based on faith in Amitabha Buddha and his paradise

KPI9- To Explain the importance of the Six perfections

"However innumerable sentient beings are; I vow to save them." Bodhisattva vow

The six perfections give guidelines as a structure for how to live a good life and behave in a morally good way.

Generosity

Morality

Patience

Energy

Meditation

Year 11 RE Short course and Full course Paper 2- Theme D: Religion, Peace and Conflict

Essential Texts to learn for the Exam:	
In the Old Testament, people are sometimes commanded by God to go to war. In Deuteronomy, Joshua and Judges, God often tells his people to fight and destroy foreign tribes to gain the Promised Land (Israel).	In the New testament Jesus showed a DIFFERENT image of God as one who forgives and Loves all human beings:
•"The lord your God will drive out those nations before you." Deuteronomy 7:22-24 The Old Testament Prophet, Joel, tells the people that God wants them to go and fight,	"While he was still a long way from home his father saw him" (The Lost Son story) Luke 15: God is waiting to forgive us
• "Prepare for war! Rouse the warriors! Let all the fighting men drawn near and attack." Joel 3:9-10	"Blessed are the Peacemakers"
•"The Lord is a warrior." Exodus 15:3	"Those who live by the sword, will die by the sword" (Matthew 26:)
•"There is a time for killing, and a time for healing, a time for war, and a time for peace." Ecclesiastes 3:2-8	'Do not take revenge on those who wrong you' Matthew 5
	"Love Your Enemies and pray for those who persecute you" Matthew 5
Buddhism: As a pacifist religion there are many key quotes which could be used:	
"It's better to conquer yourself than to win a thousand battles. Then victory is yours" The Buddha	
"In the war of the ego the loser always wins"	
"War ends only when people love each other"	
1st Moral precept "Do not Harm"	

KPI 6

Holy Wars: A Holy War is a war which is fought for religious reasons, often with the backing of religious leaders.

- An example of this was the Crusades fought from the 11th-14th Century by Christians, backed by the Pope.
- Religion can still be a cause for war today such as in Northern Ireland where Protestant and Catholic Christians fought a civil war between 1968-98.

KPI7

Pacifism: Pacifists reject all violence. They do not think that conflict should be dealt with by resorting to war.

- They think that other peaceful methods should be used.
- The early Christian communities were all Pacifist as they followed Jesus' teachings on Non-Violence. "Those who live by the sword will die by the sword"
- Famous Pacifists today such as Martin Luther King Jr and Mahatma Gandhi are examples of non-violence in action.
- Buddhism is a religion of non-violence. The first of the five moral precepts is Ahimsa which means first cause no harm to anyone or anything.
- Pacifism is the idea that all forms of violence are wrong. Pacifists such as Quakers refuse to take part in war and often choose to be a conscientious objector (someone who doesn't go to war for moral reasons) or to assist in medical tasks like ambulance driving.
- Christians try to follow Jesus' teaching that "blessed are the peacemakers"

KPI8

Responses to war:

- Christians try to show mercy and agape to victims of war and provide them with assistance.
- This can be through charity or through welcoming them into their churches. It can be victims in their own country or refugees such as people fleeing from Syria or Yemen.
- This is an example of 'love your neighbour' in action.
- Many Christian charities work around the world in countries affected by war. CAFOD (Catholic Agency for Overseas Development) is an example of a Christian charity that helps people and refugees in countries affected by war and natural disasters.

Year 11 RE Short course and Full course Paper 2- Theme D: Religion, Peace and Conflict

Forgiveness	Pardoning someone for wrongdoing	**Peace-making**	Working toward bringing about an end to war and a state of peace
Greed	Going to war to gain land or natural resources such as oil	**Protest**	A public expression of disapproval, often in a big group, can be peaceful or violent
Holy War	A war that is fought for religious reasons, usually backed by a religious leader	**Quakers**	A Christians denomination who worship in silence and are well known pacifists
Just War	A Christian theory that asks whether a war is fought justly	**Reconciliation**	Restoring friendly relationships after a war or conflict
Justice	Bringing about what is right and fair, according to the law or God's will	**Retaliation**	Deliberately harming someone as a response to them harming you
Nuclear Weapon	A weapon using a nuclear reaction to cause massive damage	**Self-Defence**	Protecting yourself or others from harm
Pacifism	A belief that all forms of violence are wrong, commonly held by Quakers	**Terrorism**	Using violence in order to further a political or religious message
Peace	A state of happiness and harmony, an absence of war	**WMD**	Weapons of mass destruction: chemical, nuclear or biological weapons

KPI 1 Terrorism

Examples of terrorism include suicide bombing, mass shootings or using vehicles to injure pedestrians.

The aim of terrorism is to make society aware of a cause or issue and to make people frightened to go about their business.

Christians don't promote political violence + believe terrorism is wrong as it targets innocent people

KPI 5 Nuclear weapons work by a nuclear reaction and devastate huge areas and kill large numbers of people.

- They are a type of WMD (weapons of mass destruction) which also includes chemical and biological weapons.
- All these weapons are not allowed under the Christian Just War Theory and would therefore be rejected by most Christians.
- Some people say their use was justified as it prevented more suffering even though 140,000 people died. Although some Christians justify war with 'an eye for an eye', this cannot be used to justify the use of weapons of mass destruction as they are not a proportionate response.

KPI 2 Protests

The right to gather together and protest is a fundamental democratic **freedom**.

UK law allows for peaceful public protest but sometimes protects can turn violent and become a **riot**.

Christians often **protest unjust laws** or for other forms of justice but would rarely advocate the use of violence in protest.

KPI 4 Just war theory

Just War Theory is a Christian moral theory for working out if a war meets internationally accepted criteria for fairness.

Christian theologians like Augustine and later, Thomas Aquinas came up with a list of conditions which MUST be met before a Christian could fight in a war.

•Jus ad bellum: the conditions under which the use of military force is justified

.•Jus in bello: how to conduct a war in an ethical manner.

These are some of the conditions that must be met in order for a war to be just:

- Just Cause – fought in self-defence or to protect others
- Just Intention – fought to promote good and defeat wrongdoing

KPI 3

Reasons for war

Greed

To gain more land or to control important resources such as oil or gas.

Self-Defence

To defend one's country against invasion or attack or to protect allies who are under attack

Retaliation

To fight against a country that has done something very wrong **or to fight against a country that has attacked you**

PCSHE – Year 11 Term 2 and 3 – Health Choices and Independence

Key Terms:

- **Stress**: A state of mental or emotional strain or tension resulting from adverse or demanding circumstances.
- **Wellbeing**: The state of being comfortable, healthy, and happy.
- **Adverse**: Unfavourable or negative.
- **Strain**: Pressure or tension on something or someone.
- **Productive**: Achieving or producing results or outcomes effectively.
- **Revision**: The process of reviewing and studying material in preparation for exams or tests.
- **Aerobic activity**: Physical activity that raises the heart rate and improves cardiovascular fitness.
- **Flight or fight response**: The body's automatic response to a perceived threat, preparing it to either confront or escape the threat.
- **Cardiovascular**: Relating to the heart and blood vessels.
- **Immune system**: The body's defence system against infections and diseases.
- **Meditation**: A practice of focusing the mind and inducing a state of calm and relaxation.
- **Optimism**: A positive or hopeful attitude towards the future.
- **Depression**: A mental health disorder characterized by persistent sadness, loss of interest, and other symptoms that affect daily life.
- **Anxiety**: A mental health condition characterized by excessive worry, fear, and nervousness.
- **Blood transfusion**: The process of taking blood from one person (donor), processing it, and then giving it to another person (patient).
- **Red blood cells**: Blood cells that contain hemoglobin and carry oxygen throughout the body.
- **Shortage**: A condition of lacking an adequate amount or quantity.
- **Donor**: A person who voluntarily gives blood or organs for the purpose of helping others.
- **Chemotherapy**: The use of drugs to treat cancer by killing or inhibiting the growth of cancer cells.
- **Stem cell transplants**: Medical procedures involving the transplantation of stem cells to replace damaged or diseased cells in the body.
- **Donation**: The act of voluntarily giving blood, organs, or other body tissues for medical use to help others.
- **Opt-in system**: A system in which individuals must actively choose or volunteer to participate.
- **Opt-out system**: A system in which individuals are considered willing donors unless they have explicitly stated their decision not to participate.
- **Excluded group**: A category of individuals who are not automatically included in the organ donation system due to specific circumstances or conditions.
- **Breast Cancer**: A type of cancer that forms in the breast tissue, typically characterized by the presence of abnormal cells that multiply and form a tumor.
- **Self-screening**: The process of examining oneself to detect any changes or abnormalities in the body.
- **GP**: General Practitioner, a primary care physician or doctor.
- **Testicular Cancer**: A type of cancer that develops in the testicles, the male reproductive organs that produce sperm and testosterone.
- **Puberty**: The stage of development during which a person reaches sexual maturity.
- **Benign**: Not cancerous or harmful.
- **Cysts**: Fluid-filled sacs or growths that can develop within the body.

KPI 1 – Wellbeing

Stress: A state of mental or emotional strain or tension resulting from adverse or demanding circumstances.

Some stress is good as it can motivate people however too much can be detrimental *(bad),* especially if over a long period of time.

Top tips for dealing with exam stress:

1. Always take a moment just to breathe, whether in the exam, before or after.
2. Remember that school does offer support, just reach out and ask!
3. Keep your work balanced. Spend time revising but socialise and relax too.
4. Keep a self-care routine so that your revision is the most productive it can be whilst you feel as good as possible.
5. Break up revision with food and exercise to make sure you stay energised.
6. Remember that results do not define you.
7. Find a revision space and style that works for you
8. Work to your own pace – everyone is different in how they work.
9. If you feel nervous about the time pressure of an exam, practice timing yourself when you revise, or try some test papers.
10. Plan in some treats to reward yourself and celebrate when it's all over!

Importance of exercise:

Exercise increases your overall health and your sense of well-being, which puts more pep in your step every day. But exercise also has some direct stress-busting benefits.

- **It pumps up your endorphins.** Physical activity may help bump up the production of your brain's feel-good neurotransmitters, called endorphins. Although this function is often referred to as a runner's high, any aerobic activity, such as a rousing game of tennis or a nature hike, can contribute to this same feeling.
- **It reduces negative effects of stress.** Exercise can provide stress relief for your body while imitating effects of stress, such as the flight or fight response, and helping your body and its systems practice working together through those effects. This can also lead to positive effects in your body—including your cardiovascular, digestive and immune systems—by helping protect your body from harmful effects of stress.
- **It's meditation in motion.** After a fast-paced game of racquetball, a long walk or run, or several laps in the pool, you may often find that you've forgotten the day's irritations and concentrated only on your body's movements.
- As you begin to regularly shed your daily tensions through movement and physical activity, you may find that this focus on a single task, and the resulting energy and optimism, can help you stay calm, clear and focused in everything you do.
- **It improves your mood.** Regular exercise can increase self-confidence, improve your mood, help you relax, and lower symptoms of mild depression and anxiety. Exercise can also improve your sleep, which is often disrupted by stress, depression and anxiety.

PCSHE – Year 11 Term 2 and 3 – Health Choices and Independence

KPI 2 - Blood Transfusions:

A blood transfusion involves taking blood from one person (a donor), processing it, then giving it to someone else (a patient).

Why might a blood transfusion be needed?

A blood transfusion may be needed if you have a shortage of red blood cells.
This may be because your body's not making enough red blood cells or because you have lost blood.
For example, you may need a blood transfusion if you have:

- a condition that affects the way your red blood cells work – such as sickle cell disease or thalassemia
- a type of cancer or cancer treatment that can affect blood cells – including leukemia, chemotherapy or stem cell transplants
- severe bleeding – usually from surgery, childbirth or a serious accident
- A blood transfusion can replace blood you have lost, or just replace the liquid or cells found in blood (such as red blood cells, plasma or cells called platelets).

Donation:

- For **blood** and **stem cell donation**, an **opt-in system** is in place. Individuals must volunteer to give blood or sign up to the stem cell register.
- For **organ donation**, an **opt-out system** is in place. All adults will be considered to have **agreed to donate their organs** when they die unless they have **recorded a decision not to donate** or are in an excluded group. Families will still be consulted about organ donation and the **donor's faith, beliefs** and **culture** will be **respected.**

KPI 3 – Self-screening information

Breast Cancer – Self-screening

- know what's normal for you
- look at your breasts and feel them
- know what changes to look for
- report any changes to a GP without delay

Look at your breasts and feel each breast and armpit, and up to your collarbone. You may find it easiest to do this in the shower or bath, by running a soapy hand over each breast and up under each armpit. You can also look at your breasts in the mirror. Look with your arms by your side and also with them raised.

See a GP if you notice any of the following changes:

- a change in the size, outline or shape of your breast
- a change in the look or feel of the skin on your breast, such as puckering or dimpling, a rash or redness
- a new lump, swelling, thickening or bumpy area in one breast or armpit that was not there before
- a discharge of fluid from either of your nipples
- any change in nipple position, such as your nipple being pulled in or pointing differently
- a rash (like eczema), crusting, scaly or itchy skin or redness on or around your nipple
- any discomfort or pain in one breast, particularly if it's a new pain and does not go away (although pain is only a symptom of breast cancer in rare cases)

Testicular Cancer – Self-screening

From puberty onwards, it is important to check your testicles regularly. Testicular cancer is usually always cured but it is easier to treat when it is diagnosed early. Checking for testicular cancer is sometimes called testicular self-examination. Doing this regularly means you soon get to know what feels normal for you. A normal testicle should feel smooth and firm, but not hard.
Hold your scrotum in the palm of your hand. Use your fingers and thumb to examine each testicle. You should feel for:

- lumps or swellings
- anything unusual
- differences between your testicles.

It is normal for the testicles to be slightly different in size. It is also normal for one to hang lower than the other. The epididymis (tube that carries sperm) is behind the top of each testicle. It feels like a soft, coiled tube. It is common to get harmless cysts or benign lumps in the epididymis. Treatment for these may vary. Other conditions can cause lumps or swellings, and most lumps are not cancer. But it is important you get your doctor to check anything unusual as soon as possible.

If you need further support...

Home and school support:

- A friend
- A teacher
- Your tutor
- Parents/carers
- Mr Ogden
- Mrs Loveridge
- Mrs Jones
- Mrs Hayward
- Mr Hayward

Reputable Organisations:

- www.childline.org.uk/info-advice/you-your-body/my-body
- www.nhs.uk/change4life
- www.nhs.uk/live-well
- www.tomkerridge.com/full-time-meals (for family friendly meal ideas, including cooking healthy food within a limited kitchen).
- Young Minds: www.youngminds.org.uk
- Contact your GP
- Contact Orchid: https://orchid-cancer.org.uk/testicular-cancer/ (0808 802 0010)
- Visit trekstock: https://www.trekstock.com/ (a resource for young people affected by cancer which provides counselling and support
- Breast Cancer Now – https://breastcancernow.org
- Teenage Cancer Trust - www.teenagecancertrust.org

PCSHE – Year 11 Term 4 – Families

KPI 1 – Key Terms

- **Pregnancy**: The term used to describe the period of time in which a foetus develops inside the uterus (typically 40 weeks)
- **Fertility**: The ability to produce offspring
- **Abortion**: A procedure to end a pregnancy, sometimes known as a termination of pregnancy.
- **Miscarriage**: The loss of a pregnancy.
- **Contraception**: Methods that are used to prevent pregnancy from occurring during sexual activity.
- **Hormonal methods**: Contraceptive methods which use hormones to prevent pregnancy usually used by women only.
- **Barrier methods**: Contraceptive methods which prevent pregnancy by stopping the sperm from reaching the egg.
- **Combination methods:** Contraceptive methods which use both hormonal and barrier methods to prevent pregnancy.
- **Natural methods**: Contraceptive methods which do not use hormones or barriers, mostly focused on fertility awareness.
- **STIs**: Sexually transmitted infections that are passed on mainly through sexual contact both vaginally, anally and orally.
- **Marriage**: legal union between a man and a woman or between a same-sex couple (in England, Wales and Scotland and, from January 2020, in Northern Ireland).
- **Civil partnership**: A relationship which can be registered by two people of the same sex (to be extended to opposite-sex couples in 2020).
- **Cohabitation**: Living together as a couple without being married/civil partners.
- **Forced Marriage**: A marriage where one or both people do not consent to the marriage and pressure, or abuse is used
- **Arranged Marriage**: A marriage planned and agreed by the families or guardians of the couple concerned, to which both individual's consent.
- **Illegal/Void marriage**: A marriage that is invalid from its inception and cannot be made valid.
- **Ceremony**: A formal religious or public occasion, especially one celebrating a particular event, achievement, or anniversary.

KPI 2 – Routes to Parenthood

- Natural conception – pregnancy achieved through sexual intercourse
- Intrauterine insemination (IUI) – Also known as artificial insemination, this involves inserting sperm into the uterus via a thin plastic tube passed through the cervix.
- In vitro fertilisation (IVF) – Fertility medicine is taken to encourage the ovaries to produce more eggs than usual. Eggs are then removed and fertilised with sperm in a laboratory. A fertilised egg (embryo) is then returned to the uterus to grow and develop.
- Co-parenting – When two or more people decide to conceive and parent children together
- Adoption – The legal process by which a child who cannot be bought up within their birth family becomes full, permanent, legal members of their new family.
- Fostering – Providing a child with a home while they are unable to live with their own family (the child remains the legal responsibility of the council and/or their birth parents.
- Surrogacy – When someone carries and gives birth to a child for a couple who cannot biologically have a child themselves.

KPI 3 – Fertility

How does fertility change?

- Females: fertility gradually decreases with age and declines in the 30s, particularly after 35 years old.
- Males: Fertility decreases with age, but to a lesser extent

What factors affect fertility?

1. Sexually transmitted infections
2. Smoking
3. Alcohol
4. Anabolic steroids
5. Other drugs or medicines
6. Weight
7. Age
8. Environmental factors (e.g. exposure to pesticides, solvents and metals)
9. Stress

KPI 4 – Maintaining a healthy pregnancy

- Do not smoke or drink alcohol
- Avoid certain medicines
- Have an STI check
- Ensure a healthy diet is followed
- Do some safe pregnancy exercise
- Attend medical appointments.

If you need further support…

- Home/School Support: Parent, Tutor, Mrs Hayward, Mrs Aston, Mrs Loveridge, Mrs Jones.

Organisations:

- NSPCC: Helpline 0808 800 5000 (24 hours, every day) www.nspcc.org.uk
- Childline: Helpline 0800 1111 (24 hours, every day) https://www.childline.org.uk
- Your Doctor, Community Nurse, School Nurse (Ask at reception for appointment), NHS Online, www.helathforteens.co.uk
- www.brook.co.uk
- CEOPS - https://www.ceop.police.uk/safety-centre/
- Childline - 0800 1111 - Online chat available at www.childline.org.uk
- Relate Relationships Advice - 0300 100 1234 - Online chat
- www.healthforteens.co.uk
- Advice on fertility, pregnancy and abortion: www.brook.org.uk/topics/pregnancy or www.nhs.uk/pregnancy-and-baby or www.nhs.uk/conditions/infertility or www.nhs.uk/conditions/abortion
- Advice on infertility - Visit www.nhs.uk/conditions/infertility
- Advice on miscarriage – visit www.miscarriageassociation.org.uk or www.nhs.uk/conditions/miscarriage

For further guidance on marriage, civil partnerships and cohabitation or forced marriage visit:

- www.gov.uk/stop-forced-marriage — for information about reporting forced marriage
- www.childline.com — for general information and guidance on reporting forced marriage
- www.freedomcharity.org.uk — for information and support regarding forced marriage.

PCSHE – Year 11 Term 4 – Families

KPI 5 - Options for Unplanned Pregnancy

Keep the Baby

When deciding if to keep the baby the people involved need to consider not just the financial implications such as the cost of raising a child but also the impact on income if one parent has to stay home to care for the child. They also need to consider the support that they have around them in terms of friends and family.

Adoption

Adoption is the least common choice for unplanned pregnancy in the UK. It means that the birth parents give up all legal rights to the child and allow other people to raise their child. Adoption are arranged through social services and adoption agencies, but they are made legal by court order. Once an adoption order is made legal it cannot be undone and the level of contact between birth parents and adoptive parents are settled by those involved. An adoption order cannot be issued until the baby is at least 6 weeks old. No one can force you to put a baby up for adoption even if you are under 18, and the father's permission is only needed if he is named on the birth certificate.

However, a court can decide the adoption can go ahead without your consent if it thinks the child would be put at risk if they were not or if it is determined that you're incapable of giving consent, for example due to a mental disability.

Abortion

Abortions are quite common and about 1/3 of women will have had an abortion by the time they are 45. If you live in **England**, **Wales** or **Scotland**, two doctors need to agree that continuing the pregnancy will cause you significant physical or mental distress. Once they have agreed, you have until 24 weeks into the pregnancy to have an abortion. A GP will not perform the abortion but will refer you to a specialist service like the Marie Stropes Clinic. You do not need the permission of the father in order to have an abortion nor do you need the permission of your parents if you are under 16 and are considered mature enough to make medical decisions. A woman can change her mind at any point in the process. If your GP does not agree with abortion and refuses to refer you for the procedure, you have the right to go to another Doctor for the referral.

There are two ways of ending an unwanted pregnancy; a medical abortion or a surgical abortion. Which you have depends on many factors, including how far along in the pregnancy you are.

- **Up to 10 weeks: Early medical abortion – sometimes known as 'the abortion pill'** - Early medical abortion can involve two visits to a clinic and is performed in the first ten weeks of pregnancy. This method involves taking two medicines which end a pregnancy. It's not the same as emergency contraception.
- **Up to 15 weeks: Vacuum aspiration – sometimes known as 'the suction method'** - For this procedure either a general (asleep) or local (awake) anaesthetic would be given. The procedure only takes about 5-10 minutes and there is no wound or stitches. The cervix is gently stretched to allow a thin tube to pass through it into the womb. Once the tube is inserted the pregnancy is removed by suction. Most people only take an hour or so to recover and go home the same day.
- **Abortions after 15 weeks** Abortion after 15 weeks is less common and most abortions happen in the first 13 weeks of pregnancy.

KPI 6 - Sexual Health

A sexually healthy person is someone who understands that sex can have various outcomes, ranging from pleasure to transmission of sexually transmitted infections (STIs).

	Types of Contraception			
	Birth control	**How to use**	**Prescription Needed**	**Protects against STIs**
Hormonal	Oral Contraceptive (the pill)	Take one pill every day as directed	Yes	No
	Patch	Apply to the skin and change weekly	Yes	No
	Vaginal ring	Insert monthly and leave in place for 21 days	Yes	No
	Hormonal intrauterine contraceptive (IUC)	Inserted into the uterus and can remain for up to three or five years	Yes, IUC inserted in the healthcare providers office	No
	Injection	Get injections every three months	Yes, injection given in health care providers office	No
	Implantable hormonal contraceptive	Implanted under the skin of the arm and can remain for up to three years	Yes, inserted in the healthcare providers office	No
Barrier	Female condom	Insert every time before sex	No	Yes
	Male condom	Partner must wear every time during sex	No	Yes

KPI 7 – Forced Marriage

A forced marriage is where one or both people do not (or in cases of people with learning disabilities or reduced capacity, cannot) consent to the marriage as they are pressurised, or abuse is used, to force them to do so. It is recognised in the UK as a form of domestic or child abuse and a serious abuse of human rights. The pressure put on people to marry against their will may be:

- physical: for example, threats, physical violence or sexual violence
- emotional and psychological: for example, making someone feel like they are bringing 'shame' on their family
- Financial abuse, for example taking someone's wages, may also be a factor.

The Anti-social Behaviour, Crime and Policing Act 2014 made it a criminal offence in England, Wales and Scotland to force someone to marry. This includes:

- taking someone overseas to force them to marry (whether or not the forced marriage takes place)
- marrying someone who lacks the mental capacity to consent to the marriage (whether they are pressured to or not)