

Chemistry facts to learn for GCSE. Remember paper 1 will have questions on topics 1,2,3,4,5 and paper 2 will have questions on topics 1,6,7,8,9.

Get someone to ask you these questions until you get all the answers right. **Questions in bold are for the Higher Paper only.**

Topic 1 (can be tested on Paper 1 and Paper 2)

Q	Topic 1 Questions	Q	Topic 1 answers
1	What are the 4 state symbols?	1	Solid (s), liquid (l), gas (g) and aqueous (aq)
2	What are the 3 sub-atomic particles and where are they found?	2	Protons and neutrons which are found in the nucleus and electrons which are in shells around the nucleus
3	What are the masses and charges of the 3 sub-atomic particles?	3	Proton – mass of 1, charge of +1 Electron – mass of 1/2000, charge of -1 Neutron – mass of 1, charge of 0
4	Why do atoms have no overall charge?	4	They contain equal numbers of protons which are positively charged and electrons which are negatively charged
5	What are isotopes?	5	Different forms of the same element which have the same number of protons but a different number of neutrons
6	Why do some atoms not have whole numbers as mass numbers?	6	The average of all the isotopes may not be a whole number
7	How do you calculate the relative atomic mass of an element?	7	Find the sum of the isotope masses and then divide by 100
8	How did Mendeleev arrange the elements in the periodic table?	8	In increasing atomic weights and by similar chemical properties
9	What is a row in the periodic table called?	9	A period
10	What is a column in the periodic table called?	10	A group
11	How are ionic bonds formed?	11	Electrons are transferred from a metal to a non-metal
12	What is a cation?	12	A positive ion made when an atom loses electrons
13	How does a Cu atom turn into a Cu ²⁺ ion?	13	It loses 2 electrons
14	What is an anion?	14	A negative ion made when an atom gains electrons
15	What does –ate mean in a compound?	15	A compound containing oxygen as well as another element
16	How does a sulphide differ from sulphate?	16	A sulphide contains sulphur in a compound, a sulphate contains sulphur and oxygen
17	What is the structure of an ionic compound?	17	A giant lattice with regularly arranged positive and negative ions held together by strong electrostatic forces of attraction
18	Do ionic compounds conduct electricity?	18	No when solid as ions fixed in lattice and cannot move; yes when molten or in solution as ions are free to move and carry charge
19	How is a covalent bond formed?	19	A shared pair of electrons between two atoms

20	Put these in order of size from biggest to smallest: molecule, atom, proton, polymer	20	Proton, atom, molecule, polymer
21	What are the properties and structure of diamond?	21	Giant tetrahedral structure with 4 strong covalent bonds between the carbon atoms. High melting points, hard, non-conductor of electricity with no charge carriers
22	What are the properties and structure of graphite?	22	Layers of carbon atoms with 3 strong covalent bonds between each carbon atom. High melting point, but slippery as weak intermolecular forces between layers. Delocalised electrons can carry charge, so a good conductor of electricity
23	What is a polymer?	23	Large molecules containing chains of carbon atoms, made from monomers
24	What are the properties and structure of C ₆₀ ?	24	Simple molecule, each carbon atom forms 3 bonds. Strong covalent bonds between atoms, but weak intermolecular forces between molecules mean low melting points and soft and slippery
25	What are the properties and structure of graphene?	24	A single sheet of no fixed size, each carbon makes 3 bonds. One atom thick, so very light, but very strong bonds; delocalised electrons move over surface so a good conductor of electricity
26	What are the properties and structure of metals?	25	Giant lattice of positive metal ions surrounded by a sea of delocalised electrons. Strong forces of attraction mean high melting points, free moving electrons mean good conductor of electricity
27	How do you calculate the relative formula mass of a substance?	26	Add together the mass numbers of the individual atoms
28	What is the empirical formula?	27	The simplest whole number ratio of atoms in a compound
29	How do you calculate the empirical formula?	28	MRSA: 1. (<u>M</u> ole) Divide each mass by the atomic mass; 2. (<u>R</u> atio) Divide by the smallest number; 3. (<u>S</u> implify) the numbers to give whole numbers; 4. Write the (<u>a</u> ctual) formula
30	How do you calculate the molecular formula?	29	Use the empirical formula to work out the empirical mass. Use the relative formula mass to work out how many lots of empirical formula are needed
31	What is the law of conservation of mass?	30	When two substances of known mass are reacted together, the mass of the products will be the same as the reactants
32	How do you calculate the concentration of a solution in g dm ⁻³ ?	31	1. Convert volume to dm ³ (÷1000 if cm ³) 2. Concentration = $\frac{\text{Mass (in g)}}{\text{Volume (in dm}^3\text{)}}$
33	What is one mole of a substance?	32	One mole of a substance contains the Avogadro constant (6.20 x 10²³) number of particles

34	How do you calculate the number of moles in a substance from its mass?	33	Number of moles = $\frac{\text{Mass}}{\text{Atomic or Formula mass}}$
35	How do you calculate the number of particles in a substance from its number of moles?	34	Number of particles = number of moles x Avogadro constant
36	What is the limiting reactant in an experiment?	35	The limiting reagent is the substance that determines the amount of product in a reaction. (The other reagent is in excess)

Topic 2 (can be tested on Paper 1) – States of matter and separating mixtures

Q	Topic 2 Questions	Q	Topic 2 Answers
1	How are the particles arranged in a solid?	1	In a regular pattern, all touching
2	How are the particles arranged in a liquid?	2	Random arrangement, some touching
3	How are the particles arranged in a gas?	3	Random arrangement, spread far apart
4	What is the name given to the state change from a solid to a liquid?	4	Melting
5	What is the name given to the state change from a liquid to a gas?	5	Evaporation
6	What is the name given to the state change from a gas to a liquid?	6	Condensation
7	What is the name given to the state change from a liquid to a solid?	7	Freezing
8	The changes of state are classed as...	8	Physical changes (not chemical changes)
9	How do the particles in a solid move?	9	Vibration about a fixed point
10	How do the particles in a liquid move?	10	They move past each other, allowing the liquid to flow
11	How do the particles in a gas move?	11	They move quickly past each other
12	What is the boiling point of a substance?	12	Temperature at which a liquid turns to a gas
13	What is a pure substance?	13	A substance that contains only one type of compound/molecule/particle
14	Pure substances have a _____ melting point	14	specific
15	Impure substances melt over a _____ of temperatures	15	range
16	In filtration, what is the residue?	16	The insoluble solid left in the filter paper
17	In filtration, what is the filtrate?	17	The liquid/solution that has passed through the filter paper
18	Simple distillation separates substances bas on their what?	18	Boiling point
19	In distillation, what is the distillate?	19	The liquid that has condensed and been collected in the beaker
20	What two state changes are involved in distillation?	20	Evaporation and condensation
21	Where does the cold running water enter the Liebig Condenser?	21	At the bottom
22	Which core practical involves crystallisation?	22	Preparing crystals of copper sulphate

23	In paper chromatography, why is the start line drawn in pencil?	23	Pencils is insoluble so won't interfere with results
24	Substances are separated based on what in paper chromatography?	24	Their relative solubilities
25	In chromatography, what is the stationary phase?	25	The chromatography paper
26	In chromatography, what is the mobile phase?	26	The solvent
27	In chromatography, what is the solvent front?	27	The distance that the solvent has travelled
28	How do you calculate an Rf value?	28	Distance travelled by the component / distance travelled by the solvent
29	If there is a dot left on the line after paper chromatography, what does this mean?	29	It is an insoluble component (in the current solvent)
30	What does potable mean?	30	Safe to drink
31	What are the three processes involved in making waste and ground water potable?	31	Sedimentation, filtration, chlorination
32	<p>What is happening at each point of the heating curve?</p>		<p>A – substance is a solid, heating up B – Melting point - the attractive forces are being broken C – Substance is a liquid, heating up D – Boiling point – the attractive forces are being broken E – Substance is a gas, heating up</p>

Topic 3 (can be tested on Paper 1) – Chemical Change

Q	Topic 3 Questions	Q	Topic 3 Answers
1	What ions do acids release in solution?	1	H ⁺ (protons!)
2	What ions do alkalis release in solution?	2	OH ⁻
3	Acids are proton _____	3	Donors
4	Alkalis are proton _____	4	Acceptors
5	What is the pH of a neutral substance?	5	7
6	What is the pH of an acidic solution	6	Lower than 7
7	What is the pH of an alkaline solution?	7	8-14
8	In Universal indicator, what colour does an acidic solution turn?	8	Red/yellow/orange

9	In Universal indicator, what colour does a neutral solution turn?	9	Green
10	In Universal indicator, what colour does an alkaline solution turn?	10	Blue/purple
11	In phenolphthalein, what colour does an acidic solution turn?	11	Colourless
12	In phenolphthalein, what colour does an alkaline solution turn?	12	Pink
13	In litmus, what colour does an acidic solution turn?	13	Red
14	In litmus, what colour does an alkaline solution turn?	14	Blue
15	In methyl orange, what colour does an acidic solution turn?	15	Red
16	In methyl orange, what colour does an alkaline solution turn?	16	Yellow
17	If you increase the concentration of hydrogen ions in a solution, what happens to the pH?	17	It decreases
18	If you increase the concentration of hydrogen ions by a factor of 10, what happens to the pH?	18	It decreases by 1
19	Core practical – investigating the change in pH when adding calcium hydroxide to hydrochloric acid – what are the issues with using universal indicator to measure pH?	19	There is often discrepancy between judgements, it is subjective.
20	What is a more accurate method of measuring pH?	20	pH probe
21	What is the difference between concentrated and dilute solutions?	21	Concentrated solutions have more of the solute/more particles in the same volume
22	Define strong acid	22	An acid that fully dissociates in to its ions in solution
23	Define weak acid	23	An acid that partially dissociates into its ions in solution
24	When an acid reacts with a base, what is formed?	24	Salt and water
25	What is an alkali?	25	A soluble base
26	Metal + acid →	26	Salt + hydrogen
27	Metal oxide + acid →	27	Salt + water
28	Metal hydroxide + acid →	28	Salt + water
29	Metal carbonate + acid →	29	Salt + water + carbon dioxide
30	Describe the gas test for hydrogen	30	Place a lighted splint in a test tube containing the collected gas, if hydrogen is present you will hear a squeaky pop
31	Describe the gas test for carbon dioxide	31	Bubble the gas evolved from the reaction through lime water (via a delivery tube). If carbon dioxide is present, the lime water will turn cloudy/milky.
32	What type of reaction occurs between an acid and a base?	32	Neutralisation
33	Describe how an acid and an alkali neutralise each other	33	The H ⁺ ions from the acid react with the OH ⁻ ions from the alkali to form water

34	When preparing soluble salts from acids, why do we use excess of the second reactant?	34	To ensure that all of the acid has reacted
35	How do we remove the excess reactant?	35	Filtration
36	After filtration, when reacting excess metal oxide and acid, what remains in the reaction mixture?	36	Salt and water only
37	If we are preparing a soluble salt using an acid and a soluble reactant, what method must be used?	37	Titration
38	During a titration, what is the name of the piece of apparatus that is used to measure 25cm ³ of solution for the conical flask?	38	Pipette
39	During a titration, what is the name of the piece of apparatus that stores 50cm ³ of solution and is used to slowly release a solution?	39	Burette
40	What is the purpose of carrying out a titration?	40	To produce salt and water only
41	What is the name of the point in which neutralisation is achieved during a titration?	41	End point
42	All common sodium, potassium and ammonium salts are...	42	Soluble
43	All nitrates are...	43	Soluble
44	Common chlorides are soluble except those of...	44	Silver and lead
45	Common sulphates are soluble except those of...	45	Lead, barium and calcium
46	Common carbonate and hydroxides are insoluble except those of...	46	Sodium, potassium, ammonium
47	If you mix two reactants together and an insoluble salt is formed, what type of reaction is this?	47	A precipitation reaction
48	How do you prepare a sample of a pure, dry, insoluble salt?	48	Mix reactants together and filter – this way you can collect the precipitate. Once you have collected the precipitate, leave to dry in a warm place, or dry gently in an oven, or dry with filter paper.
49	What is an electrolyte?	49	An ionic compound which is either molten (liquid) or dissolved in water
50	What happens in electrolysis?	50	Electrical energy (direct current) is used to decompose (break down) an electrolyte
51	Positive ions are called?	51	Cations
52	Negative ions are called?	52	Anions
53	Positive ions are attracted to which electrode?	53	Negative (Cathode)
54	Negative ions are attracted to which electrode?	54	Positive (Anode)
55	Why are carbon electrodes used for electrolysis?	55	They are unreactive (inert)

56	What happens to positive ions in electrolysis?	56	Positive ions are attracted to the negative electrode where they gain electrons. They are REDUCED
57	What happens to negative ions in electrolysis?	57	Negative ions are attracted to the positive electrode where they lose electrons. They are OXIDISED
58	What are the products if copper chloride is electrolysed?	58	Copper (Negative electrode) and Chlorine (Positive electrode)
59	Write a half equation to show how copper atoms are formed at the cathode	59	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
60	Write a half equation to show how chlorine gas is formed at the cathode	60	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
61	What is oxidation?	61	Loss of electrons
62	What is reduction?	62	Gain of electrons
63	What is a redox reaction?	63	A reaction where both reduction and oxidation take place
64	What reaction happens at the anode?	64	Oxidation (negative ions lose electrons)
65	What reaction happens at the cathode?	65	Reduction (positive ions gain electrons)
66	What ions are present in NaCl solution?	66	Na^+ , Cl^- , H^+ and OH^-
67	What are the products when NaCl solution is electrolysed?	67	Hydrogen (cathode), Chlorine (anode) and Sodium hydroxide (in solution)
68	How do you test for Cl_2 gas?	68	Damp blue litmus paper which turns red then white
69	What ions are present in copper sulphate solution?	69	Cu^{2+} , SO_4^{2-} , H^+ and OH^-
70	What are the products when copper sulphate solution is electrolysed with carbon electrodes?	70	Copper (cathode) and Oxygen (anode)
71	Which product is made in the electrolysis of solutions – H_2 or metal?	71	H_2 if the metal is more reactive than hydrogen, metal if hydrogen is more reactive than the metal
72	Which product is made in the electrolysis of solutions if OH^- or halide (Cl^- , Br^- or I^-) is present?	72	Halogen made if halide ion present, oxygen and water if no halide ion present
73	Write a half-equation to show the reaction at the anode for CuSO_4 solution electrolysis with carbon electrodes	73	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$
74	Write a half-equation to show the reaction at the cathode for CuSO_4 solution electrolysis with carbon electrodes	74	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
75	What happens at the anode if copper electrodes are used in the electrolysis of CuSO_4 solution	75	The electrode gets smaller as Cu atoms are changed into Cu^{2+} ions: $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
76	What happens at the cathode if copper electrodes are used in the electrolysis of CuSO_4 solution	76	The electrode gets bigger as Cu^{2+} ions are changed into Cu atoms: $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
77	Why is propanone used to rinse electrodes?	77	It evaporates quickly and helps to dry the electrode properly

78	Describe how copper can be purified using the electrolysis of CuSO_4	78	Impure copper is the anode, the copper atoms turn into copper ions by losing electrons Copper ions in electrolyte attracted to pure copper cathode Copper ions gain electrons and turn into copper atoms. Impurities collect as sludge at the bottom of the tank
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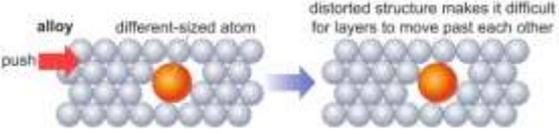
Topic 4 (will be tested on Paper 1)

Q	Topic 4 Questions	Q	Topic 4 answers
17	What is the reactivity series?	17	A list of metals in order of their reactivity, potassium is at the top and gold at the bottom
18	What is the equation for a metal reacting with water?	18	metal + water \rightarrow metal + hydrogen hydroxide
19	What is the equation for a metal reacting with steam?	19	metal + water \rightarrow metal + hydrogen oxide
20	What is the equation for a metal reacting with an acid?	20	metal + acid \rightarrow metal + hydrogen salt
21	Put these metals in order of reactivity: iron, zinc, gold, magnesium, potassium	21	Potassium, magnesium, zinc, iron, gold
22	Which metals form cations more easily – reactive or unreactive?	22	More reactive lose their electrons to form cations more easily
23	What is a displacement reaction?	23	A reaction where a more reactive metal replaces a less reactive one in a compound
24	Why is a displacement reaction a redox reaction?	24	The more reactive metal loses electrons to form a cation (oxidation), the less reactive metal cation gains electrons to form an atom (reduction)
25	Write the reaction of magnesium with iron sulphate as an ionic equation, label the equations as oxidation and reduction	25	$\text{Mg} + \text{Fe}^{2+} \rightarrow \text{Mg}^{2+} + \text{Fe}$
26	What is an ore?	26	A rock that contains enough metal to make it worth extracting economically
27	What are native metals?	27	Very unreactive metals like gold and platinum which are found uncombined in the ground
28	How can zinc, iron and copper be extracted using carbon?	28	The metal oxide is heated with carbon, the carbon displaces the metal from its oxide as it is more reactive
29	What happens to metal ores when they are heated with carbon?	29	The metal ores lose oxygen so they are reduced
30	What is the word equation for the extraction of iron from iron oxide using carbon?	30	Iron oxide + carbon \rightarrow iron + carbon dioxide
31	How are metals more reactive than carbon extracted?	31	Electrolysis of the molten metal oxide is needed, which requires lots of heat energy (to melt the oxide) and electrical energy (to do the electrolysis)

32	Describe the process of phytomining	32	Plants are grown in soil containing metal compound. They absorb the metal compounds and are burnt to form ash from which the metal is extracted
33	Describe the process of bioleaching	33	Bacteria are grown on a low grade ore. They produce a solution called a leachate which contains the metal. This can be extracted and then purified using electrolysis
34	Describe how aluminium is extracted	34	Aluminium ore (bauxite) is melted at a temperature of 1000 °C with cryolite. Al ³⁺ ions are reduced to Al at the cathode, O ²⁻ ions are oxidised to O ₂ at the anode. The graphite electrodes react with the O ₂ and wear away as CO ₂ is made
35	What is corrosion?	35	Weakening of metal due to its reaction with oxygen over time
36	What is rusting?	36	The reaction of oxygen and water with iron
37	Which metals corrode most easily?	37	More reactive metals corrode most easily
38	What is tarnish?	38	A protective layer of metal oxide which prevents further corrosion (in aluminium)
39	What are the advantages of recycling metals?	39	Conserves metal reserves, mining is reduced (damages landscape and habitats), less pollution is produced (e.g. CO ₂ and SO ₂), less waste goes to landfill
40	What are the stages of a life-cycle assessment?	40	The effect on the environment of extracting the raw materials, manufacturing and distributing the product, using the product and disposing of the product when it is no longer useful
41	What is a reversible reaction and how do we show a reaction is reversible?	41	A reaction that can go forwards and backwards. It has the symbol ⇌
42	What is a dynamic equilibrium?	42	A reversible reaction where the rate of the forward reaction is equal to the rate of the reverse reaction
43	What is the equation and the conditions used in the Haber Process?	43	$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
44	Where do the nitrogen and hydrogen used in the Haber Process come from?	44	Nitrogen comes from the air Hydrogen comes from natural gas
45	What is the effect of temperature on a dynamic equilibrium?	45	Increasing the temperature shifts the reaction in the endothermic direction to cool it down. Decreasing the temperature shifts the reaction in the exothermic direction to heat it up
46	What is the effect of concentration on a dynamic equilibrium?	46	Increasing the concentration will cause equilibrium to shift in the direction that uses up the added substance to reduce it. Decreasing the concentration will cause equilibrium to shift in the direction that makes more of the added substance to replace it
47	What is the effect of pressure on a dynamic equilibrium?	47	Increasing the pressure shifts the reaction in the direction that forms fewer molecules to reduce the pressure.

Decreasing the pressure shifts the reaction in the direction that forms more molecules to increase the pressure

Topic 5 (will be tested on Paper 1)

Q	Topic 5 Questions	Q	Topic 5 answers
1	What are the physical properties of transition metals?	1	High melting points, high density, good conductors, malleable, ductile
2	What are the chemical properties of transition metals?	2	Form coloured compounds, act as catalysts, variable oxidation states
3	What happens in corrosion? (Also topic 4)	3	Weakening of metal due to its reaction with oxygen over time
4	Give 4 methods of preventing rusting of iron?	4	Painting, oiling, sacrificial protection, galvanising or tinning
5	How can electroplating be used?	5	A thin layer of metal is used to coat another metal object. This can improve the appearance of some metals and a metal's resistance to corrosion
6	What is sacrificial protection?	6	A more reactive metal such as magnesium is bolted onto the iron object. This will preferentially react with the oxygen and water and the sacrificial metal can be replaced
7	Describe what happens in electroplating	7	The <u>anode</u> (plating metal) - atoms are oxidised to ions which go into solution, the electrolyte (solution of plating metal ions) and the cathode (object to be plated) - ions are reduced to solid metal atoms which coat the object in the metal
8	What is galvanising?	8	Iron and steels are coated with a thin layer of zinc which excludes water and oxygen and will also corrode sacrificially
9	What is tinning?	9	Iron and steels are coated with a thin layer of tin which excludes water and oxygen. If the tin is scratched, then the iron will rust more quickly
10	Why are pure metals soft? Draw a diagram to show why	10	The atoms are all the same size and the layers can easily slide over each other 
11	How can alloys increase the strength of metals? Use a diagram to explain	11	Different sized atoms disrupt the layers so they can no longer slide over each other 
12	What is the difference between tarnishing and corrosion?	12	Corrosion is the weakening of metal due to its reaction with oxygen over time. Tarnish is a protective coating of oxide which prevents further corrosion
13	What are alloy steels?	13	Alloys of iron which can have their properties changed by altering their composition

14	What are stainless steels?	14	Alloys of iron which resist corrosion, contain chromium which forms a tarnish and prevents corrosion
15	What are uses for aluminium, gold and copper?	15	Aluminium is used for overhead electrical cables, copper for electrical wiring and gold for jewellery and high grade electrical components
16	What are uses for magnalium and brass?	16	Magnalium is an alloy of Mg and Al, used in aircraft parts, and scientific instruments. Brass is an alloy of Cu and Zn and is used for electrical plug pins
17	How is the concentration of a solution in mol dm⁻³ calculated?	17	Concentration = $\frac{\text{moles}}{\text{volume in dm}^3}$
18	How is the concentration converted from g dm⁻³ to mol dm⁻³?	18	Convert the mass to moles by using: $\text{mass} \div \text{relative formula mass}$
19	How is the concentration converted from mol dm⁻³ to g dm⁻³?	19	Convert the moles to mass by using: $\text{moles} \times \text{relative formula mass}$
20	What are the steps in a titration?	20	Rinse burette and pipette with solutions; clear air bubbles in burette; record volumes from bottom of the meniscus; add indicator; swirl to mix solutions; add drop by drop to reach end-point; aim for concordant results
21	How can an unknown concentration be worked out in a titration?	21	1. Work out moles of known substance by using: $\text{volume (in dm}^3) \times \text{concentration}$; 2. Use equation to determine mole ratio; 3. Work out unknown concentration by using: $\text{moles} \div \text{volume (in dm}^3)$
22	How can an unknown volume be worked out in a titration?	22	1. Work out moles of known substance by using: $\text{volume (in dm}^3) \times \text{concentration}$; 2. Use equation to determine mole ratio; 3. Work out unknown volume (in dm³) by using: $\text{moles} \div \text{concentration}$
23	How is the percentage yield calculated?	23	Percentage yield = $\frac{\text{actual yield}}{\text{theoretical yield}}$
24	State 3 reasons why the yield may not be 100% in a reaction	24	Incomplete reaction, unwanted side reactions and loss of product when transferring between equipment
25	What are the advantages of a high percentage yield?	25	Less waste and more profit, better use of raw materials
26	What is the atom economy?	26	The percentage of reactants which end up as useful products in a reaction
27	How is the atom economy calculated?	27	Atom economy = $\frac{\text{molar masses of useful product}}{\text{molar masses of all reactants}} \times 100$
28	How can atom economy be improved?	28	Finding uses for the by-products will improve the atom economy as there is less waste
29	State Avogadro's Law	29	If the temperature and pressure are the same, equal volumes of different gases contain the same number of moles
30	What is the molar gas volume?	30	The volume occupied by one mole of molecules of any gas. It is 24 dm³ or 24000 cm³
31	State the equation for the Haber Process (also topic 4)	31	$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
32	What is the effect of temperature on the rate of attainment of equilibrium?	32	Increasing the temperature decreases the time taken to achieve equilibrium

33	What is the effect of concentration on the rate of attainment of equilibrium?	33	Increasing the concentration decreases the time taken to achieve equilibrium
34	What is the effect of pressure on the rate of attainment of equilibrium?	34	Increasing the pressure decreases the time taken to achieve equilibrium
35	What is the effect of a catalyst on the rate of attainment of equilibrium?	35	Adding a catalyst decreases the time taken to achieve equilibrium
36	What are the optimum conditions for the Haber Process?	36	A low temperature (the forward reaction is exothermic) and a high pressure (the forward reaction produces fewer moles of gas)
37	What are the conditions used in the Haber Process (also topic 4)	37	450 °C temperature 200 Atm pressure Iron catalyst
38	Why are compromise conditions used in the Haber Process?	38	Low temperatures are too slow, high pressures are expensive and dangerous to maintain. A catalyst is also added to speed up the reaction at a lower temperature
39	State the common compounds found in fertilisers	39	N, P and K - Nitrogen, Phosphorus and Potassium
40	How are nitrogenous fertilisers made from ammonia?	40	$2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ $\text{NH}_3 + \text{HNO}_3 \rightarrow \text{NH}_4\text{NO}_3$
41	How is ammonium sulphate made in the laboratory on a small scale?	41	Reaction of ammonia with sulphuric acid in a titration, then crystallisation to form the solid salt in a batch process
42	How is industrial scale ammonium sulphate production different to small scale production?	42	Several stages involving raw materials to make NH_3 and H_2SO_4 in a continuous process
43	What is a chemical cell?	43	Stored chemicals which produces a voltage until one of the reactants is used up. Can be single use or rechargeable
44	What is a fuel cell?	44	Fuel and oxygen are supplied from outside of the cell
45	What happens in the hydrogen-oxygen fuel cell?	45	At the Pt anode, H atoms lose electrons forming H^+ ions; e^- travel around the outside of the circuit, H^+ travel through the membrane to the Pt cathode where they react with oxygen and gain electrons to form water
46	What is the half equation for the reaction happening at the anode in a fuel cell?	46	$2\text{H}_2 \rightarrow 4\text{H}^+ + 4\text{e}^-$
47	What is the half equation for the reaction happening at the cathode in a fuel cell?	47	$4\text{H}^+ + 4\text{e}^- + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
48	What is the overall equation for the reaction happening in a fuel cell?	48	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
49	What are the advantages of a fuel cell?	49	Operates continuously as long as a fuel and oxygen are supplied; hydrogen fuel cells only produce water as a waste product (no greenhouse gases); often quieter as no motor and require less maintenance

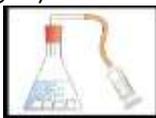
Topic 6 (tested on Paper 2)

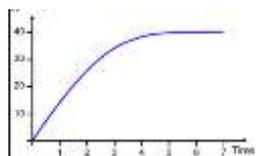
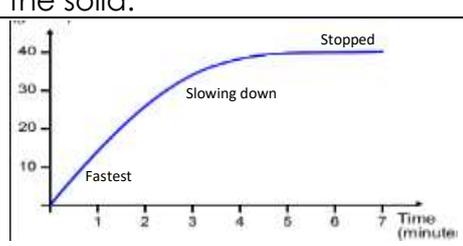
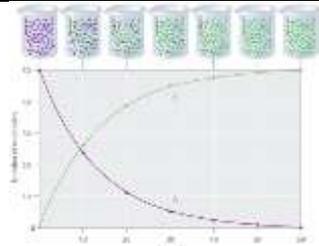
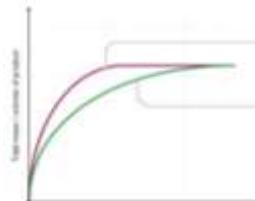
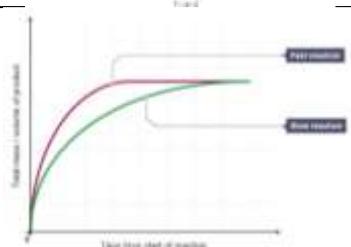
Q	Topic 6 Questions	Q	Topic 6 answers
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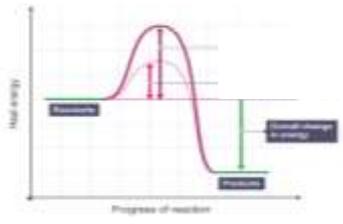
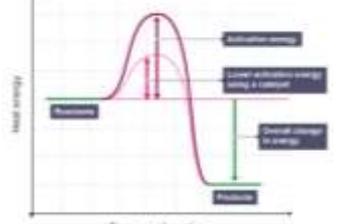
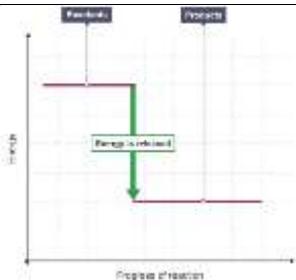
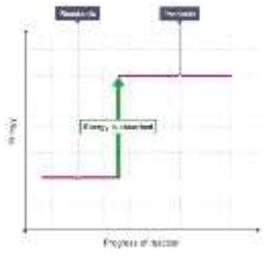
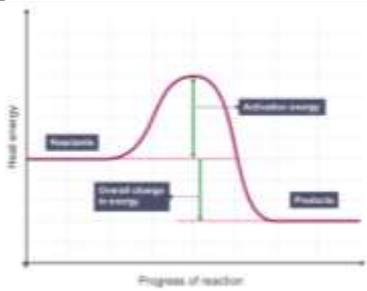
Group 1			
1	What is the name of the group 1 elements?	1	Alkali metals
2	What is the name of the group 7 elements?	2	halogens
3	Give 2 physical properties of group 1 elements	3	They are soft They have low melting and boiling points
4	What is the pattern of reactivity in group 1?	4	As you go down the group, the elements become more reactive
5	What happens to group 1 elements as they react?	5	They lose an electron
6	Why do group 1 elements get more reactive down the group? (3 points)	6	<ul style="list-style-type: none"> • Increased distance of outer shells from nucleus • More shells so more shielding from the nucleus (repulsion from inner shells) • Outer electron feels less attraction to nucleus • Takes less energy to remove the outer electron
7	describe what you would see when group 1 metals react with water	7	<ul style="list-style-type: none"> • Fizzing, metal dissolves (for all 3) • Reactions get more vigorous as you go down the group • Potassium – lilac flame
8	Give a word and symbol equation for the reaction of lithium with water	8	Lithium + water → lithium hydroxide + hydrogen $2\text{Li} + 2\text{H}_2\text{O} \rightarrow 2\text{LiOH} + \text{H}_2$
9	Give a word and symbol equation for the reaction of sodium with water	9	sodium + water → sodium hydroxide + hydrogen $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$
10	Give a word and symbol equation for the reaction of potassium with water	10	potassium + water → potassium hydroxide + hydrogen $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + 2\text{H}_2$
Group 7			
11	What is the name of the group 7 elements?	11	halogens
12	Describe the physical appearance of Cl ₂ Br ₂ and I ₂ and their state at RTP	12	Cl ₂ – green/yellow gas Br ₂ – Brown/red liquid I ₂ - dark grey solid
13	What is the pattern of boiling points for halogens?	13	Their boiling points increase as you go down the group
14	What is the chemical test for chlorine?	14	It turns damp blue litmus paper turn RED first, then BLEACHES IT WHITE
15	What happens when halogens react with metals?	15	They react to form metal halide salts Sodium + chlorine → sodium chloride $2\text{Na(s)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{NaCl(s)}$
16	What do hydrogen halides form when dissolved in water?	16	Acids eg. HCl (aq) is hydrochloric acid.
17	What is the pattern of reactivity with group 7 elements?	17	As you go down the group the elements get less reactive
18	Explain the reactivity of group 7 elements	18	Further down the group: <ul style="list-style-type: none"> • incoming electron is further from nucleus • increased shielding from nucleus • harder to attract an electron

19	What is a displacement reaction?	19	Where a more reactive element takes the place of a less reactive element
20	Describe the displacement reactions of the halogens	20	Chlorine is able to displace bromine and iodine Bromine can displace iodine but NOT chlorine Iodine cannot displace either chlorine or bromine
21	Describe how the displacement reactions of halogens are redox reactions	21	The more reactive element is reduced as it gains electrons The less reactive element is oxidised as it loses electrons
22	Give an example of an ionic equation for a displacement reaction of a halogen (include half equations)	22	Full ionic equation: $\text{Cl}_2(\text{aq}) + 2\text{Br}^-(\text{aq}) \rightarrow 2\text{Cl}^-(\text{aq}) + \text{Br}_2(\text{aq})$ Half equations: $\text{Cl}_2(\text{aq}) + 2\text{e}^- \rightarrow 2\text{Cl}^-(\text{aq})$, (reduction) $2\text{Br}^-(\text{aq}) \rightarrow \text{Br}_2(\text{aq}) + 2\text{e}^-$, (oxidation)
Group 0			
23	What is the name of the group 0 elements?	23	Noble gases
24	Describe the reactivity of the group 0 elements	24	They are unreactive
25	What happens to the melting and boiling points of the group 0 elements as you go down the group?	25	They increase
26	What are the three main physical properties of group 0 elements?	26	They are inert (unreactive) They are non-flammable They have a low density
27	What happens to the density of group 0 elements as you descend the group?	27	The density increases

Topic 7 (tested on Paper 2)

Q	Topic 7 Questions	Q	Topic 7 answers
1	What observations could you make to determine if a chemical reaction is taking place?	1	Colour change, change in mass, effervescence (bubbles), and energy change (hot/cold).
2	What two methods could you measure the production of a gas?	2	1. Collect the gas in an upside down measuring cylinder full of water, or gas syringe  2. Measure the change in mass at the start and end of a reaction. 

3	If a colour change occurs, what method could you use to measure how quickly it formed?	3	Time how long it takes for a cross to disappear under the reaction.
4	What must particles do in order to react?	4	Collide.
5	What would need to happen to the number of collisions if you wanted the reaction to slow down?	5	You would need fewer collisions.
6	How would the energy of the particles need to change if you wanted the reaction to go faster?	6	The particles would need more energy.
7	Sometimes particles don't react even if they collide; explain why?	7	Particles need to collide with sufficient energy, so collisions need to be successful.
8	What are the four factors that can influence the rate of a reaction?	8	Temperature, surface area, concentration (pressure of a gas) and catalysts.
9	Why does a higher temperature make reactions faster?	9	The particles have more energy so collide more often with enough energy.
10	Why does a higher concentration make reactions faster?	10	There are more particles in the same volume of liquid, so there are more collisions.
11	Why does a higher pressure make reactions faster?	11	There are more particles in the same volume of gas, so there are more collisions
12	Why does a larger surface area make reactions faster?	12	There is more area for the particles to collide with the solid.
13	On the graph, where is the reaction a) Slowing down? b) Fastest? c) Stopped? 	13	
14	In graph form, how would you show the change in number of reactant and product particles?	14	
15	Which line on this graph represents a faster reaction? 	15	
16	What is a catalyst	16	A substance that speeds up the rate of a reaction without altering the products of the reaction, being itself unchanged chemically and in mass at the end of the reaction.
17	What is activation energy?	17	The activation energy is the minimum amount of energy needed for a collision to be successful.
18	How does a catalyst increase the rate of a reaction?	18	A catalyst provides an alternative reaction pathway that has a lower activation energy than the uncatalysed reaction.

19	What happens to the collisions when a catalyst is used?	19	This does not change the frequency of collisions, but increase the frequency of successful collisions because a greater proportion of collisions now exceeds the activation energy.
20	Which line represents a reaction with a catalyst? 	20	
21	What is a biological catalyst?	21	An enzyme
22	What can biological catalyst be used for?	22	Making alcoholic drinks (Yeast)
23	What type of reactions can result in a change in temperature?	23	<ul style="list-style-type: none"> • Dissolving salts. • Neutralisation. • Displacement. • Precipitation.
24	What is an exothermic reaction?	24	A reaction in which heat energy is given out.
25	What is an endothermic reaction?	25	A reaction in which heat energy is taken in.
26	When bonds are broken, the process is endothermic, true or false.	26	True
27	If more heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants what type of reaction is it?	27	Exothermic
28	What type of reaction does this energy diagram represent? 	28	Exothermic
29	What type of reaction does this energy diagram represent? 	29	Endothermic
30	Label the activation energy of the energy diagram.	30	

Topic 8 (tested on Paper 2)

Q	Topic 8 Questions	Q	Topic 8 answers
Topic 8a – crude oil			
1	What is a hydrocarbon?	1	A molecule made up of hydrogen and carbon ONLY
2	What is crude oil? GIVE 3 SPECIFIC ANSWERS	2	a complex mixture of hydrocarbons in chains or rings important source of fuels a finite resource
3	What is the process by which crude oil is separated into simpler, more useful mixtures?	3	fractional distillation – the oil is <u>heated</u> to vapourise it, the vapours enter the column and <u>condense</u> where it is cooler
4	What physical property does fractional distillation rely upon?	4	Different boiling points
5	Give some uses of the different fractions	5	a. gases, used in domestic heating and cooking b. petrol, used as fuel for cars c. kerosene, used as fuel for aircraft d. diesel oil, used as fuel for some cars and trains e. fuel oil, used as fuel for large ships and in some power stations f. bitumen, used to surface roads and roofs
6	How do different fractions differ in terms of their physical properties?	6	As chain length increases: viscosity increases volatility and flammability decrease
7	Define homologous series	7	a. have the same general formula, b. differ by CH ₂ in molecular formulae from neighbouring compounds, c. have similar chemical properties
8	What are the products of complete combustion of hydrocarbons?	8	carbon dioxide and water are produced energy is given out.
9	When does incomplete combustion take place?	9	Where there is a lack of oxygen
10	What are the products of incomplete combustion?	10	carbon (soot) and carbon monoxide and water
11	How does carbon monoxide behave as a toxic gas?	11	Binds to haemoglobin in the red blood cells, stops it carrying oxygen
12	How does burning fossil fuels form acid rain?	12	Sulphur impurities in the fuel react with oxygen to form SO ₂ which dissolves in rainwater to form acid rain
13	What environmental problem does sulphur dioxide call?	13	Acid rain
14	How does acid rain damage the environment?	14	Damages buildings (especially limestone) Acidifies lakes and streams – kills aquatic life Acidifies soil – harmful to plants
15	How are oxides of nitrogen formed in vehicles?	15	High temperatures in engines cause oxygen and nitrogen from the air to react together and produce oxides of nitrogen
16	Define cracking	16	The breaking down of larger, saturated hydrocarbon molecules (alkanes) into

			smaller, more useful ones, some of which are unsaturated (alkenes). This is a thermal decomposition reaction
17	Why is cracking necessary?	17	There is a high demand for short chain hydrocarbons, but a low supply. However, there is a low demand for long chain hydrocarbons, but a large supply. Cracking helps meet the demand for short chain hydrocarbons
18	What are advantages of fossil fuels?	18	They produce energy They are readily available Our infrastructure is built to use them
19	What are disadvantages of fossil fuels?	19	They produce carbon dioxide – contributes to global warming They produce soot – contributes to global dimming and causes breathing problems, coats vehicles They produce sulphur dioxide – acid rain They are non-renewable and running out Their extraction can cause environmental disasters
20	What are the advantages of using hydrogen as a fuel?	20	Only produces water when burned Is very energy efficient Can be made from renewable resources
21	What are the disadvantages of using hydrogen as a fuel?	21	most hydrogen comes from crude oil which is non renewable; H ₂ is a gas – hard to store/transport; H ₂ is flammable – could explode if car crashes; Our infrastructure not set up to use hydrogen
22	Define saturated hydrocarbon	22	a hydrocarbon which contains single bonds between hydrogen and carbon only
23	Define unsaturated hydrocarbon	23	a hydrocarbon which contains at least 1 C=C double bond
Topic 8b – earth and atmospheric science			
24	What caused the earth's early atmosphere to form?	24	Volcanic Activity
25	What was the earth's early atmosphere composed of?	25	a little or no oxygen b a large amount of carbon dioxide c water vapour d small amounts of other gases
26	How did the oceans form?	26	Water vapour released by volcanoes (and possibly from comets) cooled, and condensed, fell as rain forming the oceans
27	Explain how the carbon dioxide levels decreased and the oxygen levels increased on earth	27	Primitive plants formed. They photosynthesised forming oxygen and removing carbon dioxide
28	What is the chemical test for oxygen?	28	Oxygen relights a glowing splint
29	What is the greenhouse effect?	29	The gradual warming of the earth by gases which absorb infra-red radiation and reflect it back to earth
30	Which gases are responsible for the greenhouse effect?	30	Carbon dioxide, methane, water vapour
31	What evidence exists for human activity causing climate change?	31	As our use of fossil fuels has increased, the level of carbon dioxide in the atmosphere

			has increased. There has been a corresponding increase in the earth's average surface temperature. However – it is hard to be entirely sure about this as historical methods of measuring carbon dioxide levels were flawed. We cannot be sure of the locations for all these measurements
32	What is the composition of the current atmosphere?	32	78% nitrogen 21% oxygen 0.04% carbon dioxide <1% argon and other gases
33	What are the potential risks associated with global warming?	33	Extreme weather patterns Melting ice caps Flooding low lying areas Leading to Loss of life
34	Where do the greenhouse gases come from?	34	Carbon dioxide – burning fossil fuels in engines and power stations Methane – livestock farming
35	Name three ways we could mitigate these effects	35	Carbon capture and storage (put it underground) Use alternative fuels Plant more trees

Topic 9 (tested on Paper 2)

Q	Topic 1 Questions	Q	Topic 1 answers
1	What colour flame does a lithium ion produce?	1	red
2	What colour flame does a sodium ion produce?	2	yellow
3	What colour ion does a potassium ion produce	3	lilac
4	What colour flame does a calcium ion produce?	4	Orange-red
5	What colour flame does a copper ion produce?	5	Blue-green
6	What do aluminium ions produce when tested with sodium hydroxide?	6	White precipitate
7	What do calcium ions produce when tested with sodium hydroxide?	7	White precipitate
8	What do copper ions produce when tested with sodium hydroxide?	8	Blue precipitate
9	What do iron (II) ions produce when tested with sodium hydroxide?	9	Green-grey precipitate
10	What do iron (III) ions produce when tested with sodium hydroxide?	10	Orange precipitate
11	What do ammonium ions produce when tested with sodium hydroxide?	11	A vapour that turns damp litmus paper blue
12	What is the test for a carbonate ion (CO_3^{2-})?	12	Add dilute acid, it will fizz, use limewater to ID the gas as carbon dioxide.

13	What is the test for a sulfate ion (SO_4^{2-})?	13	Add dilute hydrochloric acid and barium chloride solution, it will produce a white precipitate
14	What is the test for a chloride ion?	14	Add nitric acid and silver nitrate. It will produce a white precipitate
15	What is the test for a bromide ion?	15	Add nitric acid and silver nitrate. It will produce a cream precipitate.
16	What is the test for an iodide ion?	16	Add nitric acid and silver nitrate. It will produce a yellow precipitate.
17	Why are instrumental methods of analysis better?	17	They improve sensitivity, accuracy and speed of tests.
18	Why must the test for any ion be unique?	18	To prevent misidentification and false positives.
19	What happens in flame photometry?	19	Light intensity of flame tests measured and used with a calibration curve of known concentrations to determine the concentration of metal ions
20	What is the general formula of an alkane?	20	$\text{C}_n\text{H}_{2n+2}$
21	What is the formula of methane?	21	CH_4
22	What is the formula of ethane?	22	C_2H_6
23	What is the formula of propane?	23	C_3H_8
24	What is the formula of butane?	24	C_4H_{10}
25	What is the functional group in alkenes?	25	Carbon-carbon double bond
26	What is the general formula of an alkene?	26	C_nH_{2n}
27	Why are the alkanes describes as saturated?	27	They contain only single carbob-carbon bonds
28	Why are the alkenes described as unsaturated?	28	They contain a carbon-carbon double bond
29	What is the formula of ethene?	29	C_2H_4
30	What is the formula of propene?	30	C_3H_6
31	What is the formula of butene?	31	C_4H_8
32	What happens when bromine water is put in alkanes?	32	It remains orange
33	What happens when bromine water is put in alkenes?	33	It turns from orange to colourless.
34	What are the products of complete combustion of alkanes and alkenes?	34	Carbon dioxide and water.
35	What is the functional group in an alcohol?	35	-OH
36	What is the formula of ethanol?	36	$\text{C}_2\text{H}_5\text{OH}$
37	What is the functional group of a carboxylic acid?	37	-COOH
38	What is produced when ethanol is oxidised?	38	Ethanoic acid
39	What makes the alcohol in fermentation?	39	Enzymes in yeast
40	How can you concentrate alcohol produced by fermentation?	40	Fractional distillation
41	What is a monomer?	41	A small molecule found in a polymer

42	What is a polymer?	42	A large molecule, made up of small repeating units
43	What is the polymer formed from ethene called?	43	Poly(ethene)
44	How are condensation polymers formed?	44	The joining of monomer units with the elimination of a small molecule
45	How is polyester made?	45	Alcohol + Carboxylic Acid \longrightarrow Ester + Water
46	What is DNA?	46	A polymer made from nucleotides
47	What is starch?	47	A polymer made from sugars
48	What is protein?	48	A polymer made from amino acids
49	What are the disadvantages of waste polymers?	49	Non-biodegradable, produce toxic fumes when burned, persist in landfill
50	What are the problems of recycling polymers?	50	Need to be collected, sorted and cleaned
51	How are waste polymers processed?	51	Burned to generate energy, re-cracked to form new alkenes and short chain alkanes
52	How big are nanoparticles compared with atoms?	52	Bigger than atoms or molecules, about 100 atoms in size.
53	How many m is 1 nm?	53	1×10^{-9} m
54	What is a ceramic?	54	Chemically unreactive, hard, stiff but brittle, does not change when heated
55	Why is glass transparent?	55	Giant structure with an irregular arrangement, no crystals form
56	What is a composite?	56	A mixture of 2 or more materials with different properties, the materials are usually visible in the material
57	What are the <u>reinforcement</u> and <u>matrix</u> in a composite?	57	The reinforcement provides strength to the material, the matrix holds the reinforcement together and is more flexible