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SCIENCE: CHEMISTRY

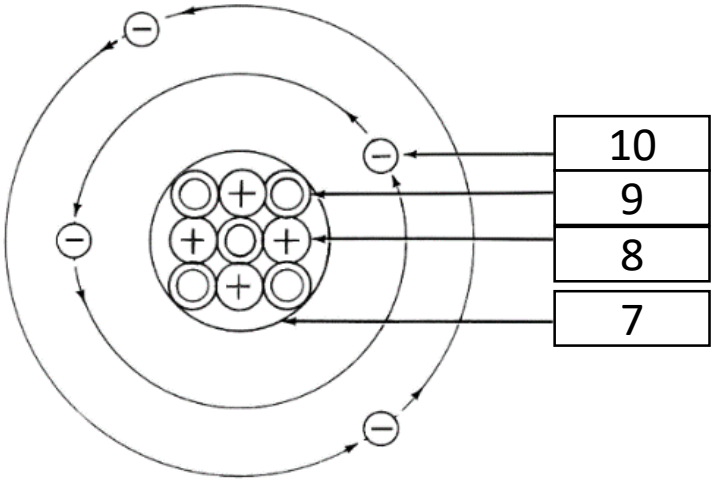
EXAM BOARD: AQA **COURSE CODE: 8462**

TOPIC NUMBER	TOPIC
1	ATOMIC STRUCTURE
2	BONDING, STRUCTURE AND THE PROPERTIES OF MATTER
3	QUANTITATIVE CHEMISTRY
4	CHEMICAL CHANGES
5	ENERGY CHANGES
6	RATE OF REACTION
7	ORGANIC CHEMISTRY
8	CHEMICAL ANALYSIS
9	CHEMISTRY OF THE ATMOSPHERE
10	USING RESOURCES

Name: ..... Tutor Group: .....

Chemistry topic 1: Atomic structure

1. Keywords	
1. Atom	The smallest possible piece of an element. Has a radius of 0.1nm (or $1x10^{-10}m$)
2. Element	A substance in which all the atoms have the same atomic number
3. Isotope	Atoms with the same number of protons but different numbers of neutrons
4. Molecule	Two or more atoms bonded together
5. Compound	Two or more <u>different</u> atoms bonded together
6. Mixture	At least two different elements or compounds together. Can be separated easily
7. Nucleus	The centre of an atom. Contains protons and neutrons
8. Proton	A positively charged particle found in the nucleus
9. Neutron	A neutral particle found in the nucleus. Has no charge
10. Electron	A negatively charged particle found in energy levels (shells) around the nucleus



2. Properties of sub-atomic particles			
Particle	Relative mass	Relative charge	Location
Proton	1	+1	Nucleus
Neutron	1	0	Nucleus
Electron	0	-1	Shells

Key

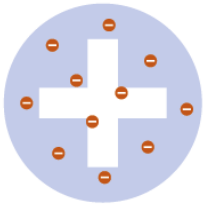
relative atomic mass
atomic symbol
name
atomic (proton) number

1
H
hydrogen
1

3. Using the periodic table		
Number of..	Is the…	Found by..
Protons	Atomic (proton) number	Smaller number on periodic table
Electrons	Atomic (proton) number	Smaller number on periodic table
Neutrons	Difference between the atomic mass and atomic number	Big number – small number

4. History of the atom			
Discovery	By	Model	Diagram
Solid particle called atom	John Dalton	Particle: solid spheres	1
The electron	JJ Thompson	Plum pudding: positive 'cake' with negative 'plums'	2
Nucleus	Rutherford	Nuclear: Positive nucleus surrounded by electrons	3
Neutron	James Chadwick	Nuclear: Now with protons and neutrons in nucleus	3
Energy levels (shells)	Niels Bohr	Planetary: Electrons now 'orbit' in different shells	4

1.

2. 

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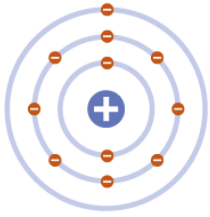
4. 

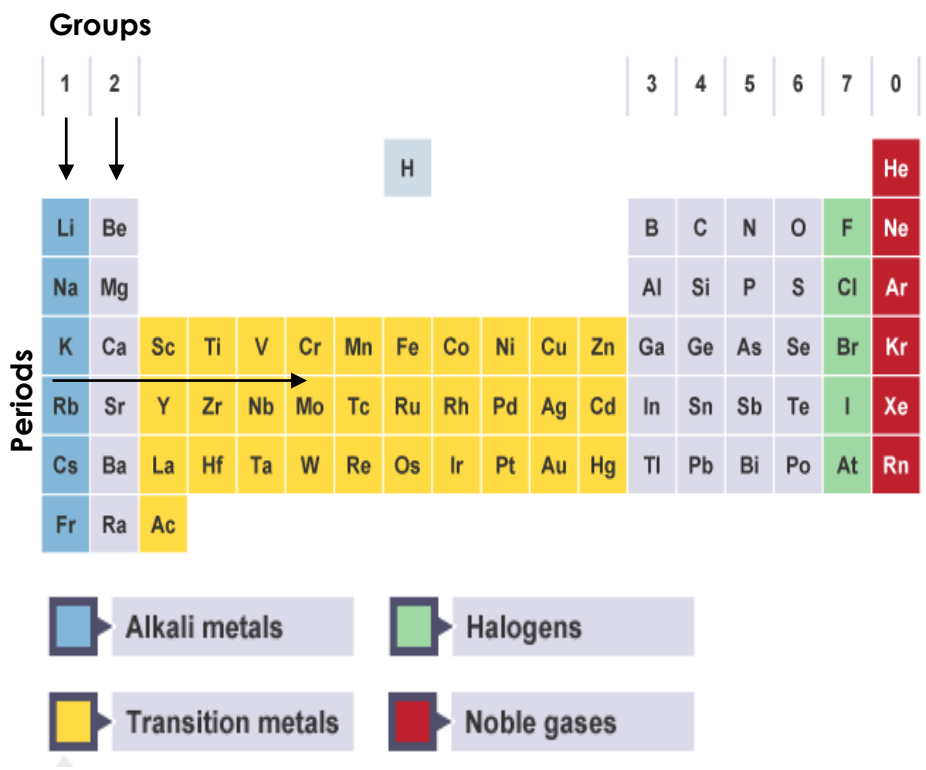
5. Electron arrangement rules	
1.	Always fill from the inside to the outside
2.	The first shell can only hold 2 electrons
3.	The second and third can hold 8

6. History of the Periodic Table	
Invented by	Dmitri **Mendeleev**, a Russian scientist.
Arranged	In order of **atomic mass**, and by their **chemical properties**
What was special about it?	**Predicted** the existence of **other elements** not discovered, and **left gaps** for them in his table
Why was it used?	**New elements** were **discovered** that **matched these gaps**

7. Properties – metals and non-metals		
Property	**Metals**	**Non-metals**
Density	High (they feel heavy for their size)	Low (they feel light for their size)
Strength	Strong	Weak
Malleable or brittle	Malleable (they bend without breaking)	Brittle (they break or shatter when hammered)
Conduction of heat	Good	Poor (they are insulators)
Conduction of electricity	Good	Poor (they are insulators) apart from graphite

Period	No. of shells
1	1
2	2
3	3
4	4
5	5
6	6
7	7

8. Layout of the periodic table



TL/DR:

Group number
Tells you're the number of outer electrons

Period number
Tells you how many shells

Group	1	2	3	4	5	6	7	8
Electrons in outer shell	1	2	3	4	5	6	7	8
Charge of ion	+1	+2	+3	N/A	-3	-2	-1	N/A
Number of covalent bonds	N/A	N/A	N/A	4	3	2	1	N/A

N/A = not applicable (does not do it)

9. Properties – Groups 1 and 7											
Group 1 (I)	**Melting point**	**Density**	**Reactivity**	**Group 7 (VII)**	**Melting point**	**Density**	**Reactivity**	**Group 0 (VIII)**	**Melting point**	**Density**	**Reactivity**
Lithium (Li)	**Decreases** down the group	**Increases** down the group	**Increases** down the group	Fluorine (F)	**Increases** down the group	**Increases** down the group	**Decreases** down the group	Helium (He)	**Increases** down the group	**Increases** down the group	**INERT** **(DO NOT REACT)**
Sodium (Na)				Chlorine (Cl)				Neon (Ne)			
Potassium (K)				Bromine (Br)				Argon (Ar)			
Rubidium (Rb)				Iodine (I)				Xenon (Xe)			

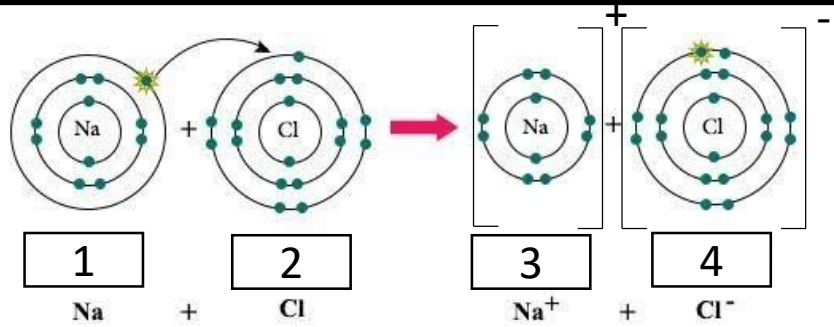
10. Transition metals (TRIPLE ONLY)	
Properties compared to group 1 elements	Other useful properties
More dense	Ions can have different charges
Harder	Form coloured compounds
Stronger	Good catalysts
Higher melting points	
Less reactive	

11. Common separation techniques
1. **Chromatography** Used to separate a mixture of dyes in ink.
2. **Filtration** Used to separate insoluble solids from liquids (e.g. sand from water).
3. **Evaporation** Used to separate a soluble salt from solution. The solution is heated strongly in an evaporating basin until dry crystals are left.
4. **Crystallisation** Used to separate a soluble salt from solution. The solution is heated gently in an evaporating basin until crystals form; the remaining liquid is filtered out.
5. **Simple distillation** Is used to separate a liquid from a solution – e.g. water from ink. A condenser is used to cool hot gas until it forms a liquid.
6. **Fractional distillation** Used to separate a mixture of liquids with different boiling points.

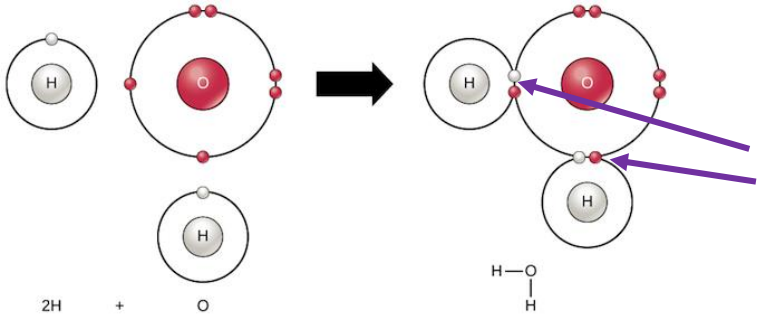
Chemistry Topic 2: Bonding, Structure, and the properties of matter

1. Keywords	
Ionic bond	When a metal donates electrons to a non-metal forming opposite charged ions that are attracted to each other
Covalent bond	A shared pair of electrons between two non-metals
Metallic bond	Positive metal ions in a 'sea' of delocalised electrons
Ions	Charged atoms which have either gained or lost electrons
Electrons	Negative particles found in the shells of atoms
Group 0	The unreactive 'noble gases' all elements aim to get to group 0 electron configuration when they react
Dot and cross diagrams	The simplest way we show the bonding in atoms
Polymer	A long chain molecule made up of repeating monomers
Monomer	The small molecules that join together to make polymers
Delocalised	Electrons which are free to move anywhere
Alloy	A mixture of a metal and another element to change its properties

2. The process of ionic bonding



No	Name	Electron movement	Charge	Electron configuration	Does it have a full outer shell?
1	Sodium atom	0	0	2,8,1	No
2	Chlorine atom	0	0	2,8,7	No
3	Sodium ion	Lost 1	+1	2,8	Yes
4	Chloride ion	Gained 1	-1	2,8,8	Yes

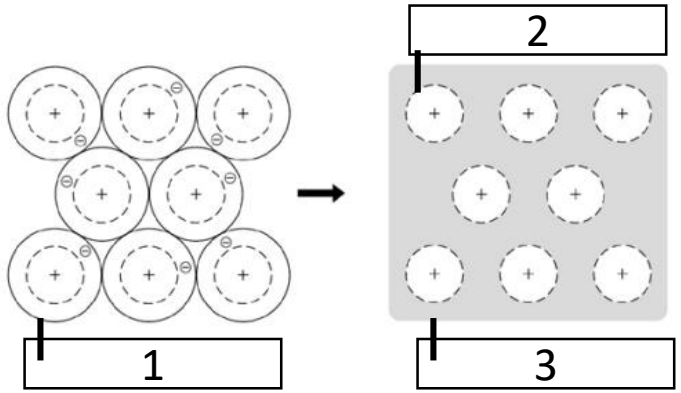


Make sure both electrons are in the overlap of the outer shells

3. The process of covalent bonding

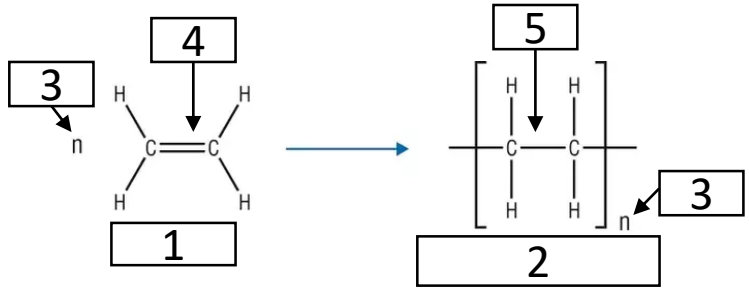
1	Non metals share their outer unpaired electrons
2	Now all outer shell spaces appear full
3	There is no change in charge. They remain uncharged

4. Metallic bonding	
1	Metal atoms
2	Positive metal ions
3	'Sea' of delocalised electrons



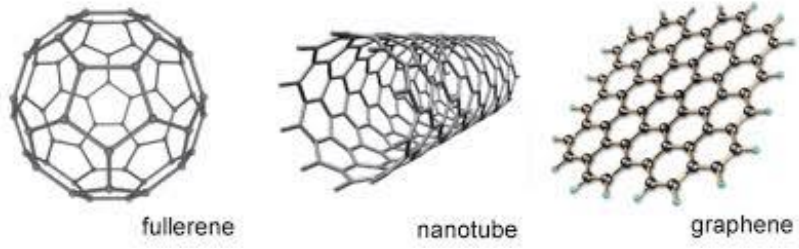
5. State symbols		
Symbol	Meaning	Example
(s)	Solid	Gold
(l)	Liquid	Water
(g)	Gas	Hydrogen
(aq)	Aqueous (dissolved in water)	Salt solution

6. Polymers	
1	Ethene
2	Poly(ethene) "polythene"
3	A very large number
4	A double bond
5	A single bond

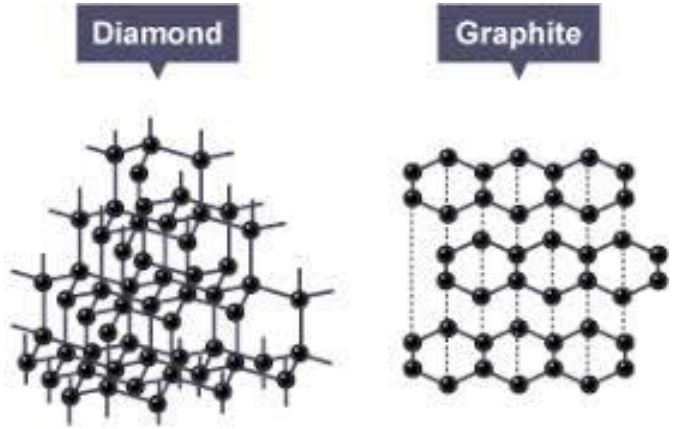


7. General properties of different substances				
Property	Ionic compounds	Small covalent molecules	Giant covalent structures	Metals and alloys
Density	High	Low	High	High
Melting and boiling point	High	Low	High	High
Conduct electricity	Only melted or dissolved in water	No	No (apart from graphite)	Yes
Conduct heat	No	No	No (apart from diamond)	Yes
Brittle or malleable	Brittle	N/A	Brittle	Malleable
Examples	• Salt (sodium chloride) • Magnesium Sulfate	• Chlorine • Oxygen	• Diamond • Graphite • Sand	• Iron • Steel

9. The structure and bonding of carbon			
Name of structure	Diamond	Graphite	Graphene + Fullerene
Number of bonds	4	3	3
Any delocalised electrons?	no	yes	Yes
Hardness	Very hard	soft	Flexible and strong
Conduct electricity	No	yes	Yes
Melting point	Very high	High	High
Uses	• Gems • Drill bits	• Electrodes • Pencils	• Electronics • Nanotubes



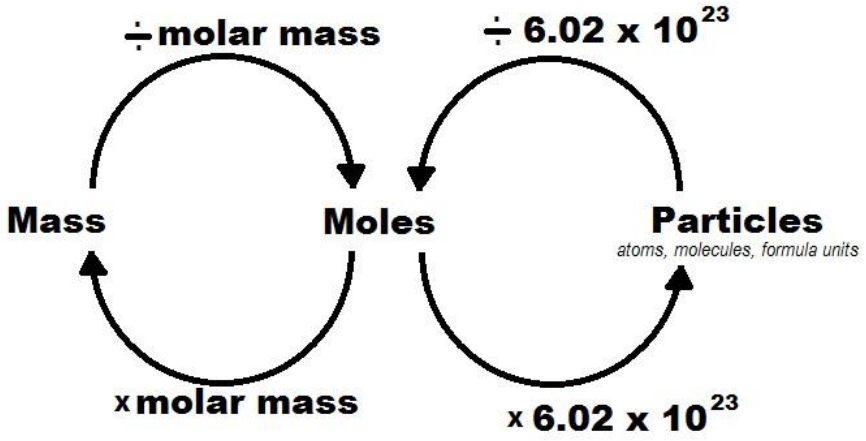
10. Bulk and surface properties of nanoparticles (TRIPLE ONLY)		
Name	Size in nanometres	Size in standard form
Nanoparticles	1-100 nm	$1x10^{-9}$ m to $1x10^{-7}$ m
Fine particles	100-2500 nm	1×10^{-7} m to 2.5×10^{-6} m
Coarse particles ("dust")	2500nm – 10000nm	2.5×10^{-6} m to 1×10^{-5} m
Uses of nanoparticles	Example	
1. Medicine 2. Electronics 3. Cosmetics 4. Sunscreen 5. Deodorants 6. Catalysts	1. Delivering drugs directly to cells 2. Wearable electronics 3. Anti-aging creams 4. Sunscreen without white marks 5. Antibacterial action 6. Fullerne	



Chemistry Topic 3: Quantitative chemistry

1. Keywords	
Conservation of mass	No atoms are made or lost during a chemical reaction. The mass before the reaction must equal the mass after a reaction IN A CLOSED SYSTEM
Closed system	A container which no chemicals can escape. Eg a sealed bottle
Relative formula mass (Mr)	Sum of relative atomic masses from periodic table
Balanced equation	When the sum of the Mr on the left equals the sum of the Mr on the right
Uncertainty	The percentage of a result that might be wrong. Shown from differences between repeats
Limiting reactant	The reactant which runs out first

2. Moles (HT ONLY)	
Mole	The number of particles needed to make the mass equal the atomic mass
Avogadro constant	6.022×10^{23} particles in 1 mole



3a. Concentration		
$$C = \frac{mass}{V}$$		
C	Concentration	g/dm^3
$mass$	mass	g
V	volume	dm^3 (litres)

3b. Concentration (HT ONLY)		
$$C = \frac{\mathrm{m}}{V}$$		
C	Concentration	g/dm^3
m	mole	
V	volume	dm^3 (litres)

4. Percentage yield (TRIPLE ONLY)

$$\%\text{Yield} = \frac{mass\ \text{of actual}}{\text{Maximum mass}}\ x\ 100$$

%Yield	Percentage yield	%
mass of actual	Mass of product actually obtained	g
Maximum mass	The theoretical maximum mass possible	g

5. Atom economy (TRIPLE ONLY)

$$\%\ \text{Atom economy} = \frac{Mr\ of\ desired\ product}{\text{Sum of Mr for all reactants}}\ x\ 100$$

% Atom economy	Percentage atom economy	%
Mr of desired product	Relative formula mass of the product you want	g/mol
Sum of Mr for all reactants	The total of all the react Mr added together	g/mol

6. Volume of gases (TRIPLE HT ONLY)

1 mole of gas occupies 24 dm^3	If 20°C and 1 atmosphere pressure
Equal moles occupy the same volume	

Chemistry Topic 4: Chemical changes

1.Keywords	
Metal oxide	A compound formed when a metal ionically bonds to oxygen
Reactivity series	The order of elements in terms of their reactivity
Acid	A substance that releases H^+ ions and has a pH below 7
Base	A substance that neutralises an Acid and has a pH above 7
Alkali	A type of soluble base. A metal hydroxide. Releases OH^- ions
Neutralisation	When an acid reacts with a base to produce a salt and water
Carbonates	Ionic compounds containing Carbon and oxygen
Salt	Ionic compound formed when acid and base react
Soluble	A substance that dissolves
Insoluble	A substance that does not dissolve
Indicator	A substance that changes colour when pH changes
Electrolysis	Splitting up an ionic substance using electricity
Molten	Turned to a liquid
Solution	Dissolved in water

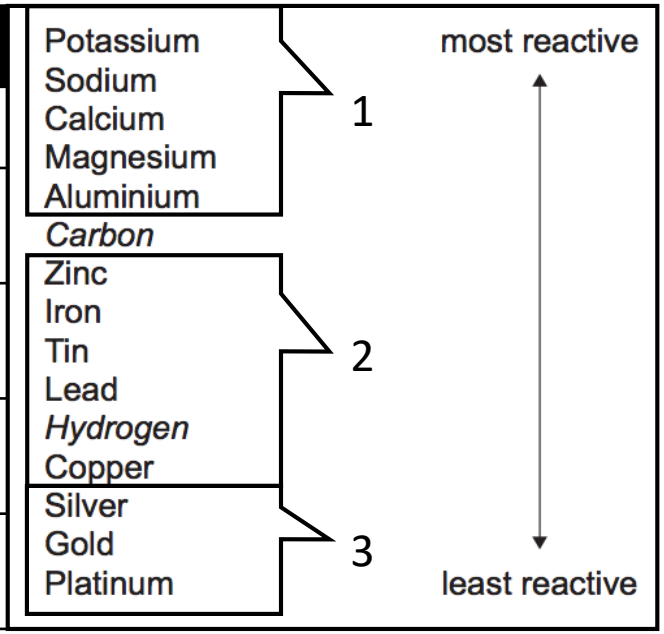
2. REDOX

Change	**In terms of oxygen**	**In terms of hydrogen**	**In terms of electrons (HT ONLY)**
Oxidation	Gaining oxygen	Losing hydrogen	Loss of electrons (OIL)
Reduction	Losing oxygen	Gaining hydrogen	Gain of electrons (RIG)

3. The reactivity series

	Category	Extracted by
1	Highly reactive metals	Electrolysis
2	Base metals	Smelting: heating with carbon
3	Native metals	Found as nuggets of pure metal

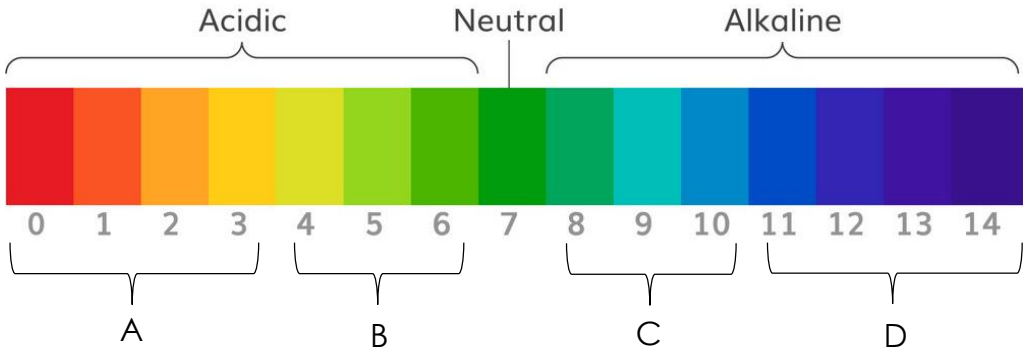
NOTE: Hydrogen is not a metal and used to extract some other metals not on this list



4. Naming salts

Acid used	Second part of salt's name
Hydrochloric acid	chloride
Sulfuric acid	sulfate
Nitric acid	nitrate

5. pH scale



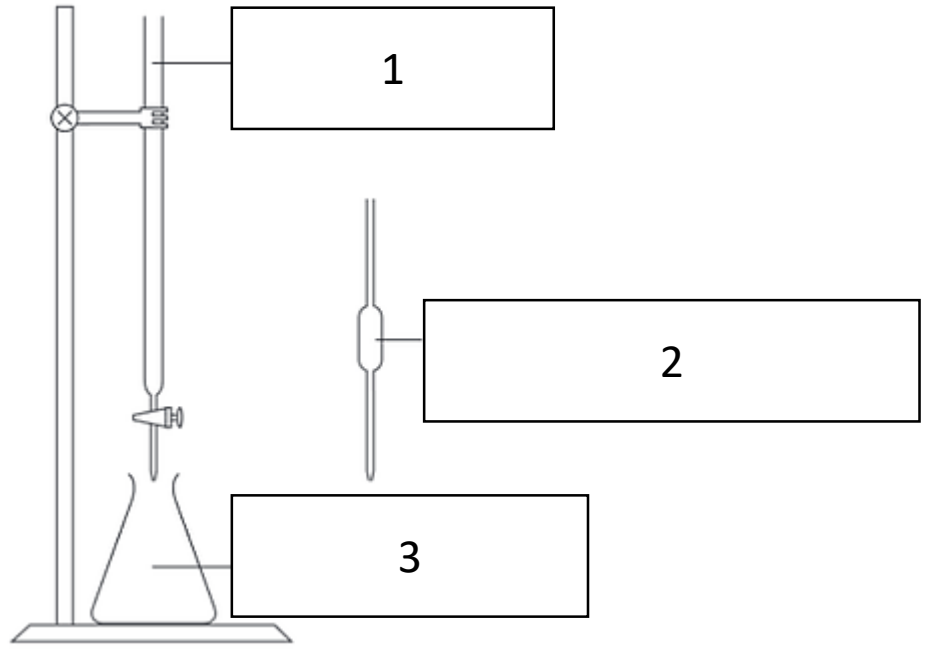
	Name	Level of ionisation in water
A	Strong acid	Fully
B	Weak acid	Partially
C	Weak base	Partially
D	Strong base	Fully

6. Equation for all neutralisations

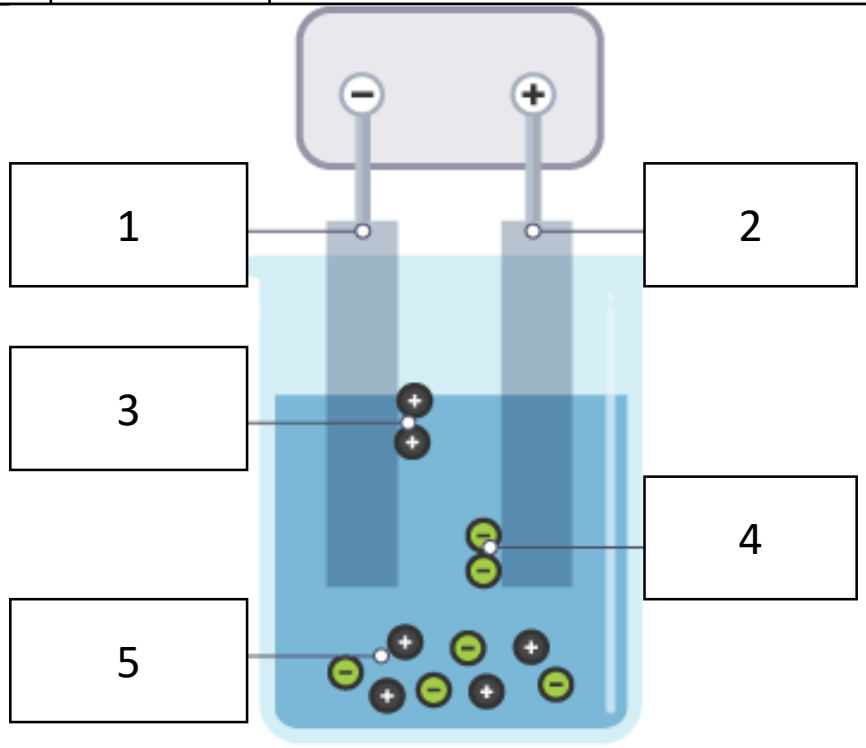
$$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$$

7. Titrations (TRIPLE ONLY)

No.	Name	Function
1	Burette	Measures amount of acid or base delivered to conical flask
2	Pipette	Accurately measures the acid or base into the conical flask
3	Conical flask	Holds the acid or base to be titrated and an indicator



7. Electrolysis		
1	Cathode	The negative electrode
2	Anode	The positive electrode
3	Positive ion	Move to cathode
4	Negative ion	Move to anode
5	Electrolyte	The ions that are being electrolysed



Don't **PANIC** - **P**ositive is **A**node, **N**egative **I**s **C**athode.

8. Electrolysis of aqueous solutions	
Place in reactivity series	**Product of electrolysis**
Metal more reactive than hydrogen	Hydrogen is produced at the cathode
If the negative ion is not a halide ion (group 7)	Oxygen is produced at the anode

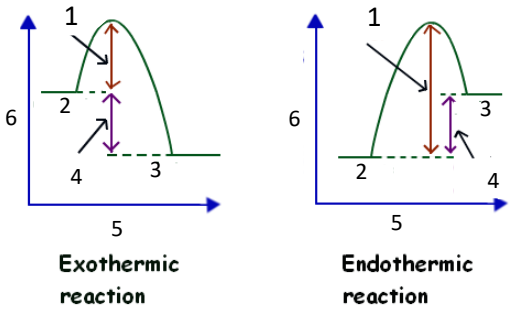
Chemistry Topic 5: Energy changes

1. Keywords

Conservation of energy	Energy can not be created or destroyed just transferred from one for to another
Exothermic reaction	Reaction which releases heat to the surroundings. Causing an increase in temperature
Endothermic reaction	Reaction which absorbs heat from the surroundings. Causing a decrease in temperature

2. Reaction profiles

1	Activation energy
2	Reactants
3	Products
4	Energy released
5	Reaction progress
6	Potential energy



3. Energy changes of reactions (HT ONLY)

Reaction type	**Temperature change**	**Amount of energy absorbed to break bonds**	**Amount of energy released when making new bonds**
Exothermic	Increases	Less	More
Endothermic	Decreases	More	Less

4. Cells and batteries (TRIPLE ONLY)

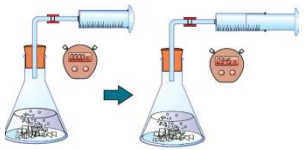
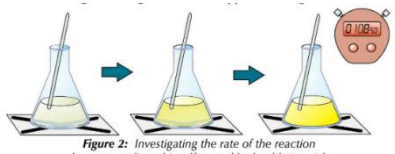
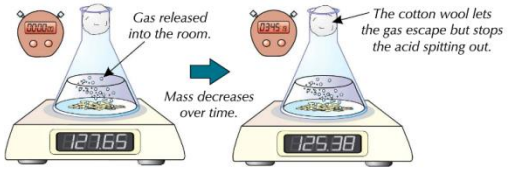
Simple cell	Made from connecting two different metals in contact with an electrolyte
Battery	Two or more cells joined together in series to make a greater voltage
Non-rechargeable cell	Type of cell where the reactions stop when one of the reactants is used up. E.g Alkali batteries
Rechargeable cell	Type of cell where the chemical reactions can be reversed when an electric current is supplied
Fuel cell	Type of cell that makes electricity from reacting a fuel (eg Hydrogen) with oxygen

5. Hydrogen fuel cell (TRIPLE ONLY)

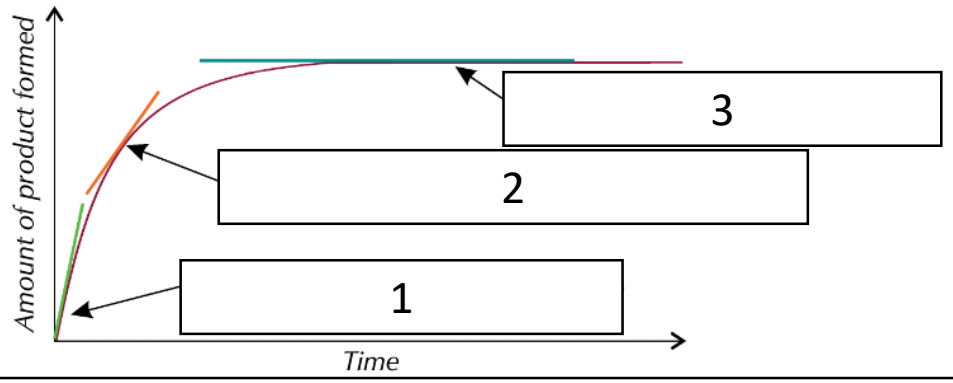
Overall equation	$2H_2 + O_2 \rightarrow 2H_2O$
Anode equation (HT ONLY)	$4H^+(aq) + O_2(g) + 4e^- \rightarrow 2H_2O(g)$
Cathode equation (HT ONLY)	$H_2(g) - 2e^- \rightarrow 2H^+(aq)$

Chemistry Topic 6: Rate of reaction

1. Keywords	
Rate of reaction	Amount of reactant used or product formed ÷ time
Collision theory	Idea that for a reaction to occur the particles have to hit each other with enough energy
Activation energy	The minimum energy needed for a collision to cause a reaction
Catalyst	A substance which speeds up a chemical reaction by lowering the activation energy
Reversible reaction	A chemical reaction that can go in either direction
Equilibrium	When the forwards and backwards reactions happen at the same rate

2. Ways to measure the rate of reaction	
Volume of gas produced	
Formation of a solid product	 **Figure 2:** Investigating the rate of the reaction between sodium thiosulfate and hydrochloric acid.
Change in mass	

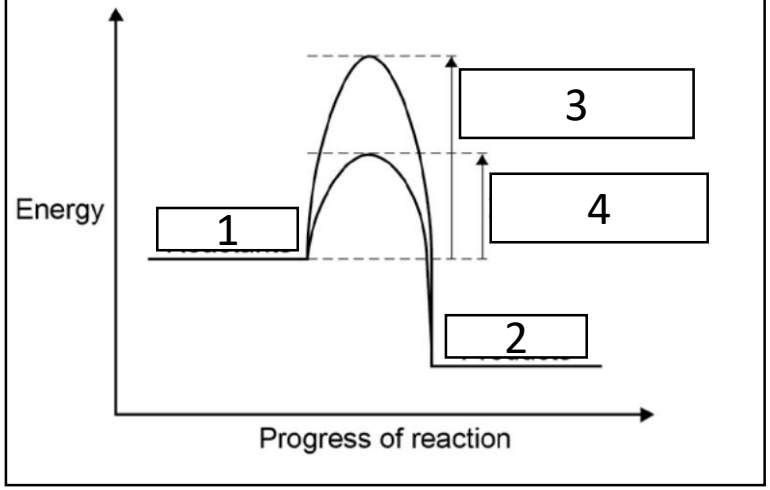
3. Calculating rates from graphs	
1	At start steep slope so fast reaction
2	As slope becomes less steep reaction is slowing
3	Flat line shows reaction has finished



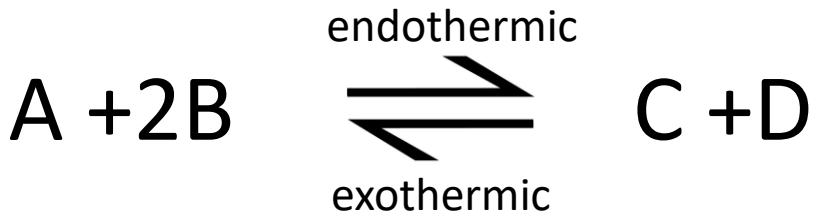
4. Factors affecting rate of reaction			
Factor	Change	Effect on rate	Reason
Temperature	Increase	Increase	The particles are moving faster so collide more often and with a greater proportion of successful collisions
Concentration	Increase	Increase	The are more particles so collisions are more frequent
Surface area	Increase	Increase	There are more particles available so more collisions
Catalyst	add	increase	The lower activation energy means more particles can successfully collide

5. Catalysts

1	Reactants
2	Products
3	Activation energy without catalyst
4	Activation energy with catalyst



6. The effect of changing conditions on equilibrium (HT ONLY)

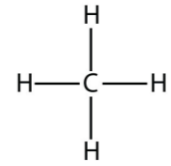
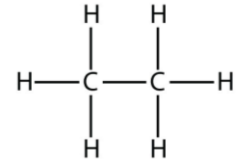
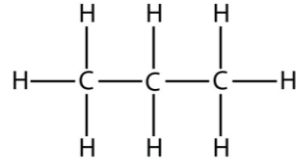
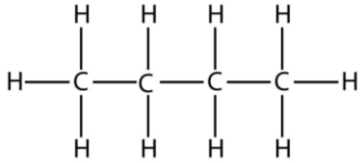


Le Charteliers principle: A reaction at equilibrium will act to oppose any change made to it

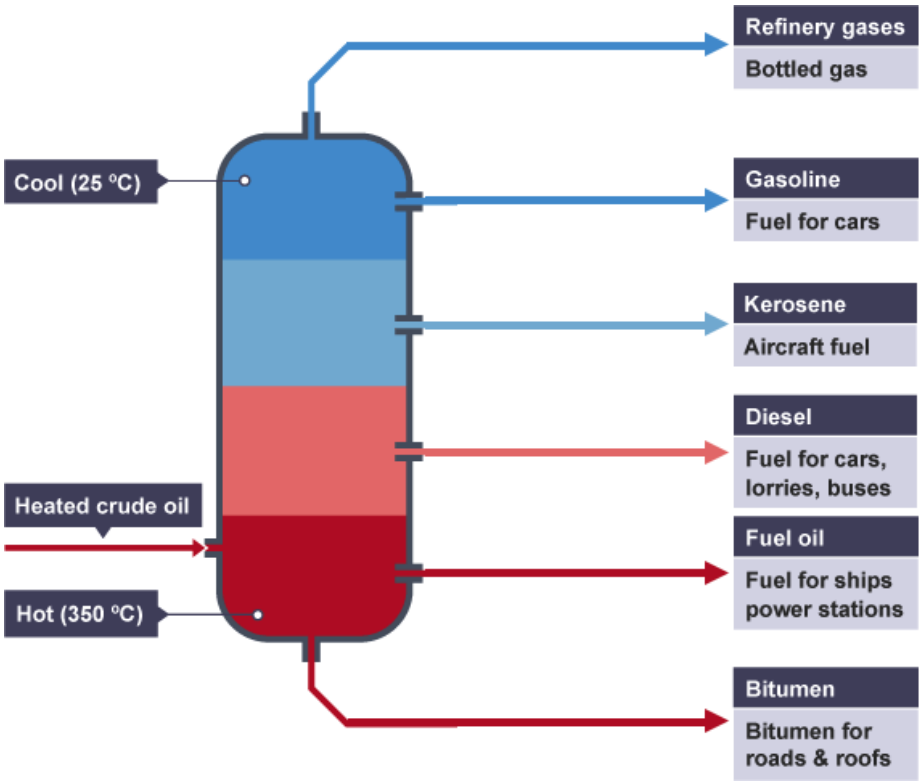
Condition	Change	Affect
concentration	Increase A or B	Shifts right to increase the concentration of C+D
	Decrease A or B	Shifts left to increase concentration of A+B
Temperature	Increase	Shifts right in favour of the endothermic reactions making more C+D
	Decrease	Shifts left in favour of the exothermic reactions making more A+B
Pressure	Increase	Shifts right to the side with the fewest moles so makes more of C+D
	Decrease	Shifts left tot eh side with the most moles so makes more A+B

Chemistry Topic 7: Organic chemistry

1. Carbon compounds as fuels and feedstock	
Hydrocarbon	A chemical made of only carbon and hydrogen
Crude oil	A mixture of hydrocarbons found in rock
Alkanes	Saturated hydrocarbons (without double bond)
Alkene	Unsaturated hydrocarbon (with double bond). They turn bromine water from brown to colourless.
Fractional distillation	A process of separating crude oil using the different boiling points of fractions
Viscosity	How thick a liquid is
Flammability	How easily a fraction catches fire
Boiling point	The temperature at which a substance turns from a liquid to a gas
Combustion	A reaction where a fuel is oxidised releasing heat energy
Cracking	Breaking less useful long-chain alkanes into useful short-chain alkanes and alkenes

2. Alkanes		
General formula	C_nH_{2n+2}	
Name	Molecular formula	Displayed formula
Methane	CH_4	
Ethane	C_2H_6	
Propane	C_3H_8	
Butane	C_4H_{10}	

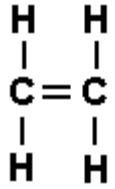
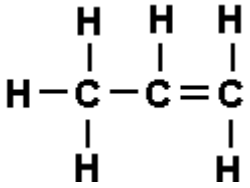
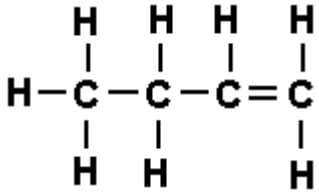
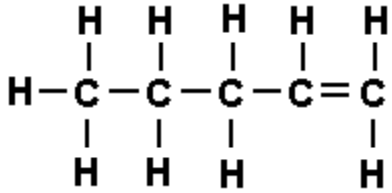
3. Fractional distillation	
1.	The column is cooler at the top than the bottom
2.	The crude oil is heated
3	The fractions evaporate and rise up the column
4	The fractions condense at different points according to their boiling point
5	The liquid fractions run off and are collected



4. Properties of hydrocarbons	
Property	Change as carbon change gets longer
Boiling point	Increases
Viscosity	Increases (less runny)
Flammability	Decreases

5. Cracking	
Type of cracking	Conditions
Catalytic	Hot (500°C) + catalyst
Steam	Very hot (850°C) + Steam
Short chain = desirable	Long chain = undesirable

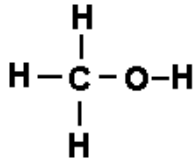
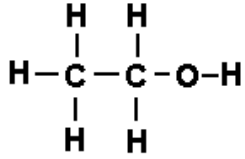
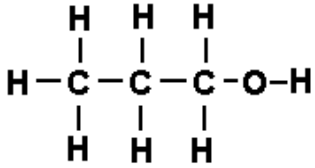
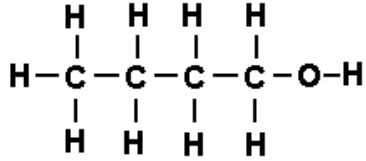
6. Alkenes (TRIPLE ONLY)

General formula	C_nH_{2n}	
Name	Molecular formula	Displayed formula
Ethene	C_2H_4	
Propene	C_3H_6	
Butene	C_4H_8	
Pentene	C_5H_{10}	

7. Reactions of Alkenes (TRIPLE ONLY)

Reaction	Observation
Oxidation (incomplete combustion)	Burn in air to produce smoky flames
Addition	Double bond opens to form single bonds. Reacts with hydrogen, water and halogens

6. Alcohols (TRIPLE ONLY)

Functional group	-OH	
Name	Molecular formula	Displayed formula
Methanol	CH_3OH	
Ethanol	C_2H_5OH	
Propanol	C_3H_7OH	
Butanol	C_4H_9OH	

7. Fermentation of alcohols (TRIPLE ONLY)

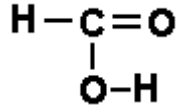
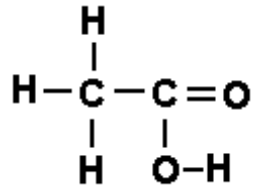
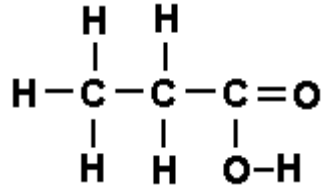
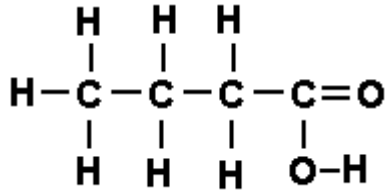
glucose $\xrightarrow{yeast}$ ethanol + carbon dioxide

$C_6H_{12}O_{6(aq)} \xrightarrow{yeast} 2C_2H_5OH_{(aq)} + 2CO_{2(aq)}$

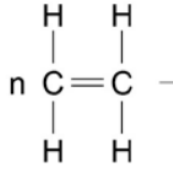
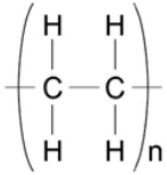
8. Reactions of alcohol (TRIPLE ONLY)

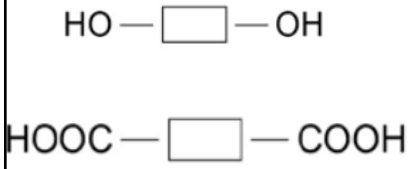
Reaction	Observation	Uses
Combustion	Burns with a clean flame	Spirit burners, biofuels
With sodium	Hydrogen bubbles given off. Metal skates around surface	N/A
Oxidation	Oxidising agent changes colour	Making carboxylic acids

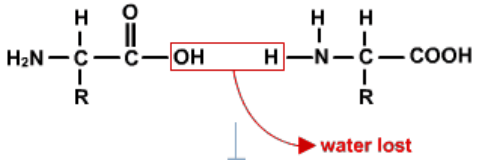
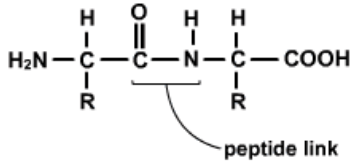
9. Carboxylic acids (TRIPLE ONLY)

Functional group	-COOH	
Name	Molecular formula	Displayed formula
Methanoic acid	HCOOH	
Ethanoic acid	CH_3COOH	
Propanoic acid	C_2H_5COOH	
Butanoic acid	C_3H_7COOH	

10. Synthetic and naturally occurring polymers (TRIPLE ONLY)	
Monomer	A small unit that joins together to make a polymer
Polymer	A long chain molecule made of many polymers
Synthetic	Man made
DNA	Deoxyribosenucleic acid. Natural polymer that codes genetic instructions. Formed of nucleotides in a double helix
Cellulose	Natural polymer made from glucose. Use in plant cell walls
Starch	Natural polymer made from glucose. Use in plant cells as a food store
Protein	Natural polymer made of amino acids. Used for growth and repair in cells. Also called a polypeptide.

11. Addition polymerisation (TRIPLE ONLY)	
Monomer(s)	Polymer
Alkenes	Long-chain alkane
 ethene	 poly(ethene)

11. Condensation polymerisation (TRIPLE HT ONLY)	
Monomer(s)	Polymer
Diol (2 alcohol) Dicarboxylic acid	Polyester (+ water)
	

12. Amino acids (TRIPLE HT ONLY)	
Monomer(s)	Polymer
Amino acid	Polypeptide (+ water)
	

Chemistry Topic 8: Chemical analysis

1. Keywords	
Pure substance	A single element or compound not mixed with any other substance. They have a specific melting and boiling point
Melting point	The temperature at which a solid turns to a liquid
Boiling point	The temperature at which a liquid turns to a gas
Formulation	A mixture that has been designed as a useful product eg fuels, cleaning agents, medicines and fuels
Chromatography	Use to separate mixtures and identify substances
Rf	$\frac{distance\ moved\ by\ substance}{distance\ moved\ by\ solvent}$

2. Identification of common gases		
Gas	Test	Observation
Hydrogen	Burning splint	Squeaky pop
Oxygen	Glowing splint	Relights
Carbon dioxide	Limewater	Goes cloudy
Chlorine	Damp Litmus paper	Bleached (goes white)

3. Flame tests (TRIPLE ONLY)	
Metal ion	Colour
Lithium (Li^+)	Crimson
Sodium (Na^+)	Yellow
Potassium (K^+)	Lilac
Calcium (Ca^{2+})	Orange-red
Copper (Cu^{2+})	Green
Flame emission spectroscopy: A sample is put in a flame and the light given out passed through a spectroscope that can identify the ions in the sample	

4. Metal hydroxides (TRIPLE ONLY)	
Metal ion	Observation with addition of sodium hydroxide
Aluminium (Al^{3+})	White precipitate which dissolves in excess
Calcium (Ca^{2+})	White precipitate
Copper (Cu^{2+})	Blue precipitate
Iron II (Fe^{2+})	Green precipitate
Iron III (Fe^{3+})	Brown precipitate

5. Testing for negative ions (TRIPLE ONLY)		
Negative ion	Reagent	Observation
Carbonate	Add carboxylic acid	Fizzes releasing Carbon dioxide
Halide	Add silver nitrate	Cl^- = white precipitate Br^- = cream precipitate I^- = yellow precipitate
Sulfate	Add Barium Chloride	White precipitate

Chemistry Topic 9: Chemistry of the atmosphere

1. Composition of the earths atmosphere now	
79%	Nitrogen
20%	Oxygen
1%	Other gases including CO_2

2. Evolution of the atmosphere		
Time	Atmosphere	reason
4 billion years a go	Nitrogen, Carbon dioxide and water vapour (like mars)	Volcanic erruptions
	Nitrogen, Carbon dioxide decreases	Earth cools and water vapour condenses. Carbon dioxide dissolves into the oceans
2.7 billion years ago	Increasing oxygen decreasing carbon dioxide	Photosynthesising organisms evolved
	Reducing oxygen to modern levels	Animals evolved and began respiring the oxygen

3. Climate change	
Greenhouse gases	Gases which increase the temperature of the atmosphere Eg Carbon dioxide, methane, water vapour
Greenhouse effect	When excess greenhouse gases absorb and radiate IR radiation back to the earth warming it
Man-made climate change	The leading theory that human activities are causing an increase in global temperature
Carbon footprint	Total amount of carbon dioxide emitted over the life of a product, service or event
Global dimming	Particulates block the light from the sun slightly, reducing global temperature
Acid rain	Gases dissolve in rain causing damage to buildings, statues, lakes and trees

4. Atmospheric pollutants from combustion		
Pollutant	Source	Effect
Carbon dioxide	All combustion	Global warming
Carbon monoxide	Incomplete combustion	Toxic, breathing problems
Carbon particle (Soot)	Incomplete combustion	Breathing problems, global dimming
Sulfur dioxide	Burning sulphur, impurities in fossil fuels	Acid rain
Oxides of nitrogen	Vehicle engines	Acid rain

Chemistry Topic 10: Using resources

1. Keywords	
Finite resources	Resources that will run out
Renewable resources	Resources that can be re-grown or will not run out
Sustainable development	Building things with depleting natural resources
Potable water	Water that is safe to drink
Pure water	Water without anything added to it Eg 100% H_2O
Desalination	Removing salt by distillation or reverse osmosis
Sterilisation	Killing bacteria and microbes (eg chlorine, ozone or UV)
Distillation	Evaporation followed by condensation, uses a lot of energy
Reverse osmosis	A process using membranes to remove the salt. Uses a lot of energy
Effluent	Liquid waste sewage discharged into rivers and seas
Sludge	Solid sewage waste. Dried and used as fertiliser or burned to generate electricity
Life cycle assessments (LCAs)	A way of assessing the impact of the production transport use and disposal of a product on the environment

2. Waster water treatment		
	Name	Description
1	Screening	Solid waste and grit removed by a metal grid
2	Primary treatment	Sediments are allowed to settle out from the mixture
3	Secondary treatment	Bacteria feed on the remaining organic waste. The tank has air bubbled through it so aerobic respiration can occur
4	Final treatment	Bacteria allowed to settle out. Water is sterilised and ready to drink

3. Alternative methods of extracting metals (HT ONLY)	
Phytomining	1. Plants absorb metal compounds 2. Plants are harvested and burnt 3. Ash contains metal compounds
Bioleaching	1. Bacteria absorb metal compounds 2. Bacteria excrete a solution of metal called Leachate 3. Electrolysis can extract the metal

4. Corrosion and its prevention (TRIPLE ONLY)		
Corrosion	Destruction of materials by chemical reactions. eg rusting	
Prevention method	Works by	Examples
Coating	Providing a barrier	Greasing Painting Electroplating
Sacrificial protection	Reacts with the oxygen instead of the metal	Galvanising by Zinc

5. Alloys (TRIPLE ONLY)		
Alloy	Made of	Use
Bronze	Copper and Tin	Coins and medals
Brass	Copper and Zinc	Musical instruments
18 carat Gold	75% gold, silver, copper, zinc	Jewellery
Steel	Iron and Carbon	High carbon: Knives Low carbon: Bridges
Stainless steel	Iron, Carbon and Chromium	Cutlery, medical instruments
Aluminium alloys	Aluminium and Scandium	Planes

6. Ceramics (TRIPLE ONLY)		
Ceramic	Made from	Use
Glass	Heating sand, sodium carbonate and limestone	Windows Lenses
Clay	Wet clay shaped and heated	Pottery Bricks

7. Polymers (TRIPLE ONLY)		
Polymer type	Property	Crosslinks present
Thermosoftening	Melts when heated	No
Thermosetting	Does not melt, just burns	Yes

8. Haber process (TRIPLE ONLY)	
Reaction	Nitrogen+Hydrogen $\rightleftharpoons$ Ammonia $N_2 + 3H_2 \rightleftharpoons 2NH_3$
Raw materials	Hydrogen: from natural gass Nitrogen: from air
Conditions	Temp: 450°C Pressure: 200atm Catalyst: Iron

9. Making fertilisers from phosphate rock (TRIPLE ONLY)	
Reagent	Product
Sulfuric acid	Calcium phosphate + Calcium sulfate
Nitric acid then ammonia	Ammonium phosphate
Phosphoric acid	Calcium phosphate

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Notes page

Y11 GCSE Exam Dates

Y11 Mock(s): _____

Y11 PPE(s): _____

Final GCSE(s): _____

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Success Programme Sessions:

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Revision Guide (if applicable):

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