Bottisham Village College

KNOWLEDGE ORGANISER

CHEMISTRY

YEAR 11 ALL YEAR

KNOWLEDGE ORGANISERS

At Bottisham Village College, we are striving to create a five-year curriculum plan that builds effective revision strategies into homework and lessons, to ensure that students are able to place powerful knowledge into their long-term memories. Additionally, we hope that this will help build effective learning strategies from early in their time here at the college.

Based on evidence, we know that regular recall activities are the best way of achieving this goal and committing powerful knowledge into the students' memories.

At the start of each term, we shall publish all the knowledge organisers that students will require for their studies in each curriculum area. These will cover a range of aspects: facts, dates, characters, quotes, precise definitions and important vocabulary. We are clear: if this fundamental knowledge is secured, students can then develop their higher-level skills of analysis and critical understanding with greater depth.

They will be given an electronic A4 Knowledge Organiser (KO) booklet for each term containing all of the knowledge required. In lessons, Bottisham staff will be regularly testing this fundamental knowledge, using short -quizzes or even more formal "Faculty Knowledge Tests".

The best way to use these organisers at home, is to follow a simple mantra:

1. Look at a certain aspects of a particular knowledge organiser
2. Cover up part of their knowledge organiser
3. Write it out from memory
4. Check and correct any spelling mistakes, missing bits or mistakes

So simple but so effective.

Rate & Extent of Chemical Change
Year 11 Foundation

A. Keywords

Collision Theory	An explanation of the way that chemicals combine in chemical reactions.
Rate	How quickly something happens.
Activation Energy	The energy required to start a reaction.
Chemical Reaction	When atoms or molecules of chemicals combine to produce a different atom or molecule.
Reactant	A substance that combines in a chemical reaction to make a new product.
Product	The substance(s) created when a chemical reaction happens.
Endothermic	One that transfers energy to the surroundings so the temperature of the surroundings increases
Exothermic	One that absorbs energy from the surroundings so the temp. of the surroundings decreases
Closed System	When a reaction takes place and no atoms can be added or escape.

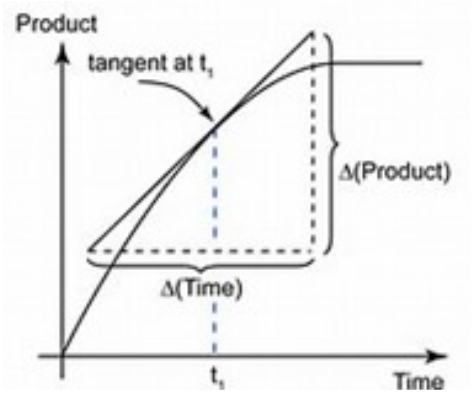
B. Collision Theory

A reaction only happens when reactants (atoms or molecules) collide or bump into each other.

The reactants have to collide with enough energy for the reaction to be successful. This is the Activation Energy.

C. Estimating Rate at a Specific Time using Tangents

A tangent is a line that has the same slope as the curve.



The steeper the tangent the faster the rate of reaction.

D. Reversible Reactions

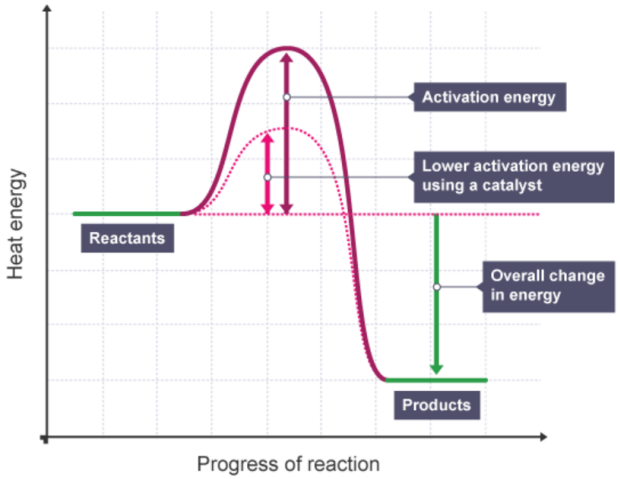
Reactions where the products can react to turn back into the reactants.

Hydrated copper sulfate ⇌ Anhydrous copper sulfate + water

If the forward reaction is exothermic, the reverse reaction will be endothermic.

E. Catalysts

Catalysts speed up reactions. They provide an alternative reaction pathway, lowering the activation energy needed.



Catalysts speed up reactions without being used themselves.

Used in industry to make reactions happen faster and lower energy costs.

F. Dynamic Equilibrium

When the forward and backward reactions happen at the same rate in a closed system. There is no change in the amount of products or reactants.

Rate & Extent of Chemical Change
Year 11 Higher

A. Keywords

Collision Theory	An explanation of the way that chemicals combine in chemical reactions.
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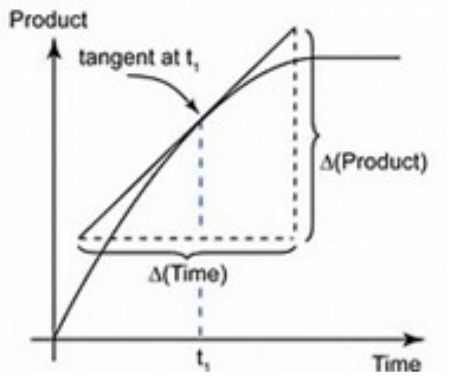
A tangent is a line that has the same slope as the curve. The steeper the tangent the faster the rate of reaction.



Calculate the gradient of the tangent by making a right angled triangle. Divide the change in y (the product) by the change in x (the time).

D. Reversible Reactions ⇌

Reactions where the products can react to turn back into the reactants.

Hydrated copper sulfate ⇌ Anhydrous copper sulfate + water

If the forward reaction is exothermic, the reverse reaction will be endothermic.

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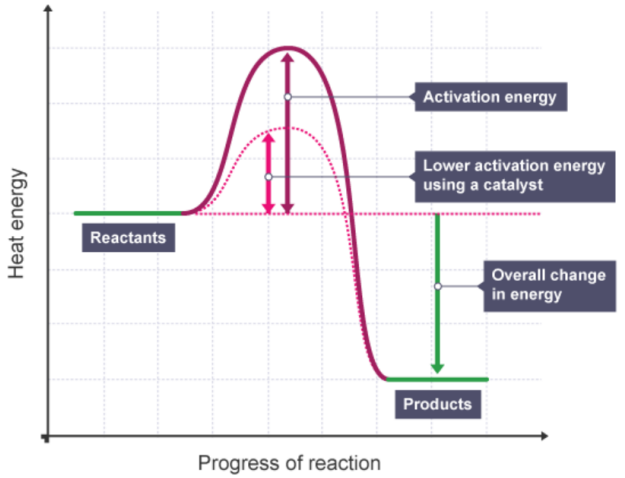

Catalysts speed up reactions without being used themselves.

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F. Dynamic Equilibrium

When the forward and backward reactions happen at the same rate in a closed system. There is no change in the amount of products or reactants.

Organic Chemistry
Year 11a

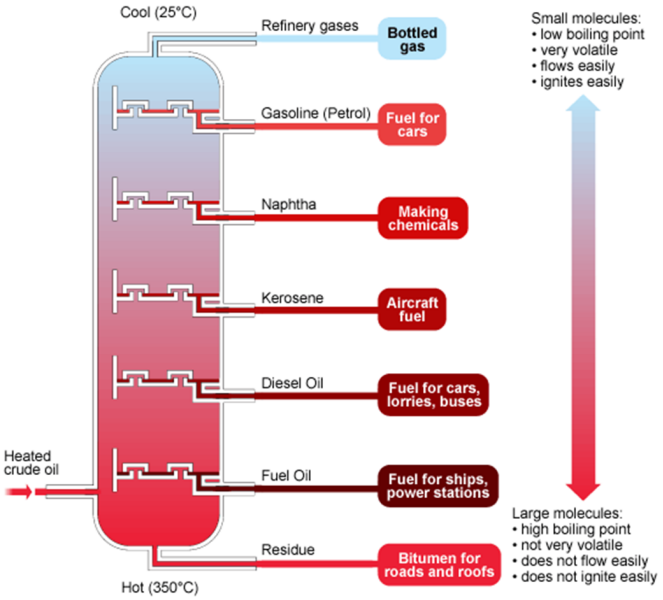
A. Keywords.

Crude Oil	Oil that has not been purified.
Fossil Fuels	Fuels that are made from the remains of dead plants and animals, eg coal and oil.
Hydrocarbons	Compounds only containing hydrogen and carbon
Alkane	A group of hydrocarbons
Saturated	A hydrocarbon with only single bonds between its carbon atoms.
Distillation	Separation of a liquid from a mixture by evaporation followed by condensation.
Fractional Distillation	Separating liquids from a mixture of liquids by boiling them off at different temperatures then condensing and collecting them.
Boiling Point	Temperature at which a substance boils.
Cracking	Reaction used to break down large hydrocarbons into smaller more useful ones.
Alkene	A hydrocarbon which contains a carbon-carbon double bond.

B. Distillation and Fractional Distillation

Distillation is evaporation followed by condensation and is used to separate a liquid from a mixture.

Crude oil is separated into hydrocarbons with similar boiling points, called fractions. This is called fractional distillation. Each hydrocarbon fraction contains molecules with similar numbers of carbon atoms.



Small molecules have low boiling points—small intermolecular forces—go to top of column.

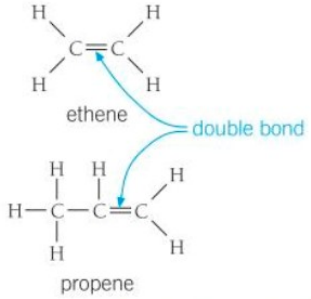
Large molecules have high melting points—large intermolecular forces—go to bottom of column.

E. Alkenes

Contain a carbon-carbon double bond.

General formula of alkenes is C_nH_{2n}.

They react with bromine water, which is orange in colour, decolourising it. This is used as a test for alkenes.

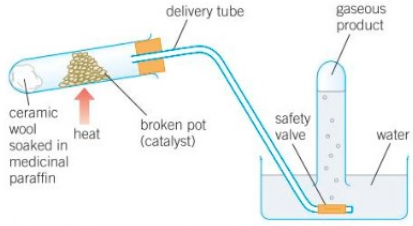


Alkenes are more reactive than alkanes.

E. Cracking

Some longer hydrocarbons don't have a high demand, but crude oil contains lots of them. They can be broken down into smaller more useful hydrocarbons, by **CRACKING**. This is done using heat and a hot catalyst.

One of the products is an alkane the other is an alkene.



$$C_{10}H_{22} \xrightarrow{500\,°C + \text{catalyst}} C_5H_{12} + C_3H_6 + C_2H_4$$

decane → pentane + propene + ethene

Chemistry of the Atmosphere Year 11

A. Keywords.

Atmosphere	The gas surrounding the Earth (or another planet)
Greenhouse effect	Trapping the energy absorbed and radiated by the Earth in the atmosphere, causing a temperature increase.
Greenhouse gases	Gases in the atmosphere that maintain temperatures on Earth high enough to support life. Carbon dioxide, water vapour and methane are greenhouse gases.
Photosynthesis	A chemical reaction carried out by algae and plants to convert carbon dioxide and water into glucose and oxygen.
Combustion	A chemical reaction where a substance reacts with oxygen and emits heat and light (e.g. burning)
Global dimming	The release of carbon particulates into the atmosphere which reflect sunlight back into space and prevent it from reaching the Earth.
Pollutant	A substance introduced into the environment that has undesired effects.
Electromagnetic radiation	Energy that travels as waves with different wavelengths
Infrared radiation	Electromagnetic radiation with a wavelength longer than visible light. Hot objects emit infrared radiation.
Ultraviolet radiation	Electromagnetic radiation with a wavelength shorter than visible light
Peer-review	Evaluation of the work of a scientist by other scientists

B. Greenhouse Effect

Electromagnetic radiation at most wavelengths passes through the Earth's atmosphere

↓

The Earth absorbs most of the radiation and warms up — Including ultraviolet waves (short wave lengths absorbed)

↓

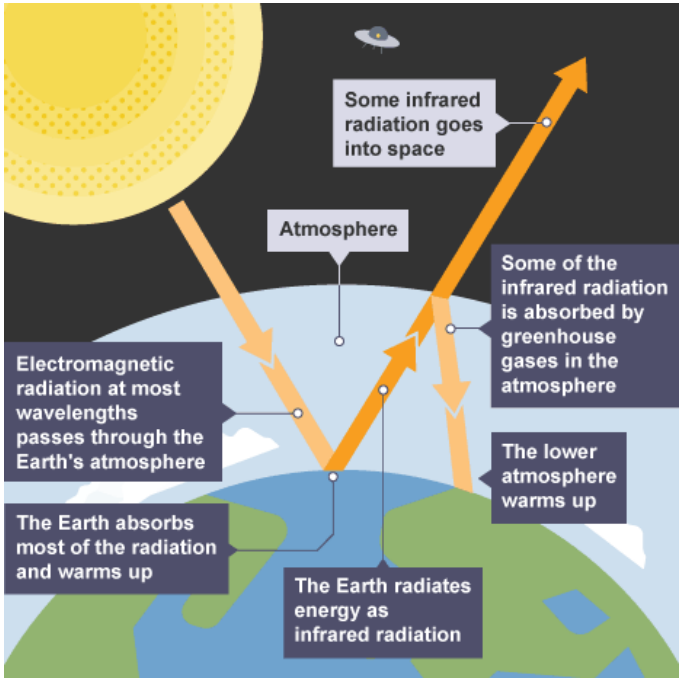
The radiates energy as infrared radiation — Longer wavelengths are radiated out.

↓

Some of the infrared radiation goes into space. The rest is absorbed by the greenhouse gases in the atmosphere.

↓

The greenhouse gases release the energy and the lower atmosphere warms up



C. Atmospheric Pollutants

The four main atmospheric pollutants are:

- Carbon monoxide, a toxic gas. It binds to haemoglobin in red blood cells and prevents oxygen from being transported round the body.
- Sulfur dioxide causes respiratory problems in humans and also causes acid rain.
- Oxides of nitrogen cause respiratory problems in humans and also cause acid rain.
- Carbon particulates, small particles of carbon that are released into the atmosphere causing health problems in humans and global dimming.

D. Human Activities and Greenhouse Gases

- Human activities that increase **carbon dioxide** levels include burning fossil fuels in vehicles and power stations; and deforestation.
- Deforestation also reduced the amount of carbon dioxide absorbed for photosynthesis.
- Human activities that increase **methane** levels include farming cattle and farming rice in paddy fields.

Modelling global climate change is difficult and it is important that statements about it are based on peer-reviewed evidence by scientists and not be based on opinions or the media. This prevents bias.

E. Global Climate Change

The effects of global warming:

- Glaciers and polar icecaps melting
- Sea levels rising
- Floods and droughts due changes in rainfall patterns.
- Habitats changing

Chemical Analysis

Year 11a

A. Keywords.

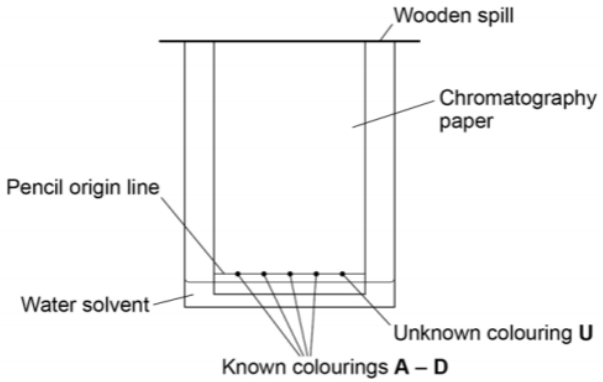
Chromatography	The process where small amounts of dissolved substances are separated by running a solvent along a material such as absorbent paper.
Diatomic	Made up of two atoms bonded together.
Mixture	Two or more elements or compounds that are not chemically bonded together.
Solvent	A liquid that will dissolve other substances
Solute	A solid that dissolves in a solvent.
Solvent front	The distance that the solvent reaches along the chromatography paper.
Mobile phase	The substance that moves during chromatography (the solvent)
Stationary phase	The substance that does not move during chromatography (the paper)
Affinity	The degree to which a substance tends to combined with another.
Solubility	The ability of a substance to dissolve.

B. Chromatography

Chromatography separates the substances in a mixture based on their solubility.

- A more soluble substance has a greater affinity for the mobile phase and will travel further along the paper.
- A less soluble substance has a greater affinity for the stationary phase and will not travel very far along the paper.

C. Required Practical: Chromatography

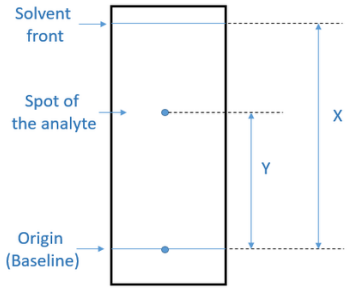


- Draw a **pencil** line near the bottom of the chromatography paper.
- Use a capillary tube to create dots of each dye at even interval across the pencil line.
- Attach the chromatography paper to a splint or glass rod so that it will hang in the solvent. The solvent must not touch the dyes or pencil line.
- The solvent will travel up the paper carrying the dyes and separating them.
- Stop the experiment before the solvent reaches the top of the paper.
- Calculate the Rf value for each dye and compare to known Rf values to identify the unknown dyes.

D. Chromatography: Rf Value

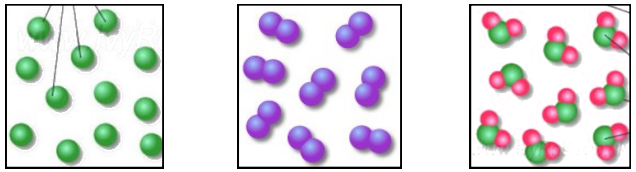
$$\frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

The Rf value will be between 0 and 1.
The smaller the Rf value the greater the affinity for the mobile phase.



E. Pure Substances and Formulations

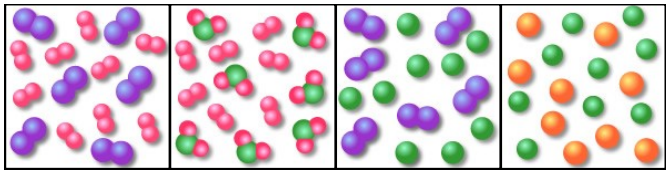
A pure substance is a single element or compound not mixed with any other substance.



Pure element | Pure diatomic element | Pure compound

- Pure substances melt and boil at specific temperatures, these can be used to distinguish a pure substance from a mixture.
- A pure substance in everyday language can mean a substance with nothing added to it but it might still be a mixture. E.g. pure milk.

A formulation is a mixture that has been designed as a useful product.



Formulations include fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods.

F. Testing for Gases

Gas	Test	Positive Result
Hydrogen	Lit splint	Squeaky pop
Oxygen	Glowing splint	Relights the splint
Carbon Dioxide	Limewater	Colourless → Cloudy
Chlorine	Damp blue litmus paper	Bleaches white

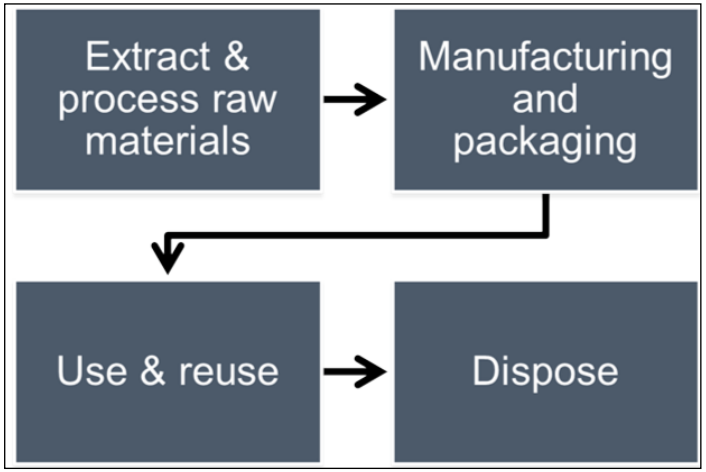
Using Resources Year 11a Foundation

A. Keywords.

Ore	A rock containing enough mineral or metal to make it worth while to extract.
Mineral	A useful metal element found in the ground.
Product (LCA)	A useful item made from materials for human use.
Subjective Judgement	A decision a person makes based on their belief or experience, not based on data.

B. Life Cycle Assessment (LCA)

Lists the energy and materials at the following stages of a product's 'life':



...and the transportation costs at each stage.

Some parts of an LCA use subjective judgements, so there can be some

C. Ores

An ore is a rock containing a useful mineral or metal.

High-grade ores contain enough of a mineral for it to be economically viable to extract.

Low-grade ores do not contain enough minerals to be economically viable.

High grade ores are running out due to increasing demand but decreasing supply.

D. Reducing Resource Use

'Reduce, Re-use and Recycle' is a campaign designed to reduce resource and energy use, produce less waste and reduce pollution.

Glass and some metals (e.g. car parts) can be re-used.

Some materials have to be recycled before re-use and this takes energy:

Metals e.g. aluminium and copper.
Glass and plastic bottles.

Recycling uses less energy than using a brand new product.

Using Resources Year 11a Higher

A. Keywords.

Ore	A rock containing enough mineral or metal to make it worth while to extract.
Mineral	A useful metal element found in the ground.
Solution	A liquid made of a chemical (solute) dissolved in a solvent, usally water.
Leachate	A solution made when chemicals dissolve into water as it passes through a substance.
Ion	An atom that has lost or gained electrons. An ion has a positive or negative charge.
Anode	The positively charged terminal used in electrolysis.
Cathode	The negatively charged terminal used in electrolysis.
Displacement	When a more reactive metal replaces a less reactive one in a chemical reaction.
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C. Extracting Copper from Ores

1. Copper ores can be mined using large machinery to dig up rocks. This produces lots of waste rock.

2. Phytomining: uses plants to absorb copper compounds from **low grade ores**. Plants are then burned and the ash dissolved in water to produce a **more concentrated solution of copper sulfate**.

3. Bioleaching uses bacteria to feed on **low grade ores**. The bacteria can then be used to obtain a **more concentrated solution of copper sulfate.**

4. Electrolysis: Uses electricity to separate a solution. Positive ions (metals) go the negative terminal (cathode). Negative ions go the positive terminal (anode).

5. Scrap iron can be used instead of electricity. The iron is more reactive so displaces pure copper from a copper sulfate solution.

$$Fe(s) + Cu^{2+}(aq) \longrightarrow Fe^{2+}(aq) + Cu(s)$$

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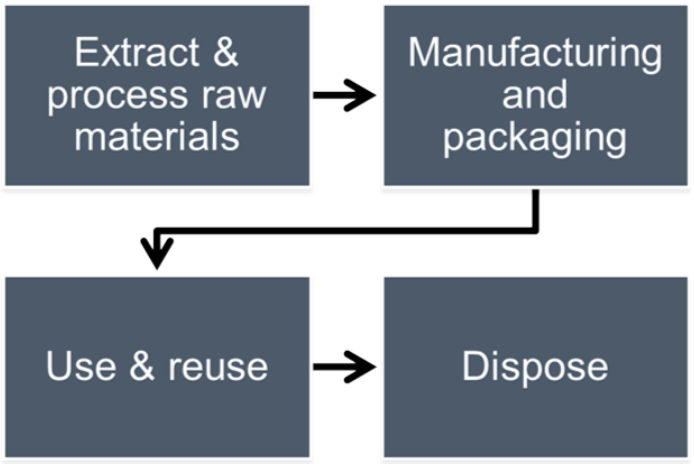

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Rate & Extent of Chemical Change
Year 11 Separate Higher

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Yield	The amount of a chemical produced in a reaction.
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Exothermic	One that absorbs energy from the surroundings so the temp. of the surroundings decreases
Closed System	When a reaction takes place and no atoms can be added or escape.
Molecule	Two or more atoms chemically bonded

B. Dynamic Equilibrium

When the forward and backward reactions happen at the same rate in a closed system. There is no change in the amount of products or reactants.

C. Le Chatelier's Principle

In equilibrium the amount of reactants and products does not change.

Le Chatelier's Principle states that changing the conditions in a reaction changes the amounts of the reactants and products.

D. Changing Concentration and Equilibrium

1. Increasing the concentration of reactants reduces space between the reactants and more collisions occur.

Therefore the *rate* of the forward reaction increases and the *amount or yield* of products increases.

2. Decreasing the concentration of reactants reduces the rate of the forward reaction.

Therefore the rate of the reverse reaction is greater, the amount of products will decrease and the amount of reactants increases.

E. Temperature and Equilibrium

1. If the forward reaction is exothermic, an increase in temperature:

- Decreases the amount or yield of products.
- Increases the amount of reactants.

2. If the forward reaction is endothermic, an increase in temperature:

- Increase the amount or yield of products.
- Decreases the amount of reactants.

$$\text{Ammonium Chloride} \underset{\text{Endothermic}}{\overset{\text{Exothermic}}{\rightleftharpoons}} \text{Ammonia} + \text{Hydrogen Chloride}$$

In this reaction, increasing temperature will decrease the yield of ammonia and hydrogen chloride.

F. Pressure and Equilibrium (Gases only)

1. If the forward reaction produces more molecules of gas:

Increasing pressure decreases the amount of products formed.

2. If the forward reaction produces fewer molecules of gas:

Increasing pressure increases the amount of products formed.

If the number of molecules is the same on each side, increasing pressure has no effect.

Organic Chemistry
Year 11b
Separate Foundation

A. Keywords.

Functional Group	An atom or group of atoms that give organic compounds their characteristic reactions.
Homologous Series	A family of organic compounds with the same functional group.
Monomer	Small molecules that react together in repeating sequences to form a very large molecule (polymer).
Polymer	A substance made from large molecules made up of many repeating units (monomer).
Unsaturated	A hydrocarbon with at least one carbon-carbon double bond.
Addition Polymerisation	The reaction between alkene monomers to form a polymer.
Alcohol	A group of compounds that contain –OH functional group.
Carboxylic Acid	A group of compounds that contain –COOH functional group.
Ester	A group of compounds that contain –COO– functional group.

B. Reaction of Alkenes

Combustion

ethene + oxygen → carbon dioxide + water

$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

Reaction with Halogens

ethene + bromine → dibromoethane

$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$

Reaction with Hydrogen

pentene + hydrogen $\xrightarrow{\text{catalyst}}$ pentane

$C_5H_{10} + H_2 \longrightarrow C_5H_{12}$

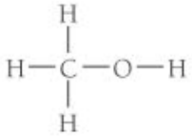
Reaction with water (steam)

ethene + steam $\overset{\text{catalyst}}{\rightleftharpoons}$ ethanol

$C_2H_4 + H_2O \rightleftharpoons C_2H_5OH$

C. Alcohols

Contain –OH functional group eg.



methanol

Ethanol used in alcoholic drinks and as a biofuel. It is made by the fermentation of sugar.

Combustion

ethanol + oxygen → carbon dioxide + water

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

Reaction with Sodium

sodium + ethanol → sodium ethoxide + hydrogen

$2Na + 2C_2H_5OH \rightarrow 2C_2H_5ONa + H_2$

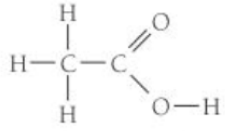
Oxidation

ethanol + oxygen atoms from oxidising agent → ethanoic acid + water

$C_2H_5OH + 2[O] \rightarrow CH_3COOH + H_2O$

D. Carboxylic Acids and Esters

Contain functional group –COOH



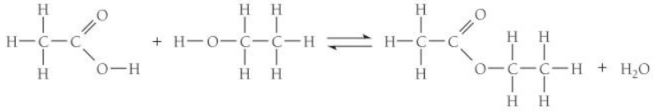
ethanoic acid

Carboxylic acids have the same reactions as other acids.

Making Esters Carboxylic acids react with alcohols to form esters. Sulphuric Acid used as a catalyst. Esters have distinctive smells and used as perfumes and flavourings.

ethanoic acid + ethanol $\overset{\text{sulfuric acid catalyst}}{\rightleftharpoons}$ ethyl ethanoate + water

$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$

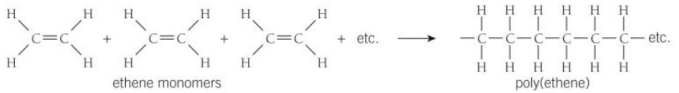


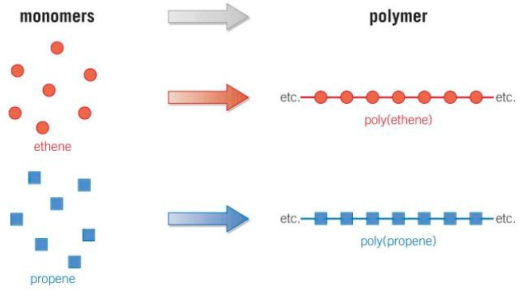
In general:

carboxylic acid + alcohol $\overset{\text{acid catalyst}}{\rightleftharpoons}$ **ester + water**

E. Polymerisation

Addition polymer—monomers add together to form polymer





Natural polymers - polysaccharides formed from many sugar monomers. DNA is a natural polymer made from monomer units called nucleotides.

Organic Chemistry
Year 11b Separate Higher

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Polymer	A substance made from large molecules made up of many repeating units (monomer).
Unsaturated	A hydrocarbon with at least one carbon-carbon double bond.
Addition Polymerisation	The reaction between alkene monomers to form a polymer.
Condensation Polymerisation	The reaction between two different monomers to form a polymer and a small molecule.
Alcohol	A group of compounds that contain –OH functional group.
Carboxylic Acid	A group of compounds that contain –COOH functional group.
Ester	A group of compounds that contain –COO– functional group.

B. Reaction of Alkenes

Combustion

ethene + oxygen → carbon dioxide + water

$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

Reaction with Halogens

ethene + bromine → dibromoethane

$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$

Reaction with Hydrogen

pentene + hydrogen $\xrightarrow{\text{catalyst}}$ pentane

$C_5H_{10} + H_2 \longrightarrow C_5H_{12}$

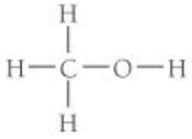
Reaction with water (steam)

ethene + steam $\overset{\text{catalyst}}{\rightleftharpoons}$ ethanol

$C_2H_4 + H_2O \rightleftharpoons C_2H_5OH$

C. Alcohols

Contain –OH functional group eg.



methanol

Ethanol used in alcoholic drinks and as a biofuel. It is made by the fermentation of sugar.

Combustion

ethanol + oxygen → carbon dioxide + water

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

Reaction with Sodium

sodium + ethanol → sodium ethoxide + hydrogen

$2Na + 2C_2H_5OH \rightarrow 2C_2H_5ONa + H_2$

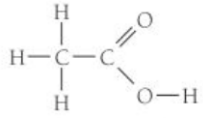
Oxidation

ethanol + oxygen atoms from oxidising agent → ethanoic acid + water

$C_2H_5OH + 2[O] \rightarrow CH_3COOH + H_2O$

D. Carboxylic Acids and Esters

Contain functional group –COOH



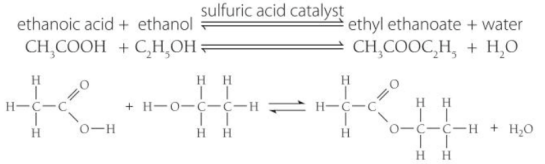
ethanoic acid

Carboxylic acids have the same reactions as other acids. They are considered weak acids as they do not fully ionise in water.

$CH_3COOH(aq) \overset{\text{water}}{\rightleftharpoons} CH_3COO^-(aq) + H^+(aq)$

ethanoic acid (high proportion) | ethanoate ions (low proportion) | hydrogen ions (low proportion)

Making Esters Carboxylic acids react with alcohols to form esters.

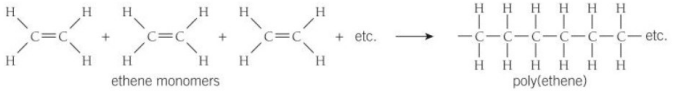


In general:

carboxylic acid + alcohol $\overset{\text{acid catalyst}}{\rightleftharpoons}$ **ester + water**

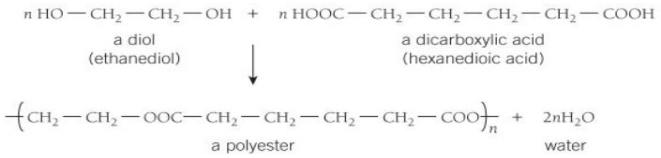
E. Polymerisation

Addition polymer—monomers add together to form polymer



ethene monomers → poly(ethene)

Condensation polymer—two different monomers add together to form a polymer and another small molecule.



Natural polymers - polysaccharides formed from many sugar monomers. Polypeptides and proteins made from amino acids that contain a $–NH_2$ and -COOH group.

Chemical Analysis

Year 11b

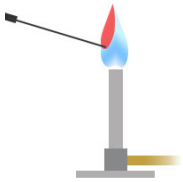
A. Keywords.

Ion	A charged particle produced by the loss or gain of electrons.
Precipitate	An insoluble solid formed by a reaction taking place in solution.
Spectroscopy	Study of the spectra produced when matter emits electromagnetic radiation
Spectroscope	A piece of apparatus used to produce a spectrum for examination.
Halide ion	A ion of an element in group 7

B. Required Practical: Flame Tests

Metal Ion	Flame Colour
Lithium	Crimson
Sodium	Yellow
Potassium	Lilac
Calcium	Orange-red
Copper	Green

Some metal ions can be identified by heating them and observing the coloured flame produced.



C. Required Practical: Positive Ion Tests

Some metal ions can also be identified by reacting the unknown compound with **Sodium Hydroxide.**

Metal Ion	Colour precipitate formed
Calcium	White
Magnesium	White
Aluminium	White (the precipitate re-dissolves if excess sodium hydroxide is added)
Copper (II)	Blue
Iron (II)	Green
Iron (III)	Brown

D. Instrumental Methods and Flame Emission Spectroscopy

Instrumental methods are useful ways of identifying elements and compounds because they are:

- Accurate
- Sensitive
- Rapid

Flame Emission Spectroscopy

A method of analysing metal ions in solutions.

- The sample is put into a flame
- The light emitted is passed through a spectroscope.
- A line spectrum is produced.
- Each line spectrum is unique to the metal ion and the concentration can also be measured.

E. Required Practical: Negative Ion Tests

Some non-metal ions can be identified by carrying out chemical tests on them.

Carbonates Test

The presence of carbonate ions can be detected by:

- Reacting the compound with **dilute hydrochloric acid**
- Bubbling the gas produced through **limewater.**
- If the limewater changes from **colourless to cloudy** carbon dioxide is present which indicates a carbonate compound was reacted.

Halides Test

The presence of a halogen ion can be detected by:

- Reacting the compound with **silver nitrate** solution and **dilute nitric acid.**
- If a halogen is present a precipitate of the silver halide will form.

Silver Chloride	White precipitate
Silver Bromide	Cream precipitate
Silver Iodide	Yellow precipitate

Sulfates Test

The presence of sulfate ions can be detected by:

- Reacting the compound with **barium chloride** and **dilute hydrochloric acid.**
- If sulfate ions are present then a **white precipitate** forms.

Using Resources

Year 11b Separate Foundation

A. Key words

Corrosion	A chemical reaction between metals and substances in the environment.
Steel	An alloy made of a mixture of iron and other elements.
Salt	The product when an acid is neutralised by a base or ammonia.
Polymer	A chemical made of a long chain of smaller units called monomers.

B. Haber Process: Ammonia

Ammonia is for fertilisers and other important chemicals.

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

An iron catalyst is used to speed up rate of reaction.

Nitrogen, Phosphorous and Potassium are used in fertiliser.

In a lab ammonia reacts with acids to make ammonium salts.

In industry potassium chloride and potassium sulfate are mined.

Phosphate rock reacts with acids and ammonia to make salts.

C. Rusting and Corrosion

Rusting is the **corrosion** of Iron in the presence of oxygen and water:

Iron + Oxygen + Water → Hydrated Iron III Oxide

To prevent rusting:

Coating metal with paint, grease or plastic prevents contact with oxygen and water.

Covering with a more reactive metal. **Galvanisation** is covering Iron with Zinc. Zinc is more reactive so reacts with the oxygen and water instead of the iron. This is called **sacrificial protection**.

Aluminium is reactive, but forms a layer of aluminium oxide on the surface, which protects/ prevents corrosion.

D. Polymers

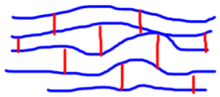
Polymer properties can be affected by the monomer used or by the reaction conditions used to make them.

LDPE is made at high pressure, HDPE is made with a catalyst at raised temperatures.

Thermosoftening

Weak forces. Soften or melt when heated.

Thermosetting



Crosslinks. Do not melt when heated (could char/burn).

E. Alloys

Alloys are usually a mixture of metals, but can be a mixture of metals and other elements.

Alloys are harder than metals as they have different sized atoms so the layers in the metals don't slide.

Bronze = copper and tin. Tough and resistant to corrosion so used for statues and ship propellers.

Brass = copper and zinc. Harder than copper so used for taps, door handles and musical instruments.

Aluminium alloys are lightweight but strong so used for aircraft.

High carbon steel is strong but brittle and used for cutting tools. **Low carbon** steel is softer and more easily shaped so used for car bodywork.

Stainless steel is made from chromium-nickel. It is hard, strong and resistant to corrosion so used for cutlery.

% gold	carat
100	24
75	18
50	12
25	6

Gold is mixed with other metals to make it stronger. 24 carat gold is pure.

F. Glass, Ceramics & Composites

Soda-lime glass = sand, limestone & sodium carbonate.

Borosilicate glass = sand and boron trioxide.

Ceramics are made from heated clay. Hard but brittle and electrical insulators e.g. bricks, pot, china.

Composites combine desired properties of 2 or more materials e.g. fibreglass or concrete.

Using Resources

Year 11b Separate Higher

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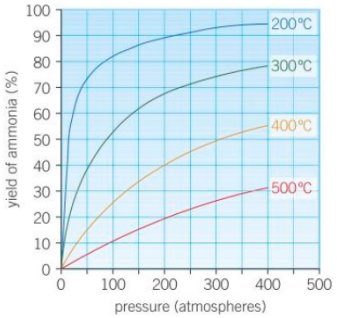
The Haber Process is not carried out at ideal conditions but a *compromise* to reduce cost and keep high rate of reaction.



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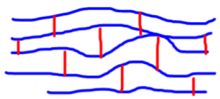

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