Year 10 Core Subjects

Knowledge Organiser

September- December 2024

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

AMBITION, CONFIDENCE, CREATIVITY, RESPECT, DETERMINATION

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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

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

Percentage change

Topics

- Compound interest calculations (U332)
- Growth and decay (U988)

Building Blocks

- Percentage change with a calculator (U671)
- Finding original values in percentage calculations (U286)

Keywords

Compound interest - interest calculated by adding the interest each year before calculating the new amount.
Growth - amount increases/goes up.
Decay - amount decreases/ goes down.

Surface area

Topics

- Finding the surface area of pyramids (U871)
- Finding the surface area of cones (U523)
- Finding the surface area of spheres (U893)
- Finding the surface area of frustums (U334)
- Finding the surface area of composite shapes (U561)

Building Blocks

- Finding the surface area of cubes and cuboids (U929)
- Finding the surface area of prisms (U259)
- Finding the surface area of cylinders (U464)

Keywords

Pyramid - 3D shape with the base of a polygon, other faces meet in one point above the base.
Cone - pyramid with a circle as a base.
Sphere (ball) - a round solid figure.
Frustum - a pyramid or a cone being cut into two parts.

Volume

Topics

- Finding the volume of pyramids (U484)
- Finding the volume of cones (U116)
- Finding the volume of spheres (U617)
- Finding the volume of frustums (U350)
- Finding the volume of composite shapes (U543)

Building Blocks

- Finding the volume of cubes and cuboids (U786)
- Finding the volume of prisms (U174)
- Finding the volume of cylinders (U915)

Keywords

(See Surface area)

Linear simultaneous equations

Topics

- Solving simultaneous equations using elimination (U760)
- Solving simultaneous equations using substitution (U757)
- Solving simultaneous equations graphically (U836)
- Constructing and solving simultaneous equations (U137)

Building Blocks

- Solving equations with two or more steps (U325)
- Solving equations with the unknown on both sides (U870)
- Constructing and solving equations (U599)

Keywords

Simultaneous equations - two linear equations satisfied by the same pair of values.
Linear - no variable with a higher power than 1.
Intersection - crossing of two lines.

Rearranging formulae

Topics

- Changing the subjects of formulae (U556)

Building Blocks

- Solving equations with two or more steps (U325)
- Solving equations with the unknown on both sides (U870)
- Solving equations with the unknown in the denominator (U505)
- Expanding and factorising brackets (U179, U768, U365)

Keywords

Formulae - equations used to find quantities when given certain values.
Subject - variable that needs to stand by itself after rearranging a formula.

Right-angled trigonometry

Topics

- Understanding sin, cos and tan (U605)
- Finding unknown sides in right-angled triangles (U283)
- Finding unknown angles in right-angled triangles (U545)
- Using the exact values of trigonometric ratios (U627)
- Angles of elevation and depression (U967)
- Calculating with trigonometry and bearings (U164)

Building Blocks

- Calculating with roots and powers (U851)
- Solving equations with two or more steps (U325)
- Changing the subjects of formulae (U556)
- Angles in triangles (U628)
- Measuring and drawing bearings (U525)

Keywords

Trigonometry - use of ratios of sides and angles.
Bearing - angle giving a direction from one object to another. Measured clockwise from the North line and given in three figures.

Constructions and loci

Topics

- Constructing loci (U820)

Building Blocks

- Constructing bisectors of angles (U787)
- Constructing perpendicular bisectors and lines (U245)

Keywords

Construct - draw accurately
Locus(plural: loci) - Path of a point that moves according to a given rule.

Year 10 Biology Knowledge Organiser - Bioenergetics – Photosynthesis

Box 1 - Photosynthesis

Most of the material that makes up a plant comes from the air through the chemical reaction photosynthesis. Plants do not consume, instead they use light energy from the Sun to react carbon dioxide from the air and water from the soil to form glucose a store of chemical potential energy. Plants form the start of every food chain making photosynthesis essential for all living things. The reaction involves energy being stored in the products of a reaction – this makes the reaction **endothermic**.

The reaction can be shown in these equations:

$$\text{carbon dioxide} + \text{water} \xrightarrow{\text{light}} \text{glucose} + \text{oxygen}$$

$$6CO_2 + 6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2$$

The oxygen released by photosynthesis has built up in the atmosphere over millions of years, allowing all forms of life to perform respiration using oxygen. .

Photosynthesis occurs in the **chloroplasts** a sub-cellular structure in some plant cells. Simple molecules like carbon dioxide and water can't be used as food. However, glucose and other more complex molecules can – so you can think of photosynthesis as a reaction that produces food.

Box 2 - Using The Glucose From Photosynthesis.

Plants use the glucose in the following ways, they cannot consume the molecules they need to produce cells, instead they absorb minerals and ions and use glucose for energy and convert it into different molecules.

- Used in <u>respiration</u> in the cells of the plant/algae
- Converted into **starch** for <u>storage</u>. Starch is good for storage as it is *insoluble*, so it doesn't affect the osmosis occurring in the plant, unlike glucose.
- Used to produce **fats or oils (lipids)** for <u>storage</u>. This is particularly noticeable in seeds and nuts.
- Used to produce **cellulose**, which is a component of the cell wall. Cellulose strengthens the cell wall.
- Used to produce **amino acids**, which in turn are used to <u>synthesise (make) proteins</u> (in the ribosomes). To produce amino acids, plants also require **nitrates** from the soil.

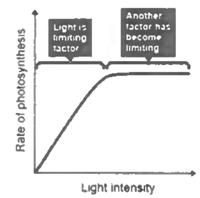
Simple lab tests can be used to identify starch, glucose and protein. Starch turns **iodine** a blue-black colour. Glucose turns **Benedict's solution** orange-red when heated with it. Proteins turn **Biuret's reagent** purple.

Key Terms	Definitions
photosynthesis	The endothermic reaction that transfers light energy to chemical potential energy. In it, simple molecules (CO_2 and H_2O) are converted into more complex molecules (glucose) that can be used for food.
nitrates	Ions containing nitrogen and oxygen. These are found in the soil; plants need nitrates to produce amino acids.
rate	How much a factor changes over time, for example how much glucose is produced every minute.
light intensity	The amount/strength of light. Use this term instead of 'amount of light'.
chlorophyll	The green pigment in leaves that absorbs light for photosynthesis. Chlorophyll is found in **chloroplasts**.

Box 3 - The Rate Of Photosynthesis.

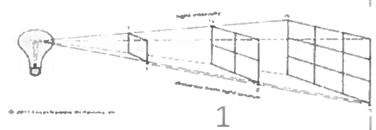
The following factors affect the rate of photosynthesis:

- **Temperature**: because all chemical reactions speed up as the temperature increases. However, as photosynthesis is controlled by enzymes, too high a temperature prevents photosynthesis (more on this in the metabolism section).
- **Carbon dioxide concentration**: the higher the concentration of CO_2 in the air, the more is available for photosynthesis, so the rate of photosynthesis increases as concentration increases.
- **Light intensity**: as the equation shows, photosynthesis requires light energy. So, the higher the light intensity, the higher the rate of photosynthesis.
- **Amount of chlorophyll**: more chlorophyll means more light can be absorbed. Some leaves have pale parts, as you may have seen, due to a lack of chlorophyll. The rate of photosynthesis is obviously much lower in the pale parts compared to the deep green parts.



<u>HT:</u> at any given time, any one of these factors may be **limiting** the rate of photosynthesis. This can be shown on graphs – see example. When it comes to light intensity, it varies with distance according to an *inverse square law*: light intensity = $\frac{1}{distance\ from\ source^2}$

In commercial growing of plants (e.g. tomatoes in a greenhouse), the conditions are optimised to maximise the rate of photosynthesis and obtain the highest profit.



Light intensity – as the distance away from the light source doubles, the strength of the light reduces by a factor of four, this is because the light is spread over a larger area.

Year 10 Physics Knowledge Organiser
The Particle Model of Matter page 1

Box 1 - States of matter and changes of state

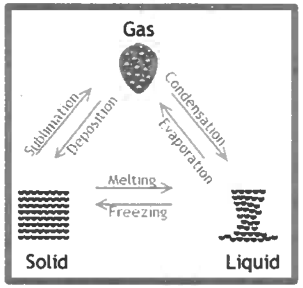
The particle model is used to explain differences between the properties of the three states of matter (solids, liquids and gases)and also changes of state.

Solids are difficult to change shape and can't be compressed. In a **solid:**

- Particles are **fixed in position**
- Particles **vibrate**
- **Strong forces of attraction** between the particles.
- Particles have **least energy** in their kinetic stores.

Liquids take the shape of their container and flow but can't be compressed. In a **liquid:**

- Particles are still **very close together** .
- Particles are **randomly arranged**
- Particles can **move/flow** past each other.
- There are **weaker forces of attraction** between the particles.



Gases expand to fill the space and are easy to compress. In a **gas**:

- Particles are **randomly arranged and further apart.**
- Particles move very quickly in **random** directions
- **There is empty space** between the particles.
- There are **very weak (almost no) forces of attractions** between the particles.
- Particles have **most energy** in their kinetic stores.

Changes of state are called **physical changes**. This is because the material recovers its original properties when the change is reversed.

Box 2 - Density and the particle model

Density is a measure of the mass of a substance per unit volume .

A **denser material has particles that are more tightly packed together**.

Substances generally have the highest density when they are in solid form and gases have the lowest density.

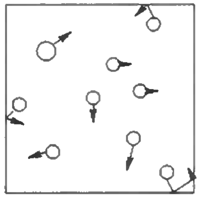
Density can be calculated using the equation given below. You need to learn this equation.

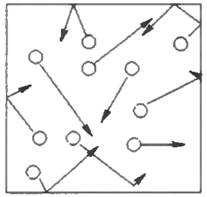
Equation	Meanings of terms in equation
$\rho = \frac{m}{V}$	***Density = Mass ÷ Volume*** *ρ = density (kilograms per metre cubed, kg/m^3)* *m = mass (kg)* *V = volume (metres cubed, m^3)*

Key Terms	Definitions
particle model	The model that represents the arrangement and movements of the molecules or atoms and shows them as small, hard spheres. It is sometimes called the kinetic model.
melt	The change of state from solid to liquid
freezing	The change of state from liquid to solid
evaporation	The change of state from liquid to gas.
condensation	The change of state from gas to liquid.
sublimation	The change of state from a solid straight to a gas.
gas pressure	The force exerted per unit area, by particles in a gas, when they hit the walls of a container.

Box 3 - Pressure in gases

Cooler gas – particles have less energy in the kinetic stores.





Hotter gas – particles have more energy in the kinetic stores.

Particles in a gas are constantly moving randomly– so they store energy in their **kinetic stores.** When they move they **collide** with the walls of their container, and **exert a force**. This is pressure.

The total force exerted on a certain area of the wall is the **gas pressure**.

Increasing the **temperature** of a gas (but keeping the volume the same) **increases** the **pressure of the gas**.

The **temperature of a gas** is related to the **average kinetic energy** of the **molecules**. The higher the temperature, the more energy the particles have in their kinetic stores. This means, on average, they move faster. Therefore, there are more collisions with the container walls and they exert a greater force when they collide with the walls . This means that the pressure increases.

Year 10 Physics Knowledge Organiser
The Particle Model of Matter page 2

Box 4 - Internal energy and the particle model

Any substance, whether solid, liquid or gas, **stores energy**. The quantity of energy stored is called the **internal energy.**
The particles (atoms and molecules) have energy in kinetic stores (since they move/vibrate) and potential energy stores (e.g. energy stored in their chemical bonds).
The total of the kinetic energy and the potential energy of the particles is called the **internal energy**.

Heating changes the energy stored within a system by increasing the energy of the particles that make up the system, so increasing the internal energy. This **increasing internal energy either raises the temperature of the system or causes a change of state**. Look at the graph on the right. The temperature remains constant when the change of state (melting or boiling) occurs.

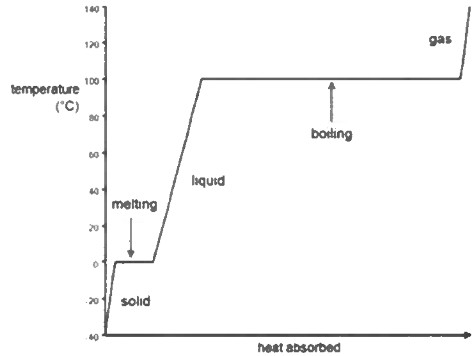
Box 5 - Specific heat capacity and temperature changes

Some substances are harder to heat up than others, and cool down less easily.
The measurement of this is called **specific heat capacity**. This is the amount of energy needed to heat 1kg of a substance by 1°C.
The value for specific heat capacity is different for different substances.
When heating something, the **temperature rise** of the system **depends on**:

- the **specific heat capacity** of the substance being heated
- the **mass** of the substance
- the **amount of energy put** into the system.

Equation	Meanings of terms in equation
$\Delta E = m\,c\,\Delta\theta$	*ΔE = change in thermal energy (joules, J)* *m = mass (kg)* *c = specific heat capacity (joules per kilogram per degree Celsius, J/kg °C)* *$\Delta\theta$ = temperature change (°C)*
$E = m\,L$	*E = energy (joules, J)* *m = mass (kg)* *L = specific latent heat (J/kg)*

Key Terms	Definitions
system	Object or group of objects.
internal energy	The total kinetic energy and potential energy of all the particles (atoms and molecules) that make up a system.
kinetic energy store	The energy store associated with the movement of the particles. Then higher the temperature, the more energy there is in this store.
specific heat capacity	The amount of energy required to raise the temperature of 1 kg of a substance by 1°C
latent heat	The energy needed for a substance to change state. This is calculated using an equation you will be given.
specific latent heat	The amount of energy required to change the state of 1 kg of a substance with no change in temperature.



Box 6 - Changes of state and specific latent heat

When a substance **changes state**, the **internal energy increases**, but the **temperature stays the same** (see graph above). The energy is being used to overcome the forces (break the bonds) between the particles instead of raising the temperature
The quantity of **energy needed for a substance to change state is called the latent heat**.
Specific latent heat is specific to a substance, and is the energy required to change the state of 1kg of the substance, with **no** change in temperature.
The energy needed for a state change depends on mass and specific latent heat of a substance – as the second equation on the left shows.
Specific latent heat of fusion is for changes from solid to liquid.
Specific latent heat of vaporisation is for changes from liquid to gas (vapour).

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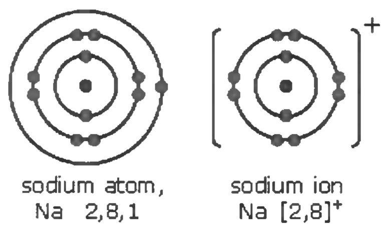
Bonding, Structure and Properties of Matter page 1

Box 1 - Formation of Ions

Chemical reactions occur between atoms so the participating atoms can have a full outer shell of electrons, and therefore become stable. Metal atoms will lose electrons to get a full outer shell and non-metals will gain electrons to get a full outer shell.
Ions are particles with a positive or negative charge. Positive ions are formed when an atom loses electrons, negative ions are formed when an atom gains electrons. For example, sodium has one electron in its outer shell - it loses one electron to form a Na^{+1} ion. We represent ions with square brackets around the ion and the charge in the top right corner.

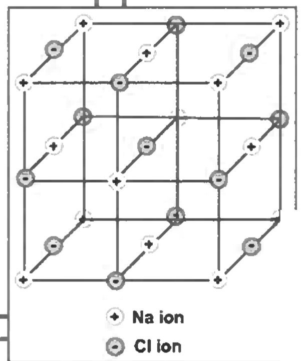


The **group number** indicates how many electrons an atom would have to lose or gain to get a full outer shell of electrons. See below to see what ions different groups form

Group	What happens to the electrons?	Charge on ions	Example
1	Lose 1	+1	Li^+, Na^+, K^+
2	Lose 2	+2	Mg^{2+}, Ca^{2+}
3	Lose 3	+3	Al^{3+}
5	Gain 3	-3	N^{3-}
6	Gain 2	-2	O^{2-}, S^{2-}
7	Gain 1	-1	F^-, Cl^-, Br^-, I^-

Box 2 - Ionic Compounds –Giant Ionic Lattice

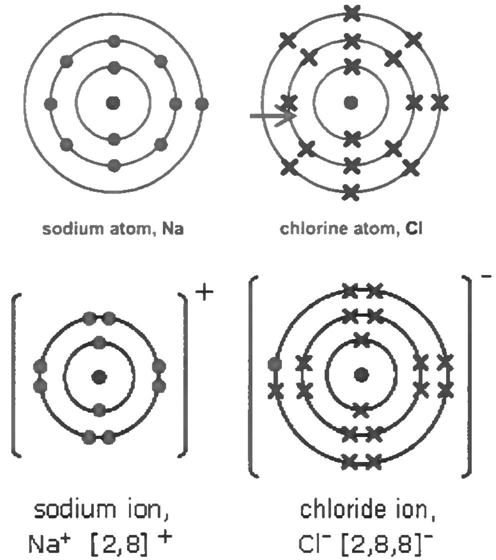
An ionic compound is a **giant structure of ions**. They are held together by strong **electrostatic forces** of attraction between oppositely charged ions. These forces act **in all directions** in the lattice and this is called ionic bonding



Key Terms	Definitions
Metal	An element that can form positive ions when it reacts
Non-metal	An element that can form negative ions when it reacts
Ion	A charged particle is formed when one or more electrons are lost or gained from an atom or a molecule.
Ionic bond	A bond formed by the electrostatic attraction of oppositely charged ions. Ionic bonds form between atoms of metals and non-metals.
Electrostatic	The force between a positive and negative charge.

Box 3 - Ionic Bonding

When metal and non-metal atoms react together, **electrons** in the outer shell of the **metal atom** are **transferred** to the outer shell of the **non-metal atom**. The metal forms a positively charged ion, and the non-metal forms a negatively charged ion. There is an **electrostatic attraction** between the two ions, and an ionic bond is formed. Both ions formed have **a full outer shell,** similar to the electronic structure of a noble gas, and are stable within the new compound.
See example below of how sodium chloride (NaCl) is formed.



Single electron in outer shell of Na atom transfers to the outer shell of the chlorine atom.

Electrostatic attraction between the oppositely charged ions and an ionic bond is formed.

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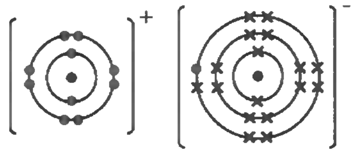
Box 4 - Ionic Bonding- Models

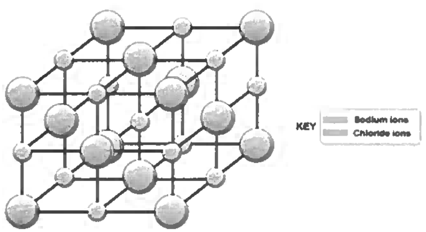
Ionic compounds can be represented using different models. Each model has **advantages (+) and limitations (-).** Below are models of diagrams representing **sodium chloride, NaCl**

Dot and cross diagrams (and some other 2D models)



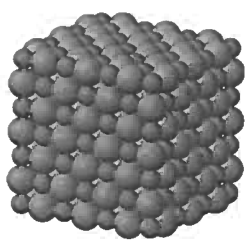
+ Show how the electrons are transferred
- Doesn't show the 3D structure of a giant ionic compound
- Doesn't show the relative sizes of the ions or how they're arranged

Ball and Stick models



+ Show the regular pattern in an ionic lattice
+ Show how the ions are arranged
+ Suggests that the structure extends beyond what is shown
- Sometimes the ions are not shown to size scale
- Suggests there are gaps between the ions (sticks) when there are not

3D Models



+ Shows the relative sizes of the ions
+ Shows the regular pattern of an ionic crystal
- Only shows outer layer of the compound
- Doesn't show how the bonds are formed
- Only shows a very small part of a compound that would be billions of ions

Key Terms	Definitions
Ionic lattice	A closely-packed regular arrangement of charged particles (ions) held together by electrostatic forces of attraction.
Model	Something used to describe or display how an object or system behaves in reality.
Aqueous	When a substance is dissolved in water
Empirical formula	A chemical formula showing the simplest possible whole number ratio of atoms in a compound

Box 5 - Properties of Ionic compounds

The bonding in ionic compounds affects their properties. Ionic compounds have:

- **high melting points** and **high boiling points** due to strong electrostatic attraction between the ions. It takes a large amount of energy to overcome the attraction and break the many strong bonds.
- Most ionic compounds **dissolve easily** in water (**soluble**) to form **aqueous** solutions
- Solid ionic compounds do not conduct electricity as the ions are held in fixed positions. They only **conduct electricity** when **molten (liquid state)** or **dissolved** in aqueous solutions. This is because the **ions** are **free to move** and so charge can flow.

Box 6 - Empirical Formula of Ionic Compounds

To calculate empirical formulae:

From dot and cross diagrams: count the numbers of metal ions to non-metal ions. Eg: In sodium chloride, 1 sodium atom transfers one electron to one chlorine atom, so the empirical formula is **1:1, NaCl**. But when sodium bonds with oxygen, sodium only transfers one electron but oxygen gains two. There are two Na atoms for every O atom, so the empirical formula is **2:1 Na_2O.**

From a 3D or ball and stick model: The diagrams are used to work out the ions in the compound. The charges of the ions counted need to balance so the overall charge is zero. E.g. A ball and stick model of sodium chloride contains Na ions with a +1 charge and Cl ions with a -1 charge. Only 1 of each is needed to produce a zero charge (+1)+ (-1) = 0, so the formula is NaCl

E.g. in a 3D model of potassium oxide, the K ion has a charge of +1, and the O ion has a charge of -2. So 2 K ions are needed for every O ion to produce a zero charge (+1) + (+1) + (-2) = 0, so the formula is K_20

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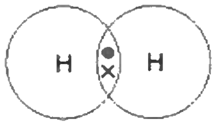
Box 7 - Covalent Bonding

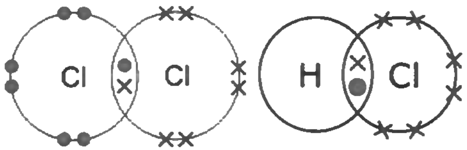
Covalent bonding occurs between atoms of **non-metal elements**. Atoms **share** electrons with each other in order to get full outer shells . Each covalent bond provides one extra electron for each atom. Each atom involved must make enough covalent bonds to fill up the outer shell.

E.g. H_2 Hydrogen atoms have one electron in their outer shell. Each H atom needs one extra electron to fill up its outer shell (H has only has one shell). So a H atom will form one covalent bond with another H atom, to give both atoms a full outer shell, we can show this bond on a dot and cross diagram.

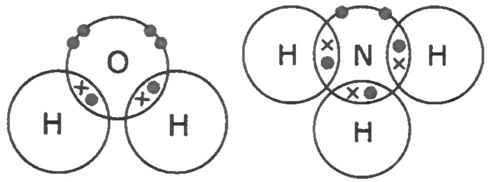
Hydrogen, H_2



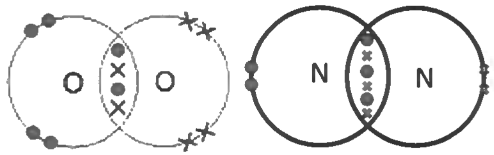
Dot and cross diagrams are used to show covalent bonding in molecules. It is important to represent the electrons on one atom with a dot and on the other atom with an X and place shared electrons **in the middle** of the overlap. Also **only** the **outer shell** of each atom is shown. A pair of shared electrons is a **single** covalent bond.



In each molecule of chlorine, Cl_2, and each molecule of hydrogen chloride, HCl – each atom needs only one electron to make a full shell, so each atom must form **one** single covalent bond.



In water, H_2O, the O atom needs to form 2 covalent bonds to get 2 extra electrons for its outer shell. It bonds with 2 atoms of H. In ammonia, NH_3, the Nitrogen atom needs to form 3 bonds to get 3 extra electrons and so bonds with 3 atoms of H.

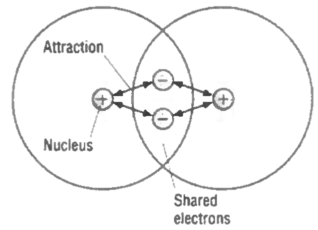


Oxygen, O_2, shares two electrons per atom to make a **double bond. (2 pairs of shared electrons)**. Nitrogen, N_2, shares 3 electrons per atom to make a **triple bond (3 pairs of shared electrons)**. In both cases, the sharing of the electrons gives a full outer shell for each atom involved.

Key Terms	Definitions
Covalent bond	A bond formed when a pair of electrons is shared between 2 atoms.
Molecule	A substance which contains two or more covalently bonded atoms
Lone pair	A pair of outer electrons that are not part of the covalent bond.

Box 8 - The Nature of a Covalent Bond

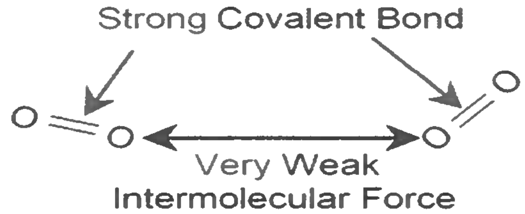
Covalent bonds are **strong** because there is <u>electrostatic attraction</u> between the electrons in the covalent bond and the positively charged nucleus. This means a lot of energy is required to break a covalent bond.

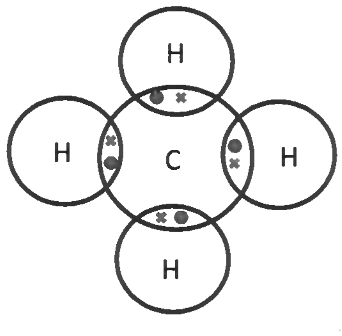


Box 9 - Properties of Simple Covalent Compounds

Simple covalent compounds e.g. O_2, CO_2, CH_4

- have low melting and boiling points
- are often gases at room temperature
- **Strong covalent bonds** between the atoms in each molecule
- **Weak intermolecular forces** between whole molecules. This means that only a small amount of energy is required to overcome these weak forces – hence low melting and boiling points.





The dot and cross diagram on the left is methane, CH_4. You will need to **memorise** how to draw dot and cross diagrams for this and **ALL** the molecules on this page.

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Box 10 - Properties of Simple Covalent Molecules-Continued

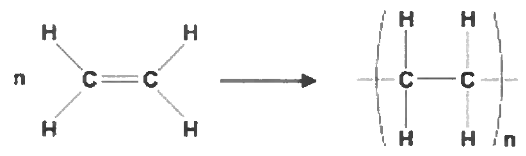
- Do not conduct electricity in any state as no ions or free electrons to carry the charge
- In order to melt or boil a simple covalent substance, the **intermolecular forces** must be overcome. The strong covalent bonds between atoms in a simple covalent molecule are too strong to be broken.
- Most simple covalent substances are gases or liquids at room temperature but some can be solids.
- As molecules get bigger, the strength of the **intermolecular forces** increases, so more energy is needed to overcome them and melting point and boiling point increase.
- Group 7, the halogens, form simple covalent molecules (F_2, Cl_2 etc)
- The molecules increase in size down the group because the atoms have extra electron shells.
- The intermolecular forces increase, and so melting points and boiling points do too

Increasing size

Element	Melting Point °C	Boiling Point °C	State at room temperature
Fluorine, F_2	-220	-188	Gas
Chlorine, Cl_2	-101	-34	Gas
Bromine, Br_2	-7	59	Liquid
Iodine, I_2	114	184	Solid

Box 11 - Polymers – larger covalent substances

- Large covalent compounds which can be many thousands of atoms in length.
- Made from small molecules known as **monomers** joined together.
- All atoms in a polymer joined by strong covalent bonds
- Represented by drawing the **repeating unit**
- **Repeating unit** is the monomer structure in square brackets with an *n* after the brackets to show that it is repeated many times



n = a big number of monomers

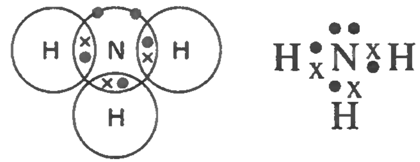
The diagram shows many (*n*) ethene molecules joined together to form poly(ethene) or polythene.
Molecular formula = $(C_2H_4)_n$

Key Terms	Definitions
Polymer	A long chain molecule that is formed by joining lots of smaller molecules (monomers) together.
Repeating unit	The shortest repeating section of a polymer
Intermolecular forces	The force of attraction between two molecules

Box 12 - Representing Simple Covalent Molecule

There are variety of ways that scientists use to represent covalent compounds.

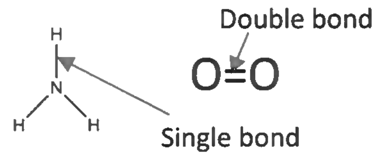
1. **Dot cross diagrams**



With electron orbitals Without orbitals

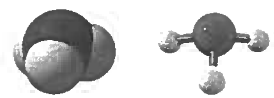
- \+ Show which atom the electrons in a covalent bond come from
- \- Doesn't show how the atoms are arranged in space
- \- Doesn't show the relative sizes of the atoms

2. **Displayed formula**



- \+ Covalent bonds as lines between atoms
- \+ Shows how atoms are connected
- \- Doesn't show 3D structure
- \- Doesn't show the origin on electrons in covalent bonds

3. **3D models & ball and stick models**



Ammonia, NH_3

- \+ Shows atoms and their arrangement
- \+ Ball & stick model shows bonds
- \- Doesn't show electrons in bonds
- \- Confusing in large molecules

Box 13 - Polymer properties

- Higher melting points and boiling points than simple covalent molecules such as CO_2, O_2
- Intermolecular forces between the long polymer chains are stronger and so require more energy to overcome in order to change state
- Most polymers are solid at room temperature
- But intermolecular forces in polymers are still weaker than bonds in giant ionic and giant covalent structures so the melting points are lower than those compounds

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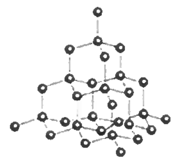
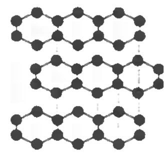
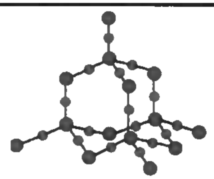
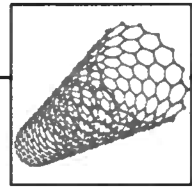
Key Terms	Definitions
Giant covalent structure	A large molecule which contains a large number of atoms held together by covalent bonds.
Delocalised electron	An electron that isn't associated with a particular atom or bond and is free to move within a structure.
Allotrope	Different forms of the same element for example diamond and graphite are allotropes of carbon.
Macromolecule	A large molecule which contains a large number of atoms held together by covalent bonds.

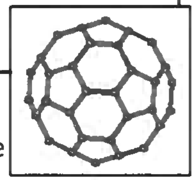
Box 14 - Giant Covalent Structures (Macromolecules)

- All atoms are bonded to each other by strong covalent bonds.
- Have a **high melting point and boiling points** because many strong covalent bonds between the atoms need to be overcome to change state and this requires a lot of energy.
- Examples are diamond, graphite (=**allotropes** of carbon), and silicon dioxide (silica)

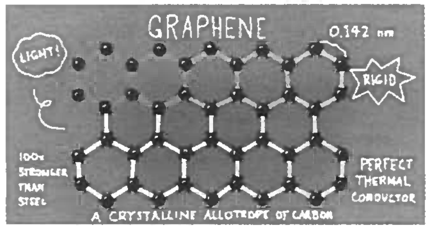
Substance	Diagram	Description	Properties
Diamond		Each carbon atom is covalently bonded to four other carbon atoms	• Vey hard due to rigid structure • Very high melting point, due to strong covalent bonds between all the atoms • Does not conduct electricity as no free electrons or ions
Graphite		Each carbon atom is covalently bonded to 3 other carbon atoms – one outer electron in each atom is free Sheets (layers) of carbon atoms arranged in hexagons Weak **intermolecular forces** between layers	• High melting point – due to covalent bonds • Conductor of electricity and heat due to free **delocalised electrons** which can move • Slippery as layers can slide over each other because of **weak intermolecular forces**
Silica (silicon dioxide)		Each silicon atom is covalently bonded to 2 oxygen atoms and vice versa	• Strong due to rigid structure and covalent bonds • High melting point – due to covalent bonding



Carbon nanotube



Buckminsterfullerene



Box 15- Graphene and Fullerenes – other allotropes of carbon

Graphene is a **single layer** of **graphite** and it is 1 atom thick. It is strong due to covalent bonds. light so can be added to composite materials to improve strength for a lower mass, and conducts electricity due to delocalised electrons. Used in electronics.

Fullerenes are hollow molecules of carbon. **Nanotubes** are cylindrical fullerenes and **buckminsterfullerene** (C_{60}) is a sphere. They are **strong** and are excellent **conductors** of both **heat and electricity.** Used in drug delivery, as catalysts (due to high surface area), as lubricants, as strengthening materials and in electronics.

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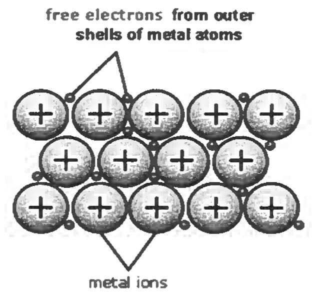
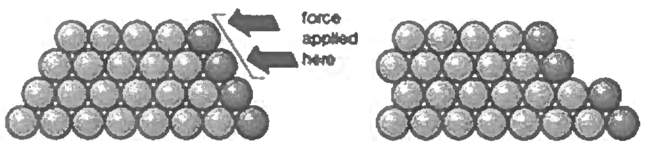
Box 16 - Metallic Bonding
Metals form giant structures. The metal atoms are arranged in a regular pattern, closely packed and in rows. The electrons in the outer shell of the atoms are not associated with any atom are so are **delocalised.** This forms positive metal ions which are in a **"sea of delocalised electrons".**
Strong electrostatic forces of attraction between the ions and the electrons, known as metallic bonding, hold the structure together.
Delocalised electrons are free to move, so conduct heat and electricity



This would be the structure of a group 1 metal like sodium, if it were a group 2 metal (e.g. magnesium) then the charge on the ions would be 2+

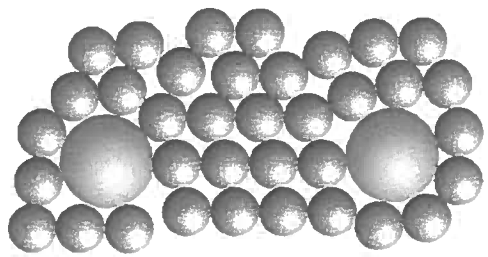
Box 17 - Properties of Metals
- **High melting points and boiling points** due to strong electrostatic forces between metal ions and delocalised electrons so a large amount of energy is needed to overcome these forces.
- **Good conductors of electricity**, due to the delocalised electrons, which can move so charge can flow. Metals are also **good conductors of heat** as the free electrons can transfer the energy through the metal.
- **Malleable -** can be bent and shaped as well as hammered and rolled into shapes. The regular layers of ions can easily slide over one another. This means that many pure metals are too soft for uses such as building.



Key Terms	Definitions
Metallic bond	The attraction between metal ions and delocalised electrons in a metal.
Mixture	A substance made form 2 or more elements or compounds that aren't chemically bonded to each other.
Alloy	A metal that is a mixture of 2 or more metals, or a mixture involving metals and non-metals
Delocalised electron	An electron that isn't associated with a particular atom or bond and is free to move within a structure.
Malleable	The ability of a material to be bent into shape.

Box 18 - Alloys
Pure metals are often too soft (easily malleable) to be used in everyday applications. They are mixed with other metals to make them harder.
An **alloy** is a metal that is a mixture of 2 or more metals, or a mixture involving metals and non-metals.
Different metal elements have different sized atoms. When mixed together, the layers are distorted by the different sized atoms and they cannot easily slide past each other when a force is applied, making them harder, and less malleable.
Brass = copper and zinc alloy used for musical instruments
Nitinol = nickel and titanium alloy used in orthodontic braces

An alloy of 2 different metals with different sized atoms means that the layers are distorted. (compare with pictures on left)



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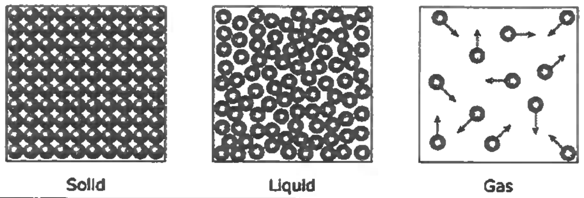
Box 19 - Materials and States of Matter

All materials can exist in 3 different forms called states of matter. These are **solid, liquid and gas.** The state of matter depends on how strong the forces of attraction are between the particles of the material. This depends on:

- The material – the structure of the substance and type of bonds between particles
- The temperature
- The pressure

The particle theory model explains how particles behave in each of the three states of matter.



State of matter	Arrangement of particles	Movement of particles	Property
Solid	Regular, in rows, with particles closely packed and touching each other Strong forces of attraction between particles	Vibrate around a point. Vibrate more when heated. Cannot move from place to place	Rigid Do not flow Fixed shape and volume Can't be compressed Expand slightly when heated
Liquid	Irregular but particles are still touching Weak forces of attraction between particles	Can move past each other Flow to fill the bottom of a container Constantly moving with random motion	Not rigid Can flow No fixed shape Fixed volume Can't be compressed Expand slightly when heated
Gas	Irregular, random arrangement. Particles are far apart (not touching) Very weak forces of attraction between particles	Constant rapid random motion in all directions. Travel in straight lines until they collide with container walls or each other Increase temperature results in faster movement	Not rigid No fixed shape No fixed volume Can flow Can be compressed Expand when heated – increase pressure if contained

<u>Higher Tier - Limitations of Particle Theory Model:</u>
- particles are not solid inelastic spheres, they are atoms, ions or molecules
- Model doesn't show strength of forces between particles, size of particles or distance between them

Key Terms	Definitions
Particle Theory Model	A model that represents how the particles in a material behave in each of the three states of matter. Each particle is a small, solid inelastic sphere.
State of matter	The physical arrangement of particles determines the state of a particular substance: solid, liquid or gas.
Changing state	A physical change between different states of matter. No new chemical substance is formed, and the change is reversible. Mass stays the same.
Melting / freezing	The change of state from solid to liquid/liquid to solid which takes place at the melting point
Evaporation/ condensation	Change of state from liquid to gas/ gas to liquid which takes place at the boiling point

Box 20 - Changing state

- Physical change. Only arrangement or energy of the particles change – not the particles themselves.
- As a solid material is heated, the particles gain more energy and vibrate. Attractive forces are weakened and at the melting point the particles have enough energy to break free from their positions and change to a liquid.
- If the liquid is heated, the particles move faster, the forces are weakened more and at the boiling point the particles overcome the forces holding them together and form a gas.
- When substances are cooled from a gas to a liquid to a solid, the particles have decreasing amounts of energy in their kinetic stores and cannot overcome the forces of attraction. The attractive forces get progressively stronger and hold the particles in position.
- The stronger the forces of attraction between the particles in a substance, the higher the melting and boiling points.

Box 21 - Atomic and bulk properties

- In bulk, there are many billions of atoms or molecules
- How this bulk behaves are 'bulk properties'
- Bulk properties include density and melting point which stays the same even if the number of particles in bulk changes
- Bulk properties depend on how the particles interact
- Single atoms or molecules therefore behave differently

Box 22 - State symbols – used in chemical reactions

- Show the physical state of the reactants and products
- (s) solid (l) liquid (g) gas (aq) aqueous

Year 10 Chemistry Knowledge Organiser
Energy Changes page 1

Box 1 - Energy in reactions

In a chemical reaction, bonds are broken and bonds are made.

Breaking a chemical bond means you need to overcome the force of attraction in the bond, which requires energy – It is **endothermic.**

Making a chemical bond is **exothermic:** energy is released when bonds form.

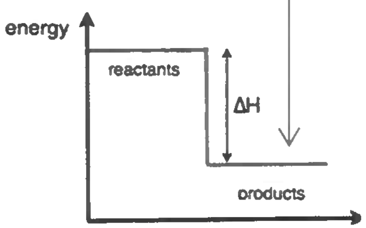
In a chemical reaction the difference between the energy required to break the bonds and the energy gained from making the bonds decides whether the overall reaction is exothermic or endothermic.

Type	What happens?	Why?	Example
Exothermic	Energy is transferred to the surroundings, so the temperature increases.	The energy required to break chemical bonds is less than the energy released by making chemical bonds. The excess energy is released to the surroundings.	Combustion reaction, reactions used in hand warmers
Endothermic	Energy is taken in from the surroundings, so the temperature decreases.	The energy required to break chemical bonds is more than the energy released by making chemical bonds. The needed energy is absorbed from the surroundings.	The reaction of citric acid and sodium hydrogen carbonate, the reactions used in ice packs

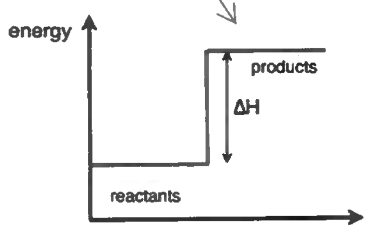
Box 2 - Reaction Profiles

Reaction profiles can be used to show the relative energies of reactants and products, and the overall energy change of a reaction.

This is the reaction profile of an **exothermic reaction:** the energy of the products is lower than that of the reactants. The difference in energy is released to the surroundings, causing a temperature rise.



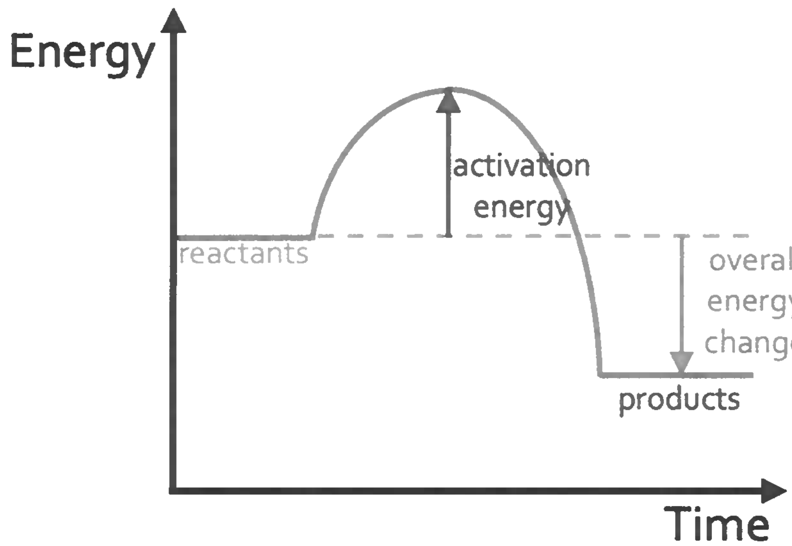
This is the reaction profile of an **endothermic reaction:** the energy of the products is higher than that of the reactants. The difference in energy is absorbed from the surroundings, causing the temperature to fall.



Key Terms	Definitions
exothermic	A reaction that gives out heat to the surroundings. Exothermic reactions increase the temperature of the surroundings.
endothermic	A reaction that takes heat in from the surroundings. Endothermic reactions decrease the temperature of the surroundings.
reactant	Reactants are chemicals used in a chemical reaction.
product	Products are chemicals made in a chemical reaction.
reaction profile	A graph which shows the energies of the products and reactants in a chemical reaction.

Box 3 - Reaction profiles and activation energy

Chemical reactions occur only when reacting particles collide with each other with sufficient energy. The minimum energy that particles need to react is called **activation energy**.



Key features

The **activation energy** the quantity of energy that is needed to break the bonds in the reactants.

Heating a reaction mixture often provides the activation energy needed for the reaction to occur.

Year 10 Chemistry Knowledge Organiser
Energy Changes page 2

Box 4 - Higher Tier: Calculating Bond Energies

The difference between the energy needed to break bonds in the reactants and the energy released when bonds in the products are formed is the overall energy change of the reaction.

Exothermic reactions have negative energy change – energy is released to the surroundings, causing the temperature to rise.

Endothermic reactions have positive energy change – energy is taken in from the surroundings, causing the temperature to fall.

Overall energy change = Total energy to break bonds in reactants – Total energy to make bonds in products

Example 1

Consider the reaction: $\mathbf{N_2 + 3H_2 \rightarrow 2NH_3}$

Bond energies (in kJ/mol): H-H 436, H-N 391, N≡N 945

Total energy to break bonds: 1 x N≡N and 3 x H-H, so 945 + (3 x 436) = 2253 kJ/mol
Total energy to make bonds: 6 x H-N, so 6 x 391 = 2346 kJ/mol
Overall energy change = 2253 – 2346 = -93 kJ/mol
→ The total energy change is negative, so the reaction exothermic

Example 2

Consider the reaction: $\mathbf{2H_2O_2 \rightarrow 2H_2O + O_2}$
This reaction can also be shown as below. It shows that hydrogen peroxide breaks down to make water and oxygen.

$$2\,H-O-O-H \longrightarrow 2\,H-O-H \quad + \quad O=O$$

We can use bond energies below to work out the overall energy change in the reaction.

Bond	Bond energy in kJ per mole
H – O	464
O – O	146
O = O	498

Total energy to break bonds: 4 x H-O and 2 x O-O, so (4 x 464) + (2 x 146) = 2148 kJ/mol
Total energy to make bonds: 4 x H-O and 1 x O=O, so (4 x 464) + (1 x 498) = 2354 kJ/mol
Overall energy change = 2148 – 2354 = -206 kJ/mol
→ The total energy change is negative, so the reaction is exothermic

Yr10 Physics Knowledge Organiser Topic – Electricity 2

Key Terms	Definitions
direct p.d.	A supply where the potential difference is fixed at a certain value, so the current flows in one direction only
alternating p.d.	A supply where the p.d. switches between positive a negative, reversing the direction of the current frequently.

Box 1 – Current flow in circuits

Direct potential difference

The flow of charge (current) in a circuit can only travel in one direction around the circuit.

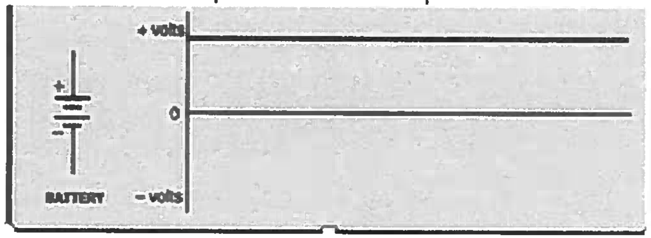
Cells and batteries provide a direct potential difference (p.d).

Alternating potential difference

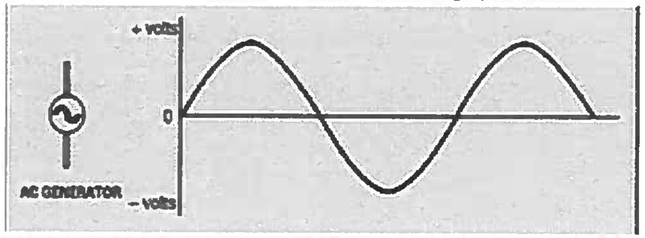
The potential difference is constantly switching from positive to negative and so the current also constantly changes direction in a circuit, which is also known as alternating current (AC).

The **frequency** of the AC is the number of times it reverses per second. It is measured in Hertz (Hz).

Oscilloscope trace – direct p.d.



Oscilloscope trace – alternating p.d.



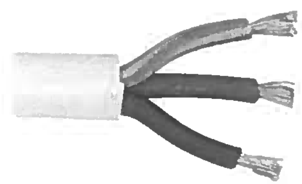
Box 3 – Mains electricity

→ the supply into your house/school etc.)

- is an **ac** supply.
- p.d. of about **230V**
- Frequency is **50 Hz.**

Box 2 – Three-core cables

We connect most electrical appliances to the mains with a three-core cable. The three pins on a plug are just the three ends, or terminals, of the three wires in the cable. Each wire in insulated in a different colour. (see table)



Wire in three-core cable	Colour of the insulation	Function of the wire
Live wire	Brown	Carries the alternating p.d. from the supply to the appliance. (p.d. is +230V to -230V)
Neutral wire	Blue	Completes the circuit. The neutral wire p.d. is at or close to 0V (earth potential).
Earth wire	Yellow and green stripes	Safety wires, and only carry a current if there is a fault and the appliance has become 'live' . Earth wire p.d. is 0V

Box 4 – The National Grid

The National Grid is a system of cables and transformers linking power stations to consumers.

Electrical power is transferred from power stations to consumers using the National grid.

There are two types of transformers in the National grid;

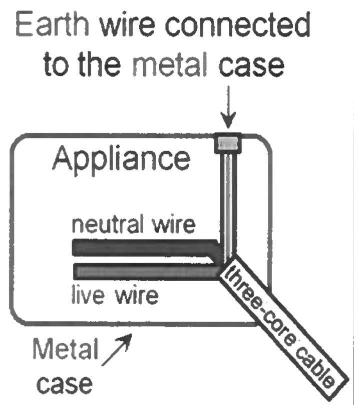
1. Step-up transformers ***increase*** the p.d. from the power station to the transmission cables. This reduces the current so less energy is lost as heat.
2. Step-down transformers ***decrease*** the p.d. from the cables to a much lower value (230V) and safer p.d. for domestic use. This also increases the current to suit electrical appliances used at home.

Box 5 – Dangers (and safety)

The earth wire carries current to the ground.

This makes circuits safer because if there is a fault, it conducts the current to the ground, causing the fuse to melt rather than making the appliance 'live'.

- Earth wires are very important for metal-cased appliances, like cookers or toasters.
- The live wire is the most dangerous wire, since it is at 230 V.



Even if a circuit is switched off (i.e. the switch is **open**), the live wire can still be dangerous because the p.d is still alternating. If you touch it, you may complete a circuit between the live wire and the earth, so you get an electric shock.

Yr10 Physics Knowledge Organiser Topic – Electricity 2

Box 6 – Power

Power is **the rate of energy transfer**, or the rate at which work is done. In electrical components/appliances, the depends on the potential difference across the component and the current through it. Power is measured in **Watts** (which is the same as Joules per second)

The second equation also finds the power. The equation comes from substituting in $V = IR$ into P=VI. The second equation is useful if you don't know the p.d. across a component.

Box 7 – Energy transfers in electrical appliances

Electrical appliances transfer energy. The other way of saying this is that **work is done** when **charge flows** in a circuit.

Some examples of energy transfers in electrical appliances:

- In your mobile phone, energy from the chemical store of the battery is transferred to the thermal store of the surroundings. This means the energy from the battery is **dissipated** to the surroundings.
- A washing machine transfers energy to the kinetic store of the electric motor and to the thermal store of the water (and the surroundings).
- An electric heater transfers energy of the supply to the thermal store of the heater and the surroundings.

The amount of energy transferred by an appliance depends on the **power** of the appliance and the **time** it is switched on for.

Furthermore, since p.d. is a measure of how much work is done per coulomb of charge, you can find out how much work is done (aka energy transferred) by a circuit by multiplying the charge flow by the p.d. (see fourth equation).

Key Terms	Definitions
power	The **rate** (speed) of energy transfer.
work	Energy transfer.
appliance	Any device that transfers energy to other stores. The supply of energy can be a cell, battery, or the mains ac supply.

Equation	Meanings of terms in equation
$P = V \, x \, I$	***Power = Potential difference x Current*** *P = power (watts, W)* *V = potential difference (volts, V)* *I = current (amps, A)*
$P = I^2 \, x \, R$	***Power = Current² x Resistance*** *P = power (watts, W)* *I = current (amps, A)* *R = resistance (ohms, Ω)*
$E = P \, x \, t$	***Energy transferred = Power x time*** *E = energy transferred (joules, J)* *P = power (watts, W)* *t = time (seconds, s)*
$E = Q \, x \, V$	***Energy transferred = Charge x Potential Difference*** *E = energy transferred (joules, J)* *Q = charge flow (coulombs, C)* *V = potential difference (volts, V)*

Box 8 – Interpreting the power of an electrical appliance

The power of an appliance determines how much energy it transfers in a given length of time. If an appliance has a high power (e.g. a washing machine), it transfers lots of energy in a given time. If it has a low power (e.g. a lamp), it doesn't transfer much energy in a given time, in comparison.

The other way of looking at it is how long the appliance takes to transfer a given amount of energy, e.g. 1000 J. A washing machine will transfer the energy in a very short length of time, whereas a lamp will take much longer to transfer this energy.

Yr10 Chemistry Knowledge Organiser
Chemical Changes 1

Box 1 - Acids and Alkalis

Aqueous solutions of **acids** produce **hydrogen ions (H^+).**
Aqueous solutions of **alkalis** contain **hydroxide ions (OH^-).**
We measure the acidity or alkalinity of a substance using the **pH scale which runs from 0-14:**

- pH 0 to less than 7 – the substance is acidic
- pH 7 – the substance is neutral
- pH greater than 7 to 14 – the substance is alkaline.

Indicators change colour depending on the acidity or alkalinity of the substance being tested.
The pH scale is a measure of the concentration of hydrogen ions ($H^{+)}$ in a solution concentration. The **lower the pH** the **higher the concentration of H^+** ions.
The pH scale is a logarithmic scale: a *decrease* of 1 on the pH scale means that the concentration of hydrogen ions increases by 10 times (x10)

Box 2 - HT - Strong and Weak Acids

Acids can be defined as either a **strong or weak acid**
A strong acid is one which **fully dissociates/ionises** in water to release hydrogen ions. E.g. hydrochloric acid, sulfuric acid and nitric acid.

$$HCl_{(aq)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$$

A weak acid is defined as one which only **partially dissociates/ionises** in water.
E.g. ethanoic acid, carbonic acid

$$CH_3COOH_{(aq)} \rightleftharpoons H^+_{(aq)} + CH_3COO^-_{(aq)}$$

Strong acids are **not the same** as concentrated acids. Concentration is the number of particles in a given volume and not how much they dissociate. It is not the same as strength.

Acid	Name of salt	Negative ion in the salt
Hydrochloric acid (HCl)	Chloride	Cl^-
Sulfuric Acid (H_2SO_4)	Sulfate	SO_4^{2-}
Nitric Acid (HNO_3)	Nitrate	NO_3^{1-}

Key Terms	Definitions
acid	A substance which forms H+ ions in aqueous solution
alkali	A substance which forms OH- ions when dissolved: these are soluble bases
base	A substance that can neutralise an acid to make a salt and water
neutralisation	A reaction between an acid and an alkali making a salt and water
strong acid	An acid which totally dissociates in water
Dissociate/Ionise	Split up into ions

Box 3 - Neutralisation Reactions

When an acid reacts with an alkali, they produce a neutral solution with a salt and water. Below are the general equations and an example for different types of neutralisation reaction:

- **Metal oxide + acid → salt + water**
  copper oxide + hydrochloric acid → copper chloride + water
  $CuO + 2HCl \rightarrow CuCl_2 + H_2O$
- **Metal hydroxide + acid → salt + water**
  sodium hydroxide + nitric acid → sodium nitrate + water
  $NaOH + HNO_3 \rightarrow NaNO_3 + H_2O$
- **Metal carbonate + acid → salt + water + carbon dioxide**
  magnesium carbonate + sulfuric acid → magnesium sulfate + water + carbon dioxide
  $MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$

Some of the reactants (for example copper oxide) are insoluble but these can still carry out a neutralisation reaction. We call these **bases** not **alkalis.**

The Neutralisation Ionic Equation

When an acid reacts with an alkali a salt and water are produced. The ionic equation for the production of water is:

$$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$$

Box 4 Required practical - Neutralisation using an acid and an insoluble base

Sulfuric acid can be neutralised with the insoluble base copper oxide to make copper sulfate and water:

1. Put sulfuric acid into a conical flask and warm in a water bath.
2. Add copper oxide to excess (until some remains unreacted) so you know all of the acid has been neutralised.
3. Filter to separate the excess copper oxide from the copper sulfate solution.
4. Place solution in evaporating basin and heat so all the water evaporates and blue crystals of copper oxide remain.

Yr10 Chemistry Knowledge Organiser Chemical Changes 1

Box 5 - Reactivity of metals
When a metal reacts it **forms a positive ion.** The easier it is for a metal to form a positive ion, the more reactive it is. This means reactivity of a metal is related to its tendency to form a positive ion.

This is shown in the reactivity series; you should memorise the position of these elements (note – the non-metals carbon and hydrogen are included in the reactivity series:

potassium	most reactive	K
sodium		Na
calcium		Ca
magnesium		Mg
aluminium		Al
carbon		C
zinc		Zn
iron		Fe
tin		Sn
lead		Pb
hydrogen		H
copper		Cu
silver		Ag
gold		Au
platinum	least reactive	Pt

Box 6 - Reactions of Metals
You can work out the reactivity of the metals by looking at how vigorously they react with water and acid.

Metal and Acids
Metal + acid → salt + hydrogen
Lithium + hydrochloric acid → lithium chloride + hydrogen

Metals and Water
More reactive metals (Group 1 metals and calcium) will react with water. The more reactive the metal is, the more vigorous the reaction. For example:
Metal + water → metal hydroxide + hydrogen
Lithium + water → lithium hydroxide + hydrogen

Metals and Oxygen
Metal + oxygen → metal oxide
Magnesium + oxygen → magnesium oxide

Key Terms	Definitions
oxidation	The loss of electrons from an atom OR when an atom gains an oxygen atom
reduction	The opposite to oxidation: when an atom gains electrons OR when an atom loses an oxygen atom
redox reaction	A reaction where one atom is oxidised and another atom is reduced

Box 9 - Oxidation and Reduction Reactions
In some chemical reactions, one of the reactants loses electrons and the other reactant gains electrons. The mnemonic
OIL RIG helps remember that **O**xidation **is L**oss (of electrons) and **R**eduction is **G**ain (of electrons).
Oxidation also means adding oxygen
Reduction also means removing oxygen.

Box 7 - Displacement reactions
A more reactive metal will displace (replace) a less reactive metal from its compound.
e.g. Magnesium + Copper sulfate →Magnesium sulfate + Copper
$Mg_{(s)} + CuSO_{4(aq)} \rightarrow MgSO_{4(aq)} + Cu_{(s)}$

Ionic equation
$Mg_{(s)} + Cu^{2+}_{(aq)} \rightarrow Mg^{2+}_{(aq)} + Cu$

The **magnesium atom** has **lost electrons** so it has been **oxidised**
The **copper ions** have **gained electrons**, so they have been **reduced**.
This is an example of a **redox reaction**. The reactions between metals and acids are also redox reactions.

Box 8 - Extraction of Metals
A metal ore is a compound found in rock, dug out of the ground, that contains enough metal that it is **economical** to extract it. For example, magnesium oxide. In order for us to use the magnesium we need to **extract** it from the oxide.
Metals more reactive than carbon are extracted from their ore using **electrolysis**.
Metals which are less reactive than carbon are extracted from their ore using **reduction** (by adding carbon). Reduction is the removal of oxygen as seen in the example.

Example: Iron Oxide + Carbon → Iron + Carbon Dioxide

Unreactive metals, such as gold, are found native (as the metal on their own). This means they do not need to be extracted from their ore using chemical reactions.

<u>RE Year 10 Short course – Theme A Religion and Relationships</u>

Adultery	Having sex with someone who is not your husband or wife, outside of marriage	**Gender Prejudice**	Holding biased opinions about people based on their gender
Artificial Contraception	Methods of preventing pregnancy e.g. condoms, the pill, the coil	**Heterosexual**	Sexual attraction to the opposite gender
Cohabitation	Living and starting a family with someone who you are not married to	**Homosexual**	Sexual attraction to the same gender
Divorce	The legal ending of a marriage	**Marriage**	A legal and religious ceremony joining two people together in love
Family Planning	Using a woman's natural cycle of fertility to try and avoid pregnancy	**Procreation**	Bringing babies into the world
Gender Discrimination	Acting against people based on their gender	**Remarriage**	Marrying someone else after divorce

Key beliefs and ideas

Topic	Christianity		Buddhism
Human sexuality	- The Roman Catholic church teaches that sex between people of the same gender is 'disordered' - They argue that homosexual relationships are banned by the Bible - Gay marriage is banned in the Catholic Church and Church of England - ***"Do not have sexual relations with a man as one does with a woman" – Leviticus 18:22***	- Liberal Christians teach that Jesus wanted people to love each other and show **mercy** and that we should be accepting of homosexuals - The Bible was speaking to a culture and society that doesn't exist today and are fine with same-sex marriage.	- Buddhism does not favour one form of sexuality over another - Most important teachings is to ***'not harm others'*** - Same sex marriage is now legal in the UK
Sexual relationships	- Roman Catholics argue that all sex before marriage and after a divorce is unacceptable. Sex should only take place inside a marriage which is a lifelong, loving relationship. - Chastity - Adultery (affair) is prohibited by the Bible and Christians argue it is wrong as it undermines marriage involves lies and secrecy. - ***"You shall not commit adultery" - Exodus 20:14***	- Liberal Christians believe sex before marriage can be a valid expression of love - Cohabitation (living together) - Disagree with promiscuity (sexual immortality) - ***"Flee from sexual immortality"***	- No teaching on sex before marriage - Most important teachings is to ***'not harm others'*** - Adultery seen as an unskilful action

Artificial Contraception	- God tells Adam and Eve (the first couple) to ***"be fruitful and multiply"*** (Genesis 1:2) which encourages them to have children. - The Catholic Church argues that all sexual acts inside marriage must be open to procreation - Natural law - They may use family planning as it is a natural method.	- The Church of England argues that contraception should be allowed so that couples can take time and consider if they want to have children.	- Acceptable to use contraception - Some may see contraception as breaking the first moral precept - In Buddhist cultures there is no obligation to have children
Marriage and Divorce	- During the ceremony you agree to be together for life saying ***"till death do us part"*** - Many Christians do not like divorce as it is seen to break the promises made in a marriage. - The Catholic Church do not support divorce. They believe that sex after divorce is a form of adultery and you cannot get remarried in a Catholic Church once you have been divorced. Jesus ***says "if a man divorces his wife [...] he involves her in adultery" (Matthew 5:32)***	- The Church of England accepts divorce, especially if it is for reasons of abuse but you have to receive special permission to get remarried in a church. They might see it as a merciful option.	- No teaching on divorce - Clinging onto attachment results in suffering (Dukkha) - Accept if suffering is caused - Remarriage an opportunity to commit to a new and healthy relationship
Family	- -Nuclear Family is a family with a mother, father and children – some Christians argue this is the ideal - Extended Family is a family where grandparents and other relatives are involved - Single Parent Family this is a family where one parent brings up the child **Purpose of the Family** - Procreation – the family should be for the purpose of having and bringing up children - Stability – the family should be for providing a secure, stable environment for children - - Faith – the family should be a way of bringing children up as good Christians		
Gender	- The Catholic Church argues that women have a special role as mothers and they do not allow women to be priests - Some Christians argue that men were in authority during Jesus' life. All the disciples were men. Women should be quiet in church - ***"Women should remain silent in the churches. They are not allowed to speak"***	- The Church of England has allowed women priests since 1994 - Other Christians say all are equal, Jesus respected women, the Good Samaritan teaches against discrimination, all are created in God's image - ***"There is neither male nor female for you are all one in Christ"***	- Buddha ordained women as nuns - ***Aparimitayur Sutra*** suggests women must be reborn as men before reaching enlightenment - ***Lotus Sutra*** teaches Buddhist that men and women are equal

Year 10 Short course RE Paper One – Christianity beliefs and teachings

Key Words

Ascension	Jesus returning to be with God in heaven after the crucifixion	Omnipotent	God's nature as all-powerful
Atonement	Making things better after sinning, asking for forgiveness from God	Original Sin	The built-in tendency to do wrong which comes from Eve's disobedience
Benevolent	God's nature as all-loving	Resurrection	Jesus returning from the dead after he was crucified
Crucifixion	Jesus' execution by the Romans on the cross	Salvation	Being saved from sin and given eternal life in heaven by God
Incarnation	God becoming flesh in the form of Jesus Christ	Sin	Any thought or action which goes against God's will
Just	God's nature as fair	Trinity	God's nature as three-parts-in-one, the Father, Son and Holy Spirit

KPI1- To explain some of the qualities of God

- Christianity is a monotheistic religion. "We believe in one God."
- All powerful (omnipotent) because he created the world (Genesis). There is nothing God cannot do or achieve. "Nothing is impossible with God."
- All loving – God sent Jesus to die on the cross so man's sins could be forgiven. This encourages Christians to love each other. "God so loved the world that he gave his one and only son."

• Judge – God (Jesus) will judge everyone on Judgement Day
• Eternal – God has no beginning and no end
• All-knowing (omniscient) God knows everything, which has happened, is happening and will happen.

KPI3- To investigate the problem of evil and suffering

- Many people question God's **benevolence** when faced with evil and suffering.
- Christians believe that a just God treats all people fairly, and they can trust God when things appear wrong.
- The story of the **'fall'** shows Adam and Eve giving into temptation, free will to make a choice- 'the **original sin.**'

KPI4- To describe the Genesis account of creation. The book of Genesis begins "In the beginning God created the heavens and the earth."

- Day 1-2 Water covered earth
- Day 3 Dry land and plants
- Day 4 Sun, moon and stars
- Day 5 Sea and flying creatures
- Day 6 Land animals and Man
- Day 7 God rested

KPI2 To understand and analyse the concept of the oneness of God and the Trinity

- **Trinity** is the Christian belief that: There is One God, who is Father, Son, and Holy Spirit.
- The Trinity describe that there is only one God, each person of the Trinity is fully God and the persons of the Trinity are not the same.
- God the Father: revealed by the Old Testament to be Creator, Lord, Father and Judge.
- God the Son: who had lived on earth amongst human beings.
- God the **Holy Spirit**: who filled them with new life and power.

KPI4- To explain different Christian beliefs about creation

- Christians believe that God created the earth. One story about the creation of the world is found in **Genesis**.
- Many Christians believe that although it may not be scientifically accurate, this account contains religious truth.
- Some Christians believe that the account should not be read as an accurate account, but as a **myth.**
- Design argument- **teleological** William Paley used this argument to explain the existence of God- There is evidence that the world has been designed. If the world has been designed then there must be a designer, this must be God.
- The First Cause Argument/ **Cosmological** (Thomas Aquinas). Everything has to have a beginning. The only possible first cause of the universe is God, therefore God must exist.

KPI5- To describe Christine belief in heaven and hell

•Christians believe that God is just and fair, and so cannot let evil go unpunished.
• Most believe in the idea of judgement after death, and that God will treat people in the afterlife according to how they lived their life on earth.
•Some believe that heaven is a physical place, where their body goes after death. Others believe that it is their soul that lives on, and that heaven is a state of being united with God.
•Christians have very different ideas about hell. Some Christians believe that hell is a place of suffering, and of separation from God. Others (perhaps most) believe that hell is a spiritual state of being separated from God for eternity.
• Their belief that Jesus rose from the dead three days after his crucifixion (a Roman method of execution) gives Christians hope that if they follow Jesus' teaching and accept him as their Lord and Saviour, then this new resurrection life awaits them.

PCSHE – Year 10 Term 1 – Financial Decision Making

Key Terms:

- **Income Tax**: Income tax is the money that individuals or businesses have to pay to the government based on the money they earn or the profits they make.
- **Earnings**: Earnings are the money or income that individuals or businesses receive from their work, businesses, or investments.
- **Employee**: An employee is a person who works for an employer or a company. They do a job or provide services in exchange for a salary or wages.
- **Employer**: An employer is a person, company, or organisation that hires and pays employees to do work for them.
- **Tax returns:** Tax returns are forms that individuals or businesses fill out and send to the government to report their income and calculate how much tax they owe or if they are owed a refund.
- **Budgets**: Budgets are plans that help individuals or businesses keep track of their money. They show how much money is coming in (income) and how much is going out (expenditure), helping to control spending and save money.
- **Income**: Income is the money or earnings that individuals or businesses receive from various sources, such as jobs, investments, or business activities.
- **Expenditure**: Expenditure is the money that individuals or businesses spend or use to pay for goods, services, or bills.
- **Disposable**: Disposable refers to the income or money that individuals or households have left after paying taxes and essential expenses. It is the money available for spending or saving on non-essential items.
- **Mortgage**: A mortgage is a loan from a bank or lender that helps people buy a house. The borrower pays back the loan over time, along with interest, until the loan is fully repaid.
- **Loan**: A loan is an amount of money borrowed from a bank or lender. The borrower agrees to repay the loan over time, usually with interest added.
- **Gambling**: Gambling refers to playing games of chance or betting on uncertain outcomes, usually involving money. It involves taking a risk with the hope of winning more money or prizes.
- **Value**: Value refers to the worth or importance of something. It can be the monetary worth of an item or the significance or usefulness it holds.
- **HMRC**: HMRC stands for Her Majesty's Revenue and Customs. It is the government agency in the United Kingdom responsible for collecting taxes and enforcing tax laws. HMRC ensures that individuals and businesses meet their tax obligations and provides guidance and support regarding tax-related matters.
- **PAYE**: PAYE stands for Pay As You Earn. It is a system used by employers in the United Kingdom to deduct income tax and National Insurance contributions from their employees' salaries or wages.
- **Tax obligations:** Tax obligations refer to the legal responsibilities or duties that individuals or businesses have to fulfill regarding their taxes.
- **Debt:** Debt refers to an amount of money that one party (person) owes to another
- **Prosecution**: Prosecution refers to the legal process of charging and following up a case against an individual or group accused of committing a crime.
- **Fraud**: Fraud is a dishonest act carried out with the intention to gain an unfair advantage. It involves concealment (*hiding)* of information, or manipulation of facts for personal or financial gain.

KPI 1: Tax

Income Tax:

As an employee:

- You pay 0% on earnings up to £12,750 for 2020-21
- Then you pay 20% on anything you earn between £12,751 and £50,000
- You'll pay 40% income tax on earnings between £50,001 to £150,000
- If you earn £150,001 and over you pay 45% tax.

For example, if you earn £52,000 a year, you pay:

- Nothing on the first £12,750
- 20% on the next £37,500
- 40% on the next £2,000.

Therefore, you would expect to pay:

- £8,300 per year / £691.66 per month

What happens if I don't pay income tax?

Most people pay Income Tax through PAYE. This is the system your employer or pension provider uses to take Income Tax before they pay your wages or pension. If your employer makes a mistake and under pays your tax, you could be made to repay that amount through the next years PAYE if the amount is under £3,000 and you earn under £30,000 per year. In some very limited circumstances, it may be possible for HMRC to write off the debt, or, if your employer or pension payer is at fault, to collect the tax from them instead. If you are a self-employed person, you are responsible for filing your tax returns each year with the HMRC. Failure to do so or filing late or inaccurate returns can result in a HMRC Enquiry. If the enquiry find you are guilty of deliberately misleading or faking your tax record you can be prosecuted for fraud. In most cases you will be given a bill for the unpaid tax and a set time frame to pay it back.

PCSHE – Year 10 Term 1 – Financial Decision Making

KPI2: Budgeting

BUDGETS are a valuable tool for managing your money. They are used to manage INCOME (money coming in) and EXPENDITURE (spending on a weekly, monthly and yearly basis). Most Budgets contain a list of all spending that is ESSENTIAL, and spending that is optional (DISPOSABLE).

Why is budgeting important?

Since budgeting allows you to create a spending plan for your money, **it ensures that you will always have enough money for the things you need** and the things that are important to you. Following a budget or spending plan will also keep you out of debt or help you work your way out of debt if you are currently in debt.

Advantages of budgeting:

- Makes it easier to track and control spending
- Shows where you are spending too much
- Can relieve and reduce money related stress
- Can help with managing debt
- Can help free up and save money
- Can help with investing money (a way to make more profit from your money)
- Can help prepare for emergencies
- Can help when applying for a loan or a mortgage

How to stick to a budget:

- Consider quality versus price – cheaper things cost less but might need frequent replacement, so in the long term you end up spending more
- Keep your budget up to date – regular checks of your money allows you to see if you need to make changes
- Treat yourself – always factor in money for entertainment, holidays and rewards
- Self-discipline – changing spending habits takes a lot of willpower
- Be realistic – what can you really afford to spend, and pay off?
- Motivation – remember your reasons for spending and saving

Consequences of poor budgeting:

- A person may fall into debt
- A person might not be able to reach their goals
- A person might not be able to pay for essential items
- Difficulty in saving for the future
- Stress because of less money and debt

KPI3: Gambling

What is gambling?

Gambling is the act of wagering something of value (usually money), on an event/game with an uncertain outcome. The aim of which is to win something else of value (usually higher value).

How common is gambling?

More than two million people in the UK either have a gambling disorder or are at risk of addiction. Technology enables greater accessibility to gambling from an early age. E-sports gambling (i.e. betting on online match-play rather than in-person sporting events) is a particular vulnerability for young people.

Why do people gamble?

- For social reasons – This may be because it's what a group of friends do when they get together, or because it makes a social gathering more enjoyable.
- For financial reasons – to win money, because someone enjoys thinking about what they would do if they won a jackpot, or because winning would change someone's lifestyle.
- To clear debt – The temptation to get rid of financial worries in one day is a reason people gamble. People can win a lifetimes salary in the space of a day, or lose everything.
- For entertainment reasons – because they like the feeling, to get that rush or "high", or because it makes them feel good.
- For coping reasons – for someone to forget their worries, because they feel more self-confident, or because it helps when they are feeling nervous or depressed.

Someone may be a compulsive gambler if they…

- spend more money on gambling than you can afford
- gamble when you should be doing something else, like working or spending time with family
- feel anxious or stressed about your gambling
- use gambling to deal with problems or difficult feelings
- lie to family and friends about your gambling
- borrow or steal to fund your gambling.

Problems gambling can cause:

- Relationship problems
- Financial problems, including bankruptcy
- Legal problems or imprisonment
- Poor work performance or job loss
- Poor general health
- Suicide, suicide attempts or suicidal thoughts

PCSHE Year 10 - Topic 2 – Emotional Wellbeing and Mental Health

KPI1: Key Definitions

- **Mental Health**: The capacity to live a full, productive life as well as the flexibility to deal with its ups and downs. In children and young people, it is especially about the capacity to learn, enjoy friendships, to meet challenges, to develop talents and capabilities.
- **Mental Wellbeing**: your mental state – how you are feeling and how well you can cope with day-to-day life.
- **Stigma:** Stigma is when someone sees you in a negative way because of your mental illness.
- **Discrimination:** Discrimination is when someone treats you in a negative way because of your mental illness.
- **Body Image**: Body image refers to a person's perception *(understanding)*, thoughts, and feelings about their own body. It includes how individuals perceive (*view)* their physical appearance, weight, size, and overall attractiveness. Body image can be influenced by societal standards *(society beliefs)*, the media *(TV, social media)*, and personal experiences, and it can greatly impact a person's self-esteem and mental well-being.
- **Mindfulness**: Mindfulness is a mental state of being fully present and aware of the current moment without judgment. It involves intentionally paying attention to one's thoughts, feelings, bodily sensations, and the surrounding environment. Practicing mindfulness helps individuals create a greater sense of clarity *(understanding)*, calmness, and self-awareness, promoting overall well-being and reducing stress.
- **Bereavement**: Bereavement refers to the period of mourning and grief that follows the death of a loved one. It involves experiencing and processing the emotional, psychological, and social impact of the loss. Bereavement is a natural response to loss and can involve various emotions, such as sadness, anger, confusion, and loneliness. It is a personal and unique experience that requires time and support to navigate.
- **Emotional Resilience**: Emotional resilience refers to a person's ability to adapt and bounce back from challenges, or stressful situations. It involves having the capacity *(ability)* to effectively manage emotions, cope with setbacks, and maintain a positive outlook in the face of difficulties. Emotional resilience allows individuals to maintain their well-being, persevere through tough times, and recover from setbacks more easily.

KPI2: Everyone is different and what affects someone's mental wellbeing won't necessarily affect others in the same way. Everyone will have times when they have low mental wellbeing, where they feel stressed, upset or find it difficult to cope. Common life events that can affect your mental wellbeing include:

- loss or bereavement
- loneliness
- relationship problems
- issues at work
- worry about money

Other influences upon someone's mental health can include factors such as social media, body image, and substances. However, there are times when there is no discernible reason for the way a person feels which can be extremely frustrating.

KPI 3: Strategies to promote emotional wellbeing and positive mental health

- Relaxation techniques like mindfulness and deep breathing
- Following interest in hobbies that provide enjoyable distractions
- Keeping active by walking, cycling, swimming or by doing another favourite sport
- Getting outside into nature
- Spending time with friends and family
- Getting plenty of good quality sleep
- Doing dedicated exercises intended to promote relaxation e.g. yoga
- Online mindfulness, stress and anxiety apps
- Asking for help from teachers, family, friends or online support when things get a bit much
- Set Realistic Goals: Set achievable goals and break them down into smaller, manageable steps. Celebrate accomplishments along the way, which helps to boost self-confidence and motivation.
- Take Breaks and Practice Relaxation: Incorporate regular breaks and relaxation into your daily routine. Engage in activities like listening to music, reading, taking walks in nature, or engaging in hobbies to relax and recharge.

Remember, everyone's needs and preferences are unique. It's essential to explore and find strategies that work best for you and prioritize self-care and mental well-being as a lifelong practice.

PCSHE Year 10 - Topic 2 – Emotional Wellbeing and Mental Health

KPI4: Types of Mental Health Problems	What is it?	Potential Signs	Strategies and Treatments
Depression	It's a feeling of low mood that lasts for a long time and affects her everyday life. It can make you feel hopeless, despairing, guilty, worthless, unmotivated and exhausted. It can affect herself esteem, sleep, appetite, sex drive and your physical health.	- Feels like something is 'missing'. - Feel like you cannot cope - Withdrawn, pulling out of activities	Medication – can provide relief while building other support strategies Cognitive behavioral therapy – practical techniques Activities – Photography and going for a walk Sport/physical exercise
Anxiety	What we feel when we are worried, tense or afraid – particularly about things that are about to happen , or which we think could happen in the future. Occasional anxiety is a normal human experience. But if your feelings are anxiety are very strong, or last for a long time, they can be overwhelming. You might also experience physical symptoms such as sleep problems and panic attacks.	- Physical symptoms e.g. shaking, heart palpitations, pins and needles, stomach pains - Withdrawn - Seeking reassurance - Perfectionism - Can be linked with depression	- Cognitive behavioral therapy - Yoga and Pilates - Meditation - Diary to reassure that things will pass - Small steps to build confidence - Talking to friends and family - Avoiding researching physical symptoms as this can make things worse.
Stress	Stress is the body's reaction to feeling threatened or under pressure. It's very common, can be motivating to help us achieve things in our daily life, and can help us meet the demands of home, work and family life. But too much stress can affect our mood, our body and our relationships – especially when it feels out of our control. It can make us feel anxious and irritable and affect our self-esteem. Experiencing a lot of stress over a long period of time can also lead to a feeling of physical, mental and emotional exhaustion, often called burnout.	- Disrupted sleep cycle - False FFF (fight, flight, freeze) responses i.e.. So wired that small stressors provide big reactions. - Can cause depression and anxiety.	- Mind tools - Exercise - Quality sleep - Relaxation - Sharing feelings with friends.

If you need any support…

Home/school support: Friends, teachers, tutor, parents/carer, Mr Ogden, Mrs Jones, Mrs Loveridge, Mrs Jones, Mr Hayward.

Reputable Organisation:
- Young Minds – www.youngminds.org.uk
- Young Minds CRISIS MESSANGER: Text YM to 85258
- Childline – www.childline.org.uk Phone: 0800 1111
- Samaritans – www.Samaritans.org Phone: 11612
- Young Mind Matters – Text 07480635723
- Kooth – Kooth.com
- TIC+ - online text chat – 07977334433
- Self-Harm Helpline Rethink Gloucestershire – webchat: www.gloucestershireselfharm.org Text: 07537410022 Phone: 0808 8010606

Self-help apps:
- Calm Harm – Managing Self-Harm
- MindShift – to help manage anxiety and urges to self-harm
- Cove – express your mood with music
- Stress and Anxiety Companion – helps to manage stress and anxiety
- Chill Panda – relaxation and breathing exercises.

On the school website, use the following link to report a concern: