Revision Mock Chemistry Workbook

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| THIS BOOK CONTAINS A SIMILAR QUESTION TO EVERY QUESTION ON YOUR MOCK |

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Calculations.

Qr code

Description automatically generatedYou must answer each of these questions correctly before sitting your GCSE

**Calculate the relative atomic mass.** (HIGHER ONLY)

A sample of silicon contains

92.2% of silicon-28 atoms

4.7% of silicon-29 atoms

3.1% of silicon-30 atoms.

Use this information to calculate the relative atomic mass of this sample of silicon.

A sample of magnesium contains 95% sulfur – 32, 1%, sulfur -33 and 4% sulfur 34 atoms. Calculate the relative atomic mass of sulfur. (2)

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**Counting the number of atoms.**

Count the number of atoms in Aluminium nitrate Al(NO3)3.

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**Calculate relative formula mass.**

Calculate the relative formula mass of ammonium nitrate, NH4NO3.

(relative atomic masses: H = 1, N = 14, O = 16).

Calculate the relative formula mass of copper carbonate, CuCO3. (2)

Relative atomic masses: Cu = 63.5, C = 12, O = 16

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Calculate the relative formula mass of glucose, C6H12O6. (2)

Relative atomic masses: C = 12, O = 16, H = 1.

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**Calculating percentage**

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Description automatically generatedCalculate the percentage by mass of aluminium in aluminium oxide, Al2O3 Give your answer to 2 significant figures. (3)

(relative atomic masses: Al = 27, O = 16).

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Copper can be extracted using plants to concentrate copper ions found in soils. 1 tonne (1000 Kg) of plant material can be processed into 80 450 g of copper compounds. Calculate the percentage by mass of copper compounds in the original plant material. Give your answer to 2 decimal places. (3)

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A 22 carat gold necklace is 91.6% gold. The necklace has a mass of 14.26 g. Calculate the mass of gold in the necklace.

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What is the percentage by mass of copper in Cu2O. Give your answer to 3 significant figures. (2)

Relative atomic masses: Cu = 63.5, O = 16

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Calculate the percentage by mass of nitrogen in magnesium nitrate, Mg(NO3)2. (2)

Relative atomic masses: Mg = 24, O = 16, N = 14

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**Empirical Formulae**

A 46.4 g sample of iron oxide contains 33.6 g of iron. Calculate the empirical formulae of this oxide.

5.29 g of element X combines with 1.84 g of element Z. Calculate the empirical formula of this compound.

Relative atomic masses: X = 23, Z = 16

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6.93 g of Manganese combines with 2.688 g of oxygen to form an oxide of manganese. Calculate the empirical formula of this manganese oxide. (3)

Relative atomic masses: Mn = 55, O = 16.

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**Empirical formulae and relative formula mass**

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Description automatically generatedA hydrocarbon contains 3 g of carbon and 0.5 g of hydrogen. The relative formula mass of this molecule is 56. Calculate the molecular formula of this hydrocarbon.

(relative atomic masses: H = 1, C = 12).

A hydrocarbon has the empirical formula CH2, its relative formula mass is 154, what is its molecular formula?

Relative atomic masses: C = 12, H = 1.

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**Calculating Quantities**

The equation for the electrolysis of aluminium oxide is

2Al2O3 🡪 4Al + O2

Calculate the maximum mass of aluminium that can be obtained from 510 tonnes of aluminium oxide.(relative atomic masses: O = 16, Al = 27).

The formula of aluminium oxide is Al2O3. What is the maximum mass of aluminium that can be obtained from the electrolysis of 51 Kg of aluminium oxide? (relative atomic masses: Al = 27, O = 16) (3)

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Two different copper ores are: Cu2O and CuO. Copper can be produced by reducing the ores with excess carbon. The equations for the two reductions are below:

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| Reduction A | 2Cu2O + C 🡪 CO2 + 4Cu |
| Reduction B | 2CuO + C 🡪 CO2 + 2Cu |

429 Kg of one of these ores produces 381 Kg of copper.

Carry out a calculation to decide whether reduction **A**  or  **B** is taking place.

Relative atomic masses: Cu = 63.5, O = 16.

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What is the minimum mass of lithium needed to react with 0.23 moles of oxygen? (2)

4Li + O2 🡪 2Li2O

Relative atomic mass: Li = 7

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20 g of calcium reacts with half a mole of nitric acid. Which reagent is in excess? (2)

Ca + 2HNO3 🡪 Ca(NO3)2 + H2O

Relative atomic masses: Calcium = 40.

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Two reactions of copper with chlorine are:

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| A | Cu + Cl2 🡪 CuCl2 |
| B | 2Cu + Cl2 🡪 2CuCl |

In an experiment, 15g of chlorine reacts with copper to make 41.62 g copper chloride. Work out whether equation A or B is taking place. (3)

Relative atomic masses: Cu = 63.5, Cl = 35.5

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What mass of hydrogen is produced when 3.45 g of sodium is reacted with excess water?

2Na + 2H2O 🡪 2NaOH + H2

Relative atomic masses: Na = 23, H = 1

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In a reaction 0.48 g of magnesium produces 0.747 g of iron. Which equation represents the reaction taking place? (3)

Equation 1

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Description automatically generated3Mg + Fe2(SO4)3 🡪 3MgSO4 + 2Fe

Equation 2

Mg + FeSO4 🡪 MgSO4 + Fe

Relative atomic masses: Mg = 24, Fe = 56

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Description automatically generated**Concentration (g dm-3)**

Sodium chloride solution was prepared by dissolving 9.11 g of solid in water and making the volume up to 200 cm3.

Calculate the concentration of sodium chloride in g dm-3. Give your answer to 3 significant figures.



A copper sulfate solution is made by dissolving 20 g of copper sulfate to make 250 cm3 of solution, calculate the concentration in g dm-3 (2)

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A potassium hydroxide solution was made by dissolving 12.7 g of potassium hydroxide in water to make 750 cm3 of solution. Calculate the concentration of this solution in g dm-3 . Give your answer to 2 significant figures. (3)

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Description automatically generated**Using the Avogadro constant.**

Calculate the number of molecules in 5 moles of glucose, C6H12O6.

(Avogadro constant = 6.02 x 1023)

A beaker of water contains 4.214 x 1024 molecules. How many moles of water are present?

(Avogadro constant = 6.02 x 1023)

Calculate the number of atoms in 2 moles of carbon dioxide, CO2. (3)

Avogadro constant = 6.02 x 1023

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My wedding ring contains 6.23 g of platinum. Calculate the number of platinum atoms in the ring. Give your answer to 3 significant figures (3)

Relative atomic masses: Pt = 195. Avogadro constant = 6.02 x 1023

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Description automatically generated**Calculating Moles**

How many moles of ammonia, NH3 are present in a 51 g sample?

(relative atomic masses: H = 1, N = 14).

Calculate the number of moles in 258 grams iron chloride hexahydrate, FeCl3. 6H2O.

Relative atomic mass: Fe = 56, Cl = 35.5, H = 1, O = 16

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How many moles are there in 3.8 g hydrogen chloride, HCl? Give your answer to 3 significant figures. (2)

Relative atomic masses: hydrogen = 1, chlorine = 35.5

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Calculate the mass of iron in 220 g of iron oxide, Fe2O3. (2)

Relative atomic masses: Fe = 56, O = 16. Relative formula mass: Fe2O3 = 160.

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**Avogadro constant and moles**

How many molecules are present in a 23 g sample of ethanol, C2H5OH? (Avogadro constant = 6.02 x 1023)Ar C = 12, H = 1, O = 16

Qr code

Description automatically generatedThe formula of iron (III) sulfate is Fe2(SO4)3.

Calculate the total number of atoms present in 23.42g of iron (III) sulfate. (4)

Relative atomic masses: Fe = 56, S = 32, O = 16. Avogadro constant = 6.02 x 1023.

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Calculate the mass, in grams, of a sulfur dioxide (SO2) molecule.

Relative formula mass: SO2 = 64 Avogadro constant = 6.02 x 1023

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Calculate the total number of atoms in 25 g of ammonium sulfate, (NH4)2SO4. (3)

Relative atomic masses: N = 14, H = 1, S = 32, O = 16. Avogadro constant = 6.02 x 1023.

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**Calculating Rf**

In a chromatography experiment a coloured substance in a food dye moved 2.1 cm when the solvent front moved 2.6 cm.

Calculate the Rf value for this substance, giving your answer to 2 significant figures.

**Law of Conservation of Mass**

Copper oxide thermally decomposes on heating to form copper oxide and carbon dioxide.

CuCO3 (s) 🡪 CuO (s) + CO2 (g)

Qr code

Description automatically generated61.75 g of copper carbonate was heated. 39.75 g of solid remained, calculate the mass of carbon dioxide produced.

10 g of green copper carbonate, CuCO3, thermally decomposes on heating to form 6.437 g of black copper oxide. What mass of carbon dioxide is also produced? (1)

CuCO3 🡪 CuO + CO2

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Paper 1

**Topic 0 - Content and Checklist**

For each content point put a tick next to it firstly when you understand it and secondly when you have learnt it. If you don’t understand a content point you must ask your teacher.

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|  | Content | Understand it | Learnt it |
| 0.1 | Learn the formulae of simple elements, compounds and ions. |  |  |
| 0.2 | Write word equations for reactions. |  |  |
| 0.3 | Write balanced symbol equations for reactions including state symbols (s), (l), (g) and (aq). |  |  |
| 0.4 | **Write balanced ionic equations (higher only)** |  |  |
| 0.5 | Name the common hazard symbols, know why these substances are dangerous and know the precautions that need to be taken when working with them. |  |  |
| 0.6 | Be able to recognise the risks associated with an experiment and suggest suitable safety precautions. |  |  |

**Topic 1 - Content and Checklist**

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|  | Content | Understand it | Learnt it |
| 1.1 | Know the Dalton model of the atom and explain how the model today is similar, but different. |  |  |
| 1.2 | Be able to draw, label and explain what an atom looks like. That is, they are made from a nucleus containing protons and neutrons, surrounded by electrons in shells. |  |  |
| 1.3 | Learn the relative charges and masses of protons, neutrons and electrons. |  |  |
| 1.4 | Explain why the numbers of protons and electrons in atoms are equal. |  |  |
| 1.5 | Be able to picture the relative size of the nucleus compared with the rest of the atom. |  |  |
| 1.6 | Learn that most of the mass of the atom is found in the nucleus. |  |  |
| 1.7 | Learn the meaning of the term: mass number of an atom |  |  |
| 1.8 | Learn that atoms of the same element have the same number of protons in the nucleus and that this number is unique to that element. |  |  |
| 1.9 | Learn the definition of an isotope: atoms of the same element with the same number of protons but a different number of neutrons. |  |  |
| 1.10 | Be able to calculate the number of protons, neutrons and electrons present in an atom when given mass and atomic numbers. |  |  |
| 1.11 | Be able to explain why elements like chlorine have a relative atomic mass that is not a whole number. E.g. Chlorine has a relative atomic mass of 35.5. |  |  |
| **1.12** | **Be able to calculate the relative atomic mass of an element when given the mass number and relative abundance of each isotope.** |  |  |
| 1.13 | Know who Mendeleev is and learn how he arranged the elements in his periodic table by looking at the properties of the known elements and their compounds. |  |  |
| 1.14 | Be able to explain how Mendeleev used his table to predict the existence and properties of yet to be discovered elements. |  |  |
| 1.15 | Explain why Mendeleev had to alter the position of a small number of elements when he arranged his table in order of atomic mass. Your explanation needs to involve detail about the relative abundance of isotopes of these elements. |  |  |
| 1.16 | Learn the meaning of the term: atomic number |  |  |
| 1.17 | Learn that the elements in the periodic table are arranged in order of increasing atomic number. Also know that the horizontal rows of the periodic table are called periods and the vertical columns contain elements with similar chemical properties and are called groups. |  |  |
| 1.18 | Learn the position of metals and non-metals in the periodic table. |  |  |
| 1.19 | Be able to draw and write the electronic configuration of the first 20 elements in the periodic table. |  |  |
| 1.20 | Explain how the electronic configuration of an element is related to its position in the periodic table. |  |  |
| 1.21 | Be able to draw diagrams and explain how ionic bonds are formed. |  |  |
| 1.22 | Learn the meaning of the terms: ion, cation, and anion. |  |  |
| 1.23 | Calculate the numbers of protons, neutrons and electrons in simple ions when given atomic and mass numbers. |  |  |
| 1.24 | Explain how ions are formed and be able to predict the charges of ions from elements in group 1, 2, 6 and 7 of the periodic table. |  |  |
| 1.25 | Correctly use the endings –ide and –ate when naming compounds. |  |  |
| 1.26 | Work out the correct formulae of an ionic compound when given the constituent ions. |  |  |
| 1.27 | Be able to draw and describe the structure of an ionic compound. You must use the term: ionic lattice. You must learn that the ionic lattice is made from a regular arrangement of ions and they are held in place by strong electrostatic forces of attraction between oppositely charged ions. |  |  |
| 1.28 | Learn that a covalent bond is formed when a pair(s) of electrons is shared between 2 atoms. |  |  |
| 1.29 | Learn that covalent bonding results in the formation of molecules. |  |  |
| 1.31 | Be able to draw dot and cross diagrams and explain how the covalent bonds are formed in: hydrogen, hydrogen chloride, water, methane, oxygen and carbon dioxide. |  |  |
| 1.32 | Learn the difference between ionic structures, simple molecular structures, giant molecular structures and metallic structures. Also learn which structures are likely to have high or low melting and boiling points, which structures conduct electricity and which structures are likely to dissolve in water. |  |  |
| 1.33 | Learn and explain why ionic substances have high melting points and why they do not conduct electricity in the solid state but they will when molten or dissolved. |  |  |
| 1.34 | Learn and explain why simple molecular substances have low melting and boiling points and why they are poor conductors of electricity. |  |  |
| 1.35 | Learn that carbon diamond and carbon graphite are examples of giant covalent structures. |  |  |
| 1.36 | Be able to recognise and explain the structures of carbon diamond and carbon graphite. |  |  |
| 1.37 | Use the structure of carbon diamond to explain why it is used for cutting tools and the structure of carbon graphite to explain why it is used for electrodes and as a lubricant. |  |  |
| 1.38 | Learn the properties of fullerenes (including C60) and be able to use the structure to explain these properties. |  |  |
| 1.39 | Learn that polymers like polyethene are made from large molecules containing many carbon atoms. |  |  |
| 1.40 | Learn and use the metallic structure to explain why metals are malleable and able to conduct electricity. |  |  |
| 1.41 | Understand that diagrams showing bonding do not always give you an idea of what the bonding will actually look like. For this 3 D diagrams would be better but are very difficult to draw. |  |  |
| 1.42 | Learn that metals are shiny solids, have high melting points, high density and are good conductors of electricity. Whereas non-metals have low melting points and are poor conductors of electricity. |  |  |
| 1.43 | Use relative atomic masses to calculate the relative formula mass. |  |  |
| 1.44 | Learn how to calculate empirical formulae. |  |  |
| 1.45 | Work out: 1) the empirical formula of a compound from the formula of its molecule and: 2) the molecular formula of a compound from its empirical formula and its relative molecular mass. |  |  |
| 1.46 | Explain how you could carry out an experiment to work out the empirical formula of magnesium oxide. |  |  |
| 1.47 | Understand the law of conservation of mass. Be able to make predictions of the mass of a container in which: 1) all reactants and products are enclosed. 2) A container from which a gas is escaping. 3) A reaction that is reacting with a gas in the air to make a solid. |  |  |
| 1.48 | Use a reaction equation to be able to calculate the mass of a reactant or product using the mass of one other substance. |  |  |
| 1.52 | **Be able to explain why one reactant is often in excess.** |  |  |
| 1.53 | **Work out the stoichiometry of a reaction from the masses of the reactants and products.** |  |  |
| 1.49 | Work out the concentration of a solution in g dm-3 |  |  |
| 1.50 | **Learn that 1 mole of a substance is the Avogadro constant number of particles of that substance.** |  |  |
| 1.51 | **Be able to calculate: 1) the number of moles of a substance when given a mass. 2) The number of particles of a substance given the number of moles. 3 The number of particles of a substance given the mass.**  **For each of the above you need to be able to do the calculation the other way round as well.** |  |  |

**Topic 2, States of matter and mixtures – Checklist**

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|  | Content | Understand it | Learnt it |
| 2.1 | Be able to draw a diagram and describe the arrangement particles in a solid, liquid and gas. Know about the relative energy of particles in each |  |  |
| 2.2 | Know the names given to the changes of state and that these are physical changes. Be able to recognise a physical or chemical change. |  |  |
| 2.3 | Explain the changes in arrangement, movement and energy of particles during changes of state. |  |  |
| 2.4 | Use melting and boiling point data to predict whether a substance will be a solid, liquid or gas. |  |  |

**Topic 2,** **Methods of separating and purifying substances – Checklist**

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|  | Content | Understand it | Learnt it |
| 2.5 | Explain the difference between a pure substance and a mixture |  |  |
| 2.6 | Understand that mixtures melt over a range of temperatures whereas pure substances have very sharp melting points. You must be able to recognise this in data. |  |  |
| 2.7 | For each of the following separating techniques you must know: 1) what they are used for, 2) the apparatus used.   * Simple distillation * Fractional distillation * Filtration * Crystallisation * Paper chromatography. |  |  |
| 2.8 | Be able to identify the correct separating technique for the correct mixture. |  |  |
| 2.9 | Be able to explain that paper chromatography can separate a mixture of soluble substances by running a solvent (mobile phase) through the mixture on the filter paper (stationary phase), which causes the substances to move at different rates over the paper. |  |  |
| 2.10 | Look at the results of paper chromatography and:   1. Identify whether the substance was pure or a mixture. 2. Identify substances by comparison with other known substances. 3. Calculate and use Rf values to identify substances. |  |  |
| 2.12 | Describe how ground water found outside can be made safe to drink (potable) using: 1) sedimentation, 2) filtration, 3) chlorination.  Describe how sea water can be made potable by simple distillation.  Understand that water used in analysis must not contain any dissolved salts. |  |  |

**Topic 3, Chemical change: Acids - Checklist**

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|  | Content | Understand it | Learnt it |
| 3.1 | Learn that acids are sources of hydrogen ions and alkalis are sources of hydroxide ions. |  |  |
| 3.2 | Learn that pH solutions with a pH of 1-6 are acidic, 7 are neutral and 8-14 are alkali. |  |  |
| 3.3 | Learn the colour changes of the following indicators with acid and alkali:   1. Litmus 2. Methyl orange 3. Phenolphthalein |  |  |
| **3.4** | **Learn the link between hydrogen ion concentration and pH. The higher the concentration of hydrogen ions the lower the pH. Also know that the higher the concentration of hydroxide solutions the higher the pH.** |  |  |
| **3.5** | **Learn that, as the hydrogen ion concentration increases by a factor of 10, the pH of the solution decreases by 1.** |  |  |
| 3.6 | Know how the pH changes when powdered calcium hydroxide is added a bit at a time to hydrochloric acid. |  |  |
| **3.7** | **Know the meanings of the words: dilute, concentrated. Talk about the amount of particles in solution.** |  |  |
| **3.8** | **Know the meaning of the phrases: strong acid, weak acid. Be able to talk about the degree of dissociation into ions.** |  |  |
| 3.9 | Know what a base is and that it will react with an acid to make a salt and water. |  |  |
| 3.10 | Know that an alkali is a base that is soluble in water. |  |  |
| 3.11 | Write equations for acids with:   1. Metals 2. Metal oxides 3. Metal hydroxides 4. Metal carbonates   Know that in each case that these are neutralisation reactions and a salt is always produced. |  |  |
| 3.12 | Know the tests for:   1. Hydrogen 2. Carbon dioxide |  |  |
| 3.13 | Know what a neutralisation reaction is. |  |  |
| 3.14 | Know that in an acid alkali neutralisation reaction hydrogen (H+) ions from the acid react with hydroxide (OH-) ions from the alkali. |  |  |
| 3.15 | Know that when you prepare a soluble salt from an acid an insoluble reactant why:   1. Excess insoluble reactant is added. 2. The excess reactant is removed 3. The solution remaining is only salt and water |  |  |
| 3.16 | Know that when you prepare a soluble salt from an acid and a soluble reactant why:   1. Titration must be used 2. The acid and the soluble reactant are mixed in the correct proportions 3. The solution remaining at the end will only be salt and water. |  |  |
| 3.17 | Know exactly the apparatus and procedure used to prepare a pure dry sample of copper sulphate from acid and copper oxide. |  |  |
| 3.18 | Know exactly what apparatus and indicator to use to carry out an acid alkali titration to prepare pure crystals of sodium chloride. |  |  |
| 3.19 | Learn which salts are soluble:   1. All common sodium, potassium and ammonium salts are soluble. 2. All nitrates are soluble. 3. Common chlorides are soluble except those of silver and lead. 4. Common sulphates are soluble except those of lead, barium and calcium. 5. Common carbonates and hydroxides are insoluble except those of sodium, potassium and ammonium. |  |  |
| 3.20 | Use the solubility rules to predict whether a salt produced in a chemical reaction will be soluble. |  |  |
| 3.21 | Be able to write a method detailing how to prepare a pure, dry sample of an insoluble salt. |  |  |

**Topic 3, Chemical change: Electrolytic processes – Checklist**

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|  | Content | Understand it | Learnt it |
| 3.22 | Learn that for electrolysis to happen you must have an electrolyte. The electrolyte is a molten or dissolved ionic substance. |  |  |
| 3.23 | Learn that electrolysis is a chemical reaction that is occurring because electrical energy from direct current supply is being passed through an electrolyte. This causes the electrolyte to decompose. |  |  |
| 3.24 | Understand and explain that during electrolysis:   1. the positively charged ions (cations) move to the negatively charged electrode (cathode); 2. the negative charged ions (anions) move to the positively charged electrode (anode). |  |  |
| 3.25 | Learn the products of the following electrolysis reactions, using inert electrodes.   1. Molten lead bromide 2. Water (acidified with sulfuric acid). 3. Copper chloride solution 4. Sodium chloride solution 5. Sodium sulfate solution |  |  |
| 3.26 | Learn the rules for products likely to be produced in electrolysis reactions, then use those rules to predict products that might be formed. |  |  |
| **3.27** | **Be able to write half equations for the reactions that take place at the anode and the cathode in electrolysis.** |  |  |
| **3.28** | **Learn that oxidation is loss of electrons and reduction is gain of electrons.** |  |  |
| **3.29** | **Learn that reduction occurs at the cathode and oxidation occurs at the anode.** |  |  |
| 3.30 | Explain how electrolysis can be used to purify copper by using copper electrodes and a solution of copper sulfate. |  |  |
| 3.31 | Investigate what happens to the mass of the anode and the cathode when copper sulfate is electrolysed using copper electrodes. |  |  |

**Topic 4, Obtaining and using metals – Checklist**

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|  | Content | Understand it | Learnt it |
| 4.1 | Construct a reactivity series of metals by looking at their reactions with water, acids and displacement reactions with salt solutions. |  |  |
| **4.2** | **Understand that displacement reactions are redox reactions. Also explain what is oxidised and reduced.** |  |  |
| 4.3 | Explain the reactivity series of metals (potassium, sodium,  calcium, magnesium, aluminium, (carbon), zinc, iron,  (hydrogen), copper, silver, gold) in terms of the reactivity of  the metals with water and dilute acids and that these  reactions show the relative tendency of metal atoms to form  cations. |  |  |
| 4.4 | Learn that: 1) most metals are extracted from ores that are found in the Earth’s crust. 2) Unreactive metals like gold are found in the Earth’s crust as the uncombined elements (if you’re lucky enough). |  |  |
| 4.5 | Learn that oxidation is defined as the loss of electrons and reduction is defined as gaining electrons. |  |  |
| 4.6 | Learn that extraction of metals involves the reduction of ores. |  |  |
| 4.7 | Be able to explain that the method of extraction used to obtain a metal is related to its position in the reactivity series and the cost of the process. For example iron and aluminium. |  |  |
| **4.8** | **Learn the advantages and disadvantages of alternative methods of metal extraction. For example bacterial and phytoextraction.** |  |  |
| 4.9 | Predict a metal’s resistance to oxidation by looking at its position in the reactivity series. |  |  |
| 4.10 | Evaluate the advantages of recycling metals, including  economic implications and how recycling can preserve both  the environment and the supply of valuable raw materials |  |  |
| 4.11 | Learn about ‘life time assessment’ of a product. This involves evaluating the effect on the environment of obtaining the raw materials, manufacturing the product, using the product and disposing of it when it is no longer useful. |  |  |
| 4.12 | Look at data of a life time assessment of a product and use it to answer questions about the product. |  |  |

**Topic 4, Reversible reactions and equilibria - Checklist**

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|  | Content | Understand it | Learnt it |
| 4.13 | Know that some chemical reactions are reversible and where this is the case the following symbol is used: ⇌ |  |  |
| 4.14 | Learn the definition of dynamic equilibrium. |  |  |
| 4.15 | Learn how ammonia is formed from nitrogen (from the air) and hydrogen (obtained from natural gas) and understand that it is a reversible reaction and that it can reach a dynamic equilibrium. |  |  |
| **4.17** | **Learn how changing:**   1. **Temperature** 2. **Pressure** 3. **Concentration**   **Can change the position of a dynamic equilibrium.** |  |  |

**Topic 5 - Content and Checklist: Transition metals, alloys and corrosion**

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|  | Content | Understand it | Learnt it |
| 5.1 | Most metals are transition metals and they have a number of properties in common, these are:   * High melting points * High densities * Formation of coloured compounds * Catalytic activity of the metals and their compounds e.g. iron. |  |  |
| 5.2 | Learn that the reaction of metals with oxygen (oxidation) results in corrosion. |  |  |
| 5.3 | Explain how the rusting of iron can be prevented by:   * Exclusion of oxygen * Exclusion of water * Sacrificial protection |  |  |
| 5.4 | Understand that electroplating can be used to improve the appearance and/or the resistance to corrosion of something made from metal. |  |  |
| 5.5 | Be able to draw and use a diagram to explain why alloys are stronger than pure metals. |  |  |
| 5.6 | Learn why iron is alloyed with other metals to make steel. |  |  |
| 5.7 | Explain how the uses of metals are related to their properties. Be able to do this for aluminium, copper and gold as well as the alloys magnalium and brass. |  |  |

**Topic 5 – Quantitative Analysis**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Content | Understand it | Learnt it |
| 5.8 | Be able to calculate the concentration of solutions in moles per dm3 (mol dm-3) and convert into grams per dm3 (g dm-3) and vice versa. |  |  |
| 5.9 | Write a method naming all the apparatus used in order to perform an acid-alkali titration. |  |  |
| **5.10** | **Use the results of an acid base calculation to calculate the concentration of an unknown reactant or an unknown volume of solution.** |  |  |
| 5.11 | Calculate the percentage yield of a reaction. Do this using actual yield and theoretical yield. |  |  |
| 5.12 | Understand and learn that the theoretical yield is usually less than the actual yield for a reaction because:   1. The reaction is incomplete 2. Reactant or product is lost during the reaction. This is called practical losses. 3. Competing, unwanted reactions. |  |  |
| 5.13 | Learn that atom economy is a measure of the amount of starting materials that become useful products. This can be expressed as a percentage by calculating the formula mass of all the products and the desired product. |  |  |
| 5.14 | Calculate atom economy of a reaction. |  |  |
| **5.15** | **Look at different reaction pathways and by looking at data such as atom economy, yield, rate, equilibrium position and usefulness of by-products explain why a particular pathway is chosen.** |  |  |
| **5.16** | **Learn that the definition of the molar volume of a gas at room temperature and pressure is: the volume occupied by one mole of molecules of any gas at room temperature and pressure. (This volume will be provided in the exam as 24 dm3 (or 24000 cm3)** |  |  |
| **5.17** | **Use the molar volume of a gas in mole calculations involving masses of solids and volumes of gases.** |  |  |
| **5.18** | **Use avogadro’s law to calculate the volumes of gases involved in a gaseous reaction.** |  |  |

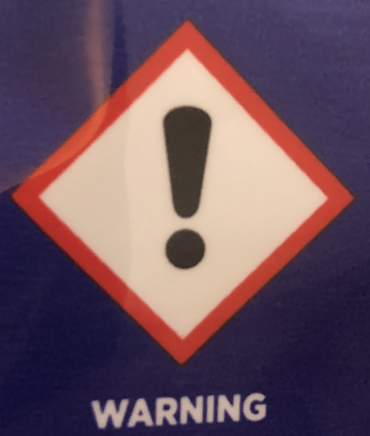
**Topic 5 – Dynamic Equilibria**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Content | Understand it | Learnt it |
| 5.19 | Remember the Haber process from year 10 as a reversible reaction between nitrogen and hydrogen to form ammonia. |  |  |
| **5.20** | **Learn how the rate of attainment of equilibrium is affected by changes in temperature, pressure, concentration and catalyst.** |  |  |
| **5.21** | **Explain how, in industrial reactions, including the Haber process, conditions used are related to:**   1. **Availability and cost of raw materials and energy supplies** 2. **Controlling reaction conditions like temperature, pressure and catalyst so a compromise can be used to produce an acceptable yield in an acceptable time.** |  |  |
| 5.22 | Learn that fertilisers contain nitrogen, phosphorus and potassium compounds and that these are essential for plant growth. |  |  |
| 5.23 | Learn that ammonia is reacted with nitric acid to produce the salt ammonium nitrate and that this salt is used as a fertiliser. |  |  |
| 5.24 | Understand that ammonium sulfate can also be used as a fertiliser and that the lab based preparation method and the industrial production are different. You need to be able to explain each and state the differences between the small scale lab production and the several stage large scale production method used in industry. |  |  |

**Paper 1 and 2**

FOUNDATION QUESTION - The packaging of the dishwasher tablets in my kitchen has this hazard symbol.

Qr code

Description automatically generated

One of the tablets has split open and the liquid it contains has spilt out. What would be a sensible safety precaution to use when clearing up the mess (1)

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Qr code

Description automatically generatedCalcium hydroxide (Ca(OH)2) solid reacts with hydrochloric acid (HCl) to make calcium chloride (CaCl2) solution and water. Write a balanced symbol equation including state symbols for this reaction. (4)

\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_) +\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_) 🡪\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_) +\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_)

Qr code

Description automatically generatedName a piece of equipment that could be used to accurately measure out 25 cm3 of hydrochloric acid. (1)

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Qr code

Description automatically generated

Give 3 pieces of equipment that would accurately measure out 25 cm3 of sodium hydroxide solution? (3)

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Qr code

Description automatically generated

Write a balanced symbol equation for the reaction of magnesium burning with the oxygen in the air. (3)

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Qr code

Description automatically generatedWrite a balanced symbol equation for the reaction of potassium iodide solution reacting with chlorine water to make potassium chloride and iodine solution. Include state symbols. (4)

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Qr code

Description automatically generated

Qr code

Description automatically generatedWrite an ionic equation for the reaction of magnesium ions with phosphate ions (PO43-) to form magnesium phosphate.

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Write a balanced symbol equation for the reaction of aluminium with bromine to form aluminium bromide. (3)

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Qr code

Description automatically generated

Write a balanced symbol equation for nitrogen reacting with oxygen to make nitrogen dioxide. (3)

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Qr code

Description automatically generated

Write a balanced symbol equation for the reaction of fluorine with iron to make iron (III) fluoride. (3)

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Qr code

Description automatically generatedWrite an ionic equation for nitric acid reacting with sodium carbonate. (3)

Na2CO3 (aq) + 2HNO3 (aq) 🡪 2NaNO3 (aq) + CO2 (g) + H2O (l)

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Qr code

Description automatically generated

Write a balanced symbol equation for the reaction between lithium and fluorine gas to make lithium fluoride solid. Include state symbols (4)

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Qr code

Description automatically generatedTitanium is extracted from its ore, rutile - TiO2. It is first converted into titanium(IV) chloride, this is achieved by heating with chlorine and carbon. As well as producing titanium (IV) chloride the reaction also produces carbon monoxide.

Write the balanced equation for this reaction. (3)

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Qr code

Description automatically generatedDescribe what you would see when magnesium is added to copper sulfate solution. Magnesium sulfate solution is colourless. (2)

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Qr code

Description automatically generated

Write a balanced symbol equation for the reaction of copper oxide and sulfuric acid. (2)

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Qr code

Description automatically generated

Small amounts of copper carbonate are added to sulfuric acid until all the acid has reacted. What would you see as the reaction is taking place and how would you know when it has finished? (4)

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Hydrochloric acid reacts with sodium thiosulfate (Na2S2O3) to make sodium chloride, sulfur dioxide, sulfur and water. Complete the ionic equation for this reaction. (2)

\_\_\_\_ \_\_\_\_\_\_\_\_ (aq)  +  Na2S2O3(aq)  →        \_\_\_\_\_ Na+ (aq)    +      SO2(g)    +   S(s)  +  H2O(l)

Qr code

Description automatically generated**Atoms**

John Dalton came up with an early model of the atom over 200 years ago. Give differences between Dalton’s model of the atom and today’s model of the atom. (2)

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What is the definition of an isotope?

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Qr code

Description automatically generatedFill in the blank:

Elements of the same element contain the same number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (1)

An element has a mass number of 23 and an atomic number of 11. State the electronic configuration. (1)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedAn element has a mass number of 9 and an atomic number of 4. How many protons, neutrons and electrons are there in this atom? (2)

|  |  |
| --- | --- |
| Protons |  |
| Neutrons |  |
| Electrons |  |

Qr code

Description automatically generated

A copper atom has 29 protons, 34 neutrons and 29 electrons. What is the mass number of this copper atom? (1)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedA potassium atom has 19 protons, 20 neutrons and 19 electrons. What is the electronic configuration of this potassium atom? (1)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generated

An element has the electronic configuration: **2.8.4**

Explain which group and period of the periodic table would this element be found in? (4)

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Qr code

Description automatically generated

An atom has an atomic number of 15 and a mass number of 31. What is its electronic configuration? (1)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedAn atom of sodium has an atomic number of 11 and a mass number of 23, how many protons and neutrons are present in a sodium ion (Na+)? (1)

|  |  |  |  |
| --- | --- | --- | --- |
| Protons |  | Neutrons |  |

Qr code

Description automatically generated

What’s an isotope?

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Qr code

Description automatically generatedTwo isotopes of carbon are carbon-12 and carbon-14? How are these isotopes similar? (1)

|  |
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Qr code

Description automatically generated**Periodic table**

Name the element that is in period 2 group 4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1)

Qr code

Description automatically generatedAn element has the electronic configuration: **2.8**

Explain which period of the periodic table would this element be found in? (2)

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Qr code

Description automatically generated

An element has the electronic configuration: **2.7**

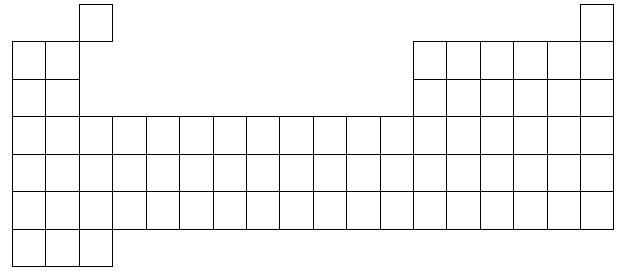
Which period and group of the periodic table would this element be found in? (2)

|  |  |
| --- | --- |
| Group |  |
| Period |  |

Qr code

Description automatically generatedDraw the metal/ non-metal divide on the periodic table below. (1)

Qr code

Description automatically generated

Where on the periodic table would we find elements that form a 2- charge?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedUse the electronic configuration of an atom of chlorine to explain its position on the periodic table (2)

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Qr code

Description automatically generated

**Empirical formula experiments**

Describe an experiment to determine the empirical formula of a calcium oxide. (3)

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Qr code

Description automatically generatedText

Description automatically generated with medium confidenceThe diagram below shows a molecule of but-1-ene. Give the molecular and the empirical formula of but-1-ene. (2)

Molecular formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Empirical formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Bonding**

Qr code

Description automatically generatedAluminium has an atomic number of 13. What is the electronic configuration of the aluminium ion? (1)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedWhy do metals have high melting points? (2)

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How does Mg turn into the Mg2+ ion? (2)

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Qr code

Description automatically generated

Aluminium chloride, AlCl3 is ionic. What are the charges on the aluminium and chloride ions? (2)

Aluminium ion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Chloride ion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the formula of aluminium sulfate? (1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedHow many protons, neutrons and electrons are present in the S2- ion? (Atomic number 16, mass number 32) (2)

|  |
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Qr code

Description automatically generatedHow many protons, neutrons and electrons are present in the Fe (III) ion? (Atomic number 26, mass number 56) (2)

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Qr code

Description automatically generated

What is the formula of sodium carbonate? (1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedExplain why calcium chloride has a high melting point. (2)

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Qr code

Description automatically generatedA water molecule can be drawn in many different ways. Look at each representation in turn and explain what you learn from it.

|  |  |
| --- | --- |
| H2O |  |
|  |
|  |
| H-O-H |  |
|  |
|  |
|  |  |
|  |
|  |
| Logo, icon  Description automatically generated with medium confidence |  |
|  |
|  |
| Diagram  Description automatically generated |  |
|  |
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Qr code

Description automatically generatedMagnesium burns in oxygen to from magnesium oxide. What is the electronic configuration of the magnesium ion and the oxide ion? (2)

|  |  |
| --- | --- |
| Magnesium ion |  |
| Oxide ion |  |

Qr code

Description automatically generatedWhat are the physical properties of ionic solids? (2)

|  |
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Qr code

Description automatically generated

An oxide of iron has the formula Fe2O3. What is the charge on the iron ion? (1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedWhat is a covalent bond? (2)

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Qr code

Description automatically generatedAn element has a melting point of -38.9 oC and a boiling point of 356.7 oC. What physical state would you expect it to be at room temperature (20 oC)? (1)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedExplain why graphene is a good conductor of electricity. (3)

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Qr code

Description automatically generated



Draw a dot and cross diagram for an oxygen molecule. (2)

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Qr code

Description automatically generatedExplain why oxygen has a boiling point of -183 oC? (2)

|  |
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Qr code

Description automatically generatedDraw a dot and cross diagram for a carbon dioxide molecule. Show outer electrons only. (2)

|  |
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Qr code

Description automatically generatedExplain whether you would you expect a sample of F2 to be a gas or a solid at room temperature. (2)

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Qr code

Description automatically generated

Explain why ammonia has a boiling point of -33 oC. (2)

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Qr code

Description automatically generated

Complete the table to give information about the bonding and properties about the 4 different allotropes of carbon. (6)

|  |  |  |  |
| --- | --- | --- | --- |
| Allotrope | Type of bonding | Melting point (explain) | Conductivity (explain) |
| Diamond |  |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| Graphite |  |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| Graphene |  |  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| fullerene |  |  |  |
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Qr code

Description automatically generated

Explain in terms of bonding and structure why the substances listed have the different melting points and conductivities stated. (6)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Melting point | Conducts electricity in solid state (s) | Conducts electricity in liquid state (l) |
| Ammonia | Low | Poor | Poor |
| Iron | High | Good | Good |
| Sodium bromide | High | Poor | Good |

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**Paper 1**

Qr code

Description automatically generatedFOUNDATION QUESTION - Describe the arrangement and movement of particles in a solid, liquid and gas. (3)

|  |  |  |
| --- | --- | --- |
| State of matter | Arrangement | Movement |
| Solid |  |  |
| Liquid |  |  |
| Gas |  |  |

Qr code

Description automatically generatedFOUNDATION QUESTION – Use a line to join the change of state to its name. (3)

|  |  |  |
| --- | --- | --- |
| Change of state |  | Name |
| Solid to liquid |  | Boiling |
| Liquid to gas |  | Melting |
| Gas to liquid |  | Freezing |
| Liquid to solid |  | Condensing |

Qr code

Description automatically generatedFOUNDATION QUESTION - On heating a substance changes from a solid to a liquid. Explain what you could do next to conclude whether this was a chemical or physical change. (2)

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**Qr code

Description automatically generatedSeparating techniques**

Explain how sea water can be turned into pure water (as part of your answer name the separating technique and explain how it works). (3)

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Qr code

Description automatically generatedDraw a labelled diagram that can be used to separate a mixture of sea water and sand? (2)

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Qr code

Description automatically generated

How would you obtain pure dry crystals of the salts present in sea water? (3)

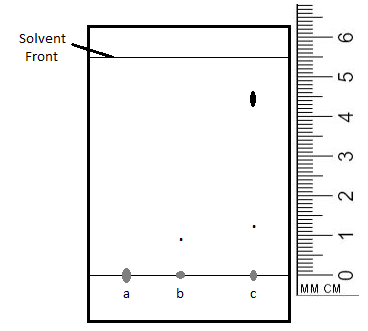
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Qr code

Description automatically generatedHow could a liquid with dissolved impurities be purified? (1)

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The diagram below shows the chromatogram obtained when the inks from 3 pens were separated using chromatography.



Why has ink **a** not moved and how could we change the experiment to try and separate the inks in this sample? (2)

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Qr code

Description automatically generated

What is the Rf for the dye in sample **b**? Give your answer to 3 significant figures.(2)

|  |
| --- |
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Qr code

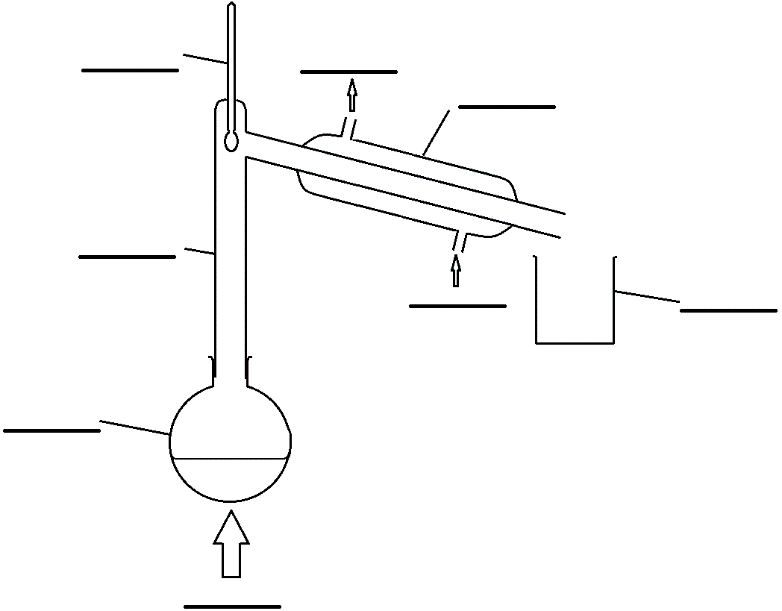
Description automatically generated

How many different dyes are in ink **c**? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedName this separating technique and label this apparatus

Qr code

Description automatically generated

Ethanol solution can be made by fermenting sugar, the solution is usually about 12% ethanol mixed with water. Describe the process used to concentrate the ethanol. (3)

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Qr code

Description automatically generated

After water has been through a treatment works it is described as, potable. What does, potable mean? (1)

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Qr code

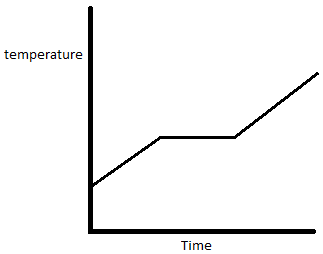
Description automatically generatedExplain how is water made potable? (4)

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**Change of State**

Qr code

Description automatically generatedA solid is heated at a constant rate and its temperature is regularly recorded and a graph of the results plotted. Explain the shape of the graph in terms of the changes in movement and arrangement of the particles. (4)



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Qr code

Description automatically generated

**Gas tests**

What’s the test for hydrogen? (2)

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Qr code

Description automatically generatedA sample of hydrogen is burnt – what happens? (1)

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Qr code

Description automatically generatedWhat’s the test for carbon dioxide? (2)

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**Indicators, pH and Neutralisation.**

What is the formula of the ion that causes a solution to be acidic? (1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the formula of the ion that causes a solution to be alkaline? (1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the name of the reaction between an acid and an alkali? (1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generatedOne of the core practical experiments was to slowly add calcium hydroxide to hydrochloric acid and monitor the pH. It is possible to monitor the pH with universal indicator paper. Describe how this could be done. (2)

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Qr code

Description automatically generated

Methyl orange is also an indicator. Why would this not be used to monitor the pH? (2)

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Plot a graph of pH against mass of calcium hydroxide added to hydrochloric acid. Draw a line of best fit. (3)

|  |  |
| --- | --- |
| Mass of calcium hydroxide (g) | pH of mixture |
| 0 | 1 |
| 0.25 | 1 |
| 0.5 | 1 |
| 0.75 | 6 |
| 1 | 11 |
| 1.25 | 12 |
| 1.5 | 12 |

Qr code

Description automatically generatedBackground pattern

Description automatically generated

Qr code

Description automatically generated

What is the formula of the salt produced when aluminium oxide (Al2O3) reacts with hydrochloric acid (HCl) (1)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Qr code

Description automatically generated

Why can strong acids be strong even when they are dilute? (2)

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Complete the table to show what effect acids and alkalis have on the following indicators.

|  |  |  |
| --- | --- | --- |
| Indicator | Acid | Alkali |
| Litmus |  |  |
| Methyl orange |  |  |
| phenolphthalein |  |  |

Qr code

Description automatically generatedIn an experiment to see how pH changes during neutralisation calcium hydroxide powder is added 1 g at a time to 50 cm3 hydrochloric acid. Phenolphthalein is used as the indicator. State what the colour at the start of the experiment and then at the end of the experiment after all the acid has reacted and there is an excess of calcium hydroxide.

Start: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ End: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1)

Explain how and why the pH changes during this experiment (3)

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|  |

What colours are:

1. Qr code

   Description automatically generatedMethyl orange
2. Phenolphthalein
3. Litmus

in acid and alkali?

|  |  |  |
| --- | --- | --- |
|  | Acid | Alkali |
| Methyl orange |  |  |
| Phenolphthalein |  |  |
| Litmus |  |  |

Qr code

Description automatically generated

Write a balanced symbol equation for the reaction of ammonia and sulfuric acid. (3)

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Qr code

Description automatically generatedSulfuric acid is a strong acid and citric acid is a weak acid. Explain the difference between a strong and a weak acid. (2)

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Qr code

Description automatically generated**pH**

1 cm3 of acid with a pH of 2 is made up to 1 dm3 with water. What is the pH of the new solution? (2)

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Qr code

Description automatically generatedIf the hydrogen ion concentration of a solution increases by a factor of 10 what effect does it have on the pH? (1)

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Qr code

Description automatically generated

What’s the most accurate way of measuring pH of a solution? (1)

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Qr code

Description automatically generated

Other than universal indicator, give another way of measuring the pH of a solution? (1)

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Qr code

Description automatically generated

What’s the most accurate way of measuring 25 cm3 of acid?

|  |
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Qr code

Description automatically generated

What is the difference in hydrogen ion concentration between 2 solutions if one has a pH of 3.2 and the other 5.2?

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Qr code

Description automatically generated

What’s a test for oxygen? (2)

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Qr code

Description automatically generatedWhat’s a test for carbon dioxide? (2)

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**Salt production**

Qr code

Description automatically generatedIn an attempt to produce pure dry crystals of copper sulfate a student adds sulfuric acid to copper carbonate (s). Quickly the copper carbonate completely dissolves. Why would it be very unlikely that the resultant solution would contain pure copper sulfate? (1)

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How can a pure dry sample of copper sulfate crystals be obtained from copper oxide and sulfuric acid? (4)

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Qr code

Description automatically generated

FOUNDATION QUESTION - What is a precipitate? (1)

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Qr code

Description automatically generatedHow can a pure dry sample of potassium chloride crystals be obtained from potassium hydroxide and hydrochloric acid? (4)

KOH (aq) + HCl (aq) 🡪 KCl (aq) + H2O (l)

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To understand how much hydrochloric acid that is needed to completely neutralise sodium hydroxide it is added 1 drop at a time until phenolphthalein indicator changes from pink to colourless. At this point the solution is exactly neutral as neither reactant is in excess. Why is a student incorrect to think that a pure dry sample of sodium chloride can be obtained from this mixture? (1)

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Qr code

Description automatically generated**Metal extraction**

Iron can be produced in the thermite reaction by reacting iron (III) oxide with aluminium. This displacement reaction could be also described as a REDOX reaction. Explain, in terms of electrons, which particles have been oxidised and which particles have been reduced.

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Qr code

Description automatically generated

Explain how aluminium oxide can be reduced to produce aluminium. (2)

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Look at the observations of different metals reactions with sulfuric acid and place the metals in order of reactivity

1. Bubbles quickly and the test tube gets hot
2. No reaction
3. A very vigorous reaction is observed with gas rapidly being produced and the test tube gets very hot.
4. Qr code

   Description automatically generatedExtremely small bubbles can be seen slowly appearing on the surface of the metal.
5. No reaction initially observed but on revisiting 1 hour later very small bubbles were observed on the metal.
6. Bubbles form slowly on the surface of the metal and rise to the surface of the acid.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Most reactive |  |  |  |  |  |  | Least reactive |

Qr code

Description automatically generatedWhen lead reacts with sulfuric acid you initially see some bubbles but the surface of the lead turns white and the reaction stops despite their still being lead and sulfuric acid left in the test tube. Explain why the reaction stops. (2)

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Qr code

Description automatically generatedWhat is the formula of iron (III) sulfate? (1)

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Qr code

Description automatically generatedGive 2 disadvantages of phytoextraction as a way of extracting metals from the environment. (2)

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Qr code

Description automatically generatedDraw and label apparatus that could be used to extract copper from copper oxide in the laboratory. (2)

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Qr code

Description automatically generatedCopper oxide can be extracted from its ore by displacement with carbon. Use electrons to explain how this can be classified as a redox reaction. (3)

2CuO + C 🡪 2Cu + CO2

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Qr code

Description automatically generatedThe table below shows whether metals and salt solutions react or not. Draw a labelled diagram of the apparatus used for the reaction and explain how you can use the results to work out the order of reactivity of the metals. (3)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Copper sulfate | Zinc sulfate | Magnesium sulfate |
| Copper | X | X | X |
| Zinc | ✓ | X | X |
| Magnesium | ✓ | ✓ | X |

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Magnesium reacts with oxygen in the air to make magnesium oxide. What type of reaction is this an example of? (1)

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Qr code

Description automatically generatedMetals are extracted from their ores. When this happens are the metal ores oxidised or reduced? (1)

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Qr code

Description automatically generatedWhy can aluminium not be extracted from its ore by heating with carbon? (2)

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Qr code

Description automatically generatedWhy is aluminium extracted from its ore using electrolysis and iron is extracted by heating with carbon? (3)

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Qr code

Description automatically generatedHow can metals be sourced using phytoextraction? (2)

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Qr code

Description automatically generated

Give advantages of extracting metals by phytoextraction rather than from its ore. (2)

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**Electrolysis**

Explain why calcium chloride in water would undergo electrolysis whereas calcium carbonate will not?

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Qr code

Description automatically generated

What are the products of the electrolysis of molten lead bromide (1)

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Qr code

Description automatically generatedA core practical involves electrolysing copper sulfate with copper electrodes. Draw a labelled diagram to show the apparatus that could be used. (2)

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Qr code

Description automatically generatedTo accurately measure the mass change of copper electrodes in the electrolysis of copper sulfate the electrodes first need to be prepared. Explain what should be done to prepare the electrodes. (2)

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Qr code

Description automatically generatedExplain the mass change that takes place at the anode and cathode when copper sulfate is electrolysed using copper electrodes. (4)

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Qr code

Description automatically generatedWhen copper sulfate solution is electrolysed for 4 minutes the mass of the anode decreased by 0.16 g. In another experiment also lasting 4 minutes the decrease in mass was 0.32 g. Explain what change was made to the procedure to bring about this change in results. (2)

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Qr code

Description automatically generatedFOUNDATION QUESTION - Electrolysis is often used to split compounds apart. Why is it important that inert electrodes are used? (1)

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Qr code

Description automatically generatedSodium chloride and water will undergo electrolysis but silver chloride and water will not. Explain the difference. (2)

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Qr code

Description automatically generated

Write a half equation for the formation of hydrogen gas from hydrogen ions. (2)

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Qr code

Description automatically generatedWrite the half equation for the formation of chlorine from chloride ions. (2)

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Qr code

Description automatically generated

What is a test for oxygen gas? (2)

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Qr code

Description automatically generated

Explain how hydrogen is produced when water is electrolysed. (2)

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Qr code

Description automatically generated

Write a half equation for the formation of copper from copper (II) ions. (2)

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Qr code

Description automatically generatedDraw a labelled diagram showing the apparatus required for the electrolysis of copper sulfate (aq) using carbon electrodes. (2)

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Qr code

Description automatically generated

Copper sulfate (s) and Copper sulfate (aq) were tested with a circuit containing a light bulb to investigate whether electricity can pass through them. What result would you expect and explain these results. (3)

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| --- | --- |
| Result |  |
| Explanation |  |
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Qr code

Description automatically generatedWhen the electrolysis of copper sulfate solution takes place using copper electrodes we would expect the mass of the electrodes to change. What change in mass would you expect and use half equations to explain your answer. (4)

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Qr code

Description automatically generated

When copper sulfate (aq) is electrolysed using copper electrodes what observations would you make?

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| --- | --- |
|  | Observation |
| Anode |  |
| Cathode |  |
| Electrolyte |  |

Qr code

Description automatically generated

**Reversible reactions**

What is the definition of, **dynamic equilibrium**? (1)

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Qr code

Description automatically generatedA student states you can tell that a reversible reaction is in a state of dynamic equilibrium when the concentrations of the reactants and products are equal. Explain why they are incorrect in saying this (1)

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Qr code

Description automatically generated

What is the name of the process used in industry to produce ammonia? (1)

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Qr code

Description automatically generated

How does a catalyst affect the rate of attainment of equilibrium? (1)

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Qr code

Description automatically generatedHow does a catalyst affect the equilibrium yield of ammonia? (1)

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Qr code

Description automatically generated

Write a balanced symbol equation for the production of ammonia? (2)

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Qr code

Description automatically generatedIron is added to the reactants in the Haber process. How does this effect the rate of attainment of equilibrium and the equilibrium yield of ammonia? (2)

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Qr code

Description automatically generatedExplain what effect increasing the pressure would have on the rate of attainment and the equilibrium yield of ammonia in the Haber process? (4)

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Why are ammonium salts suitable for fertilisers (2)

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Qr code

Description automatically generated

Write a balanced symbol equation for the formation of ammonium sulfate from ammonia and sulfuric acid? (3)

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Ammonium sulfate can be produced in the lab from sulfuric acid and ammonia using a pipette and burette. This is not how they do this in industry. What is a similarity and difference between the lab and industrial preparation of ammonium sulfate? (2)

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Qr code

Description automatically generated

What is the definition of dynamic equilibrium? (1)

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Qr code

Description automatically generatedAlcohols can be dehydrated to form ethene and steam in the presence of a catalyst. The forward reaction is endothermic. Explain how the conditions should be changed to maximise the yield of ethene. (6)

C2H5OH (g) ⇌ C2H4 (g) + H2O (g)

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Qr code

Description automatically generatedThe production of sulfur trioxide is a reversible reaction

2SO2 (g) + O2 (g) ⇌ 2SO3 (g)

The forward reaction is exothermic. Complete the following table to state and explain the ideal conditions for the production of sulfur trioxide. (6)

|  |  |
| --- | --- |
| Delete as appropriate | Explain why this condition is optimum in terms of both rate and yield |
| High pressure/low pressure |  |
|  |
|  |
| High temperature/low temperature |  |
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| With catalyst/without catalyst |  |
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|  |

The following reaction is reversible.

[Co(H2O)6]2+ (aq) + 4Cl- (aq) ⇌ [CoCl4]2- (aq) + 6H2O (l)

[Co(H2O)6]2+ (aq) is pink solution

[CoCl4]2- (aq) is blue a blue solution

Cl- (aq) is hydrochloric acid and is colourless.

If left to reach dynamic equilibrium the solution is violet.

Qr code

Description automatically generatedStarting with three tubes of violet-coloured solution, keep one tube as a control, and place another tube in the hot water, you will observe it will turn blue. Put the third tube in the ice/water mixture and you will see it will turn pink. Following this, the tubes in the hot and cold water are swapped over and the pink and blue colours reverse to show the reaction is reversible.

Devise a different experiment to show that this is a reversible reaction.

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The following reaction is reversible.

[Co(H2O)6]2+ (aq) + 4Cl- (aq) ⇌ [CoCl4]2- (aq) + 6H2O (l)

[Co(H2O)6]2+ (aq) is pink solutionQr code

Description automatically generated, [CoCl4]2- (aq) is blue a blue solution, Cl- (aq) is hydrochloric acid and is colourless.

What would be the effect on the colour if you: (2)

1. Increase the concentration of the chloride ions: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Decrease the concentration of the chloride ions: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In another reversible reaction a mixture of nitrogen dioxide (NO2) and dinitrogen tetroxide (N2O4) is left in a sealed container.

2NO2 ⇌ N2O4

Nitrogen dioxide (NO2) is brown and dinitrogen tetroxide (N2O4) is colourless.

A container left at a constant room temperature filled with these gases will reach a dynamic equilibrium and the colour is light brown.

Qr code

Description automatically generatedThe container is put in the fridge and the colour lightens from light brown to yellow. (Assume the pressure remains unchanged.)

Explain what you observe.

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Qr code

Description automatically generated

What type of reaction is it when ammonia reacts with sulfuric acid? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1)

Qr code

Description automatically generatedWrite a balanced symbol equation for the reaction of ammonia with sulfuric acid. (3)

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Qr code

Description automatically generatedThe reaction of carbon with steam to make hydrogen and carbon dioxide is reversible. The forward reaction is endothermic.

C (s) + 2H2O (g) ⇌ 2H2 (g) + CO2 (g)

Explain the effect of increasing the temperature on the yield of the products. (2)

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**Essential Knowledge Questions**

**Learn the answers to each of these:**

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|  | **Question** | **Answer** |
| 1 | What is an atom? | The smallest particle that has the properties of a chemical element. |
| 2 | Describe the structure of an atom. | A nucleus containing protons and neutrons, surrounded by electrons in shells. |
| 3 | What are the relative charges and masses of protons, neutrons and electrons. | Protons: mass 1, charge +1  Neutrons: mass 1, charge 0  Electrons: mass almost zero, charge -1. |
| 4 | Why do atoms contain the same number of protons and electrons? | Atoms are neutrally charged so they must have the same number of positive particles (protons) as negative particles (electrons) |
| 5 | How would you describe the size of the nucleus relative to the rest of the atom? | Very small |
| 6 | Where is most of the mass of the atom found? | In the nucleus. |
| 7 | What is the mass number of an element? | The total number of protons and neutrons. |
| 8 | What is the atomic number of an element? | The number of protons. |
| 9 | The number of which particle is unique to an element and gives it its identity? | Protons |
| 10 | If an atom contains 12 protons, how many electrons will it have? | 12. |
| 11 | If an atom has a mass number of 23 and an atomic number of 11, how many protons, neutrons and electrons does it contain? | 11 protons  11 electrons  23-11 = 12 neutrons |
| 12 | What is an isotope? | Two or more atoms of the same element (the same number of protons) but with a different number of neutrons. |
| 13 | What is the relative atomic mass, (Ar)? | The relative mass of an atom compared to the one twelfth mass of an atom of carbon-12. |
| 14 | Why do some elements have a relative atomic mass that is not a whole number. | The relative atomic mass is an average mass of all the isotopes that make up the element. |
| 15 | What is the formula for calculating relative atomic mass of an element from the relative mass and abundance of its isotopes? |  |
| 16 | How did Mendeleev arrange the elements known at the time into a periodic table? | By using the mass number and the properties of the elements and the properties of their compounds of the elements. |
| 17 | How did Mendeleev use his table? | To predict the existence and properties of some elements that were still to be discovered. |
| 18 | Why does Mendeleev’s method of organising elements in order of increasing atomic mass not always work? | The relative abundancies of some elements isotopes means they can be placed in the wrong place. |
| 19 | How are elements in the modern periodic table arranged? | In order of increasing atomic number in rows called periods and elements with similar properties are placed in the same vertical columns called groups. |
| 20 | Where are the non-metals found in the periodic table? | At the top on the right hand side. |
| 21 | What do all elements in the same row of the periodic table have in common? | They have the same number of shells of electrons. |
| 22 | What do all elements in the same column of the periodic table have in common? | They have the same number of electrons in their outer shell (and therefore have similar chemical properties). |
| 23 | What is an ion? | A charged atom or group of atoms. |
| 24 | Describe how an ionic bond is formed. | A metal loses electron(s) to a non-metal. This results in the metal becoming a positively charged ion (cation) and the non-metal a negatively charged ion (anion). These oppositely charged ions then attract. |
| 25 | Is a cation positively or negatively charged? | Positive |
| 26 | Is a anion positively or negatively charged? | Negative |
| 27 | What charge do the ions have when formed from elements in group:   1. 1 2. 2 3. 6 4. 7 | 1. + 2. 2+ 3. 2- 4. - |
| 28 | What do the compound endings:   1. ide 2. ate   mean? | 1. ide – a compound of only the named substances 2. ate – a compound of the named substances and oxygen |
| 29 | What is the formula of the compounds formed from:   1. Mg2+ and Cl- 2. Na+ and O2-? | 1. MgCl2 2. Na2O |
| 30 | Describe the structure of ionic substances. | Ionic substances are a regular arrangement of oppositely charged ions held together in a lattice structure by strong electrostatic forces. |
| 31 | How many electrons does Mg2+ have? Mg has an atomic number of 12 | 10 |
| 32 | Describe what happens in covalent bonding? | Two non-metals overlap their outer electron shells and share at least one pair of electrons. |
| 33 | What does covalent bonding result in the formation of? | molecules |
| 34 | Name and explain two physical properties of ionic compounds. | 1. They have high melting and boiling points because there are strong electrostatic forces holding the oppositely charged ions in place, therefore a lot of energy is needed to separate the ions. 2. They can conduct electricity when molten or in aqueous solution (dissolved in water) because the ions are free to move and carry their charge. |
| 35 | Name and explain two physical properties of covalent, simple molecular compounds. | 1. They have low melting and boiling points because there are weak intermolecular forces of attraction between molecules. 2. They do not conduct electricity because the molecules are not charged. |
| 36 | Describe the structures of:   1. Diamond 2. Graphite | 1. Each carbon atom is held in place by 4 strong covalent bonds to other carbon atoms. This arrangement is replicated throughout the whole structure creating a giant structure. 2. Each carbon atom is held in place by 3 strong covalent bonds. This creates flat layers of carbon atoms which stack on top of each other. The unused outer electron on each carbon atom sits between these layers and is delocalised (free to move). |
| 37 | Why is diamond used in cutting tools? | Diamond is very hard because all the carbon atoms are joined by 4 strong covalent bonds. |
| 38 | Why does diamond have such a high melting point? | In diamond each carbon atom is held in place by 4 strong covalent bonds and it takes a lot of energy to break these bonds. |
| 39 | Why does graphite conduct electricity? | In graphite each carbon forms 3 bonds, this leaves one electron left over from each carbon atom which sits between the graphite layers and is free to move and carry a charge. |
| 40 | Why can graphite act as a lubricant? | The layers of carbon atoms in graphite are only very weakly joined and are therefore free to slide past each other. |
| 41 | What are fullerenes? Explain its properties in terms of its structure and bonding. | C60 is one example where 60 carbons bond together covalently making a structure that looks like a football. These are simple molecules and behave as such. It is possible to ‘dope ‘ the C60 with metal atoms and it then becomes a superconductor. |
| 42 | What is graphene? Explain its properties in terms of its structure and bonding. | Graphene is like graphite, just 1 layer thick. It therefore conducts electricity and for its thickness is very strong. |
| 43 | Describe polythene’s structure | Polythene is an example of a polymer. It is a large molecule containing chains of carbon atoms surrounded by hydrogen. |
| 44 | Describe the bonding in metals? | All metals form positive ions and their outer electrons are delocalised and sit between the metal ions (forming a ‘sea of electrons’). |
| 45 | Why do metals conduct electricity? | There are free electrons in the metallic structure that can move. |
| 46 | Why are metals malleable? | They bend because the ions can slide over one another. |
| 47 | Why is it difficult to represent models of compounds on paper? | Compounds are normally 3 dimensional and contain different sized atoms. This can give them particular shapes that are hard to draw clearly in 2 dimensions (on paper). |
| 48 | What are the properties of most metals? | Shiny solid, high melting points, high density and good conductors of electricity. |
| 49 | What is an empirical formula? | The simplest ratio of the elements in a compound. |
| 50 | What is the law of conservation of mass? | During any chemical reaction no particles are created or destroyed. So the overall mass of the reactants must equal the mass of the products. |
| 51 | What unit do we use for concentration? | g dm-3 (grams per decimetre cubed) |
| 52 | What is 1 mole of particles? | The Avogadro constant (6.02 x 1023 particles). |
| 53 | What is the formula to calculate moles? | Moles = Mass/Relative formula mass |
| 54 | What are the 3 states of matter? | Solid, liquid and gas |
| 55 | Name the interconversion between the:   1. Solid to the liquid state 2. Liquid to the gaseous state 3. gaseous state to the liquid state 4. Liquid to the solid state | 1. Melting 2. Evaporating (or if heated to boiling point – Boiling) 3. Condensing 4. Freezing |
| 56 | Describe how the particles arrangement, movement and energy changes during melting. | The particles energy increases on heating causing the vibrations between particles to increase to an extent that they break free from their regular arrangement and start moving over one another. |
| 57 | Describe how the particles arrangement, movement and energy changes during condensing. | The particles energy decreases on cooling causing the particles to slow down and become attracted to other particles. |
| 58 | What is the difference between a pure substance and a mixture? | A pure substance is made of just one thing whereas a mixture is made of more than one substance which are not chemically joined. |
| 59 | What type of mixtures can be separated by each of these techniques?   1. Simple distillation 2. Fractional distillation 3. Filtration 4. Crystallisation 5. Paper chromatography | 1. A dissolved solid where you want to keep the liquid or 2 liquids with very different boiling points. 2. A large sample of a mixture of liquids with similar boiling points 3. An insoluble solid and a liquid. 4. A dissolved solid where you do not want the liquid. 5. A small sample of a mixture of liquids. |
| 60 | What is Chromatography? | A separating technique used to separate mixtures of soluble substances by running a solvent (mobile phase) through the mixture on the paper (stationary phase) which causes the substances to move at different rates over the paper. |
| 61 | How can you use paper chromatography to identify a substance? | Each substance will run a specific distance up the paper and have its own unique Rf. |
| 62 | In chromatography, define the Rf value. | Rf = distance moved by the component  distance moved by the solvent |
| 63 | How can ground water be made potable? | Sedimentation, filtration and chlorination |
| 64 | How can sea water be made potable? | Distillation. |
| 65 | Why must water used in analysis not contain any dissolved salts? | Dissolved salts could cause an analysis to give a false positive result. In other words you might get a positive result for something that isn’t really there. |
| 66 | What are acids and alkalis sources of? | Acids – hydrogen ions  Alkalis – hydroxide ions |
| 67 | What are the colour changes of?   1. Litmus 2. Methyl orange 3. Phenolphthalein   With acid and alkali? | |  |  |  | | --- | --- | --- | |  | Acid | Alkali | | Litmus | red | blue | | Methyl orange | red | yellow | | Phenolphthalein | colourless | pink | |
| 68 | What is the link between hydrogen ion concentration and pH? | The higher the concentration of hydrogen ions the lower the pH (a stronger acid). As the hydrogen ion concentration increases by a factor of 10, the pH of the solution decreases by 1.The higher the concentration of hydroxide solutions the higher the pH. |
| 69 | When calcium hydroxide is added slowly to hydrochloric acid the pH of the resulting solution changes. What would the graph of this look like? |  |
| 70 | What pH could a concentrated acid have? | Anything between 1 and 6. Acid concentration refers to the dilution with water. A strong acid can still have a lot of hydrogen ions in solution even when it is of a weak concentration. |
| 71 | Which would have a pH of 1?   * 0.25M Sulphuric acid (a strong acid) * 10M Ethanoic acid (a weak acid) | Strong acids will always have low pH regardless of the concentration. |
| 72 | What is a base? | It is a substance that can react with an acid to make a salt and water. |
| 73 | What is an alkali? | A soluble base. |
| 74 | What type of reaction is it when an acid reacts with a base? | Neutralisation |
| 75 | What are the products of the following neutralisation reactions?   1. Metal + acid = 2. Metal oxide + acid = 3. Metal hydroxide + acid = 4. Metal carbonate + acid = | 1. Salt + hydrogen 2. Salt + water 3. Salt + water 4. Salt + water + carbon dioxide |
| 76 | What is the chemical test for?   1. Hydrogen 2. Carbon dioxide | 1. Lit splint gives a squeaky pop. 2. Bubbling carbon dioxide through limewater turns it milky. |
| 77 | Explain why water is produced when an acid reacts with an alkali? | The hydrogen ions (H+) from the acid react with the hydroxide ions (OH-) from the alkali to form water (H2O). |
| 78 | When preparing a soluble salt from an acid an insoluble reactant how do you ensure the salt is pure? | 1. Use excess insoluble reactant to neutralise all the acid. 2. Filter the resulting mixture to remove the excess reactant. |
| 79 | How do you prepare a soluble salt when both the reactants are soluble? | Titration is used to ensure the reactants are mixed in the correct proportions. |
| 80 | How would you prepare a sample of pure, dry hydrated copper sulfate crystals starting from copper oxide. | 1. Add excess copper oxide to sulfuric acid and place in a water bath to gently heat. 2. Filter the mixture to remove excess copper oxide. 3. Evaporate the mixture, this can be heated to start with but it must be left to evaporate at room temperature to produce hydrated crystals. |
| 81 | How do you carry out an acid-alkali titration, using burette, pipette and a suitable indicator, to prepare a pure, dry sample of sodium chloride? | 1. Fill a burette with hydrochloric acid. 2. Measure 25 cm3 of sodium hydroxide using a pipette and place in a conical flask. 3. Add a few drops of phenolphthalein indicator. 4. Place the conical flask on a white tile underneath the burette. 5. Run in hydrochloric acid fairly quickly at first whilst continually stirring. 6. When the neutralisation point is approaching start to add the acid drop wise. 7. Stop adding the acid the moment the indicator goes clear. 8. Repeat the titration 2 further times and average results. 9. Carry out titration one final time, this time without indicator to ensure the salt produced is pure. Stop adding acid when the average quantity previously identified has been added. |
| 82 | Are the common sodium, potassium and ammonium salts soluble or insoluble? | Soluble |
| 83 | Are nitrates soluble or insoluble? | Soluble |
| 84 | Are common chlorides soluble or insoluble? And what is the exception to the rule? | Soluble, except silver chloride and lead chloride. |
| 85 | Are common sulfates soluble or insoluble? And what is the exception to the rule? | Soluble, except lead sulphate, barium sulphate and calcium sulphate. |
| 86 | Are common carbonates and hydroxides soluble or insoluble? And what is the exception to the rule? | Insoluble, except sodium, potassium and ammonium. |
| 87 | What is a precipitate? | A solid formed from two reacting solutions. |
| 88 | What is the name of the insoluble precipitate formed when lead nitrate reacts with potassium chloride? | Lead chloride |
| 89 | How do you prepare a pure, dry sample of an insoluble salt? | Mix reacting solutions together in order to get the precipitate, then filter the precipitate out of the solution, wash it with distilled water and dry it. |
| 90 | What is an electrolyte? | An ionic compound in either the molten state or dissolved in water. |
| 91 | What is electrolysis? | A chemical process that decomposes an electrolyte using electrical energy from a direct current (DC) supply. |
| 92 | What are positively charged ions called? | Cations |
| 93 | What are negatively charged ions called? | Anions |
| 94 | What is the positive electrode called? | Anode |
| 95 | What is the negative electrode called? | Cathode |
| 96 | How do the ions move during electrolysis? | The cations migrate to the cathode.  The anions migrate to the anode. |
| 97 | What products are formed in the electrolysis of the following electrolytes:   1. Copper chloride solution 2. Sodium chloride solution 3. Sodium sulphate solution 4. Water acidified with sulphuric acid 5. Molten lead bromide | |  |  |  |  | | --- | --- | --- | --- | |  | Anode | Cathode | Left in solution | | 1 | Chlorine | Copper |  | | 2 | Chlorine | Hydrogen | Sodium hydroxide | | 3 | Oxygen | Hydrogen |  | | 4 | Oxygen | Hydrogen |  | | 5 | Bromine | Lead |  | |
| 98 | What is the cathode half equation when water is electrolysed? | 2H+ + 2e- → H2 |
| 99 | What is the anode half equation when water is electrolysed? | 2O2- → O2 + 4e- |
| 100 | Define oxidation and reduction. | Oxidation is loss of electrons and reduction is gain of electrons. |
| 101 | When water is electrolysed are the hydrogen ions oxidised or reduced? | Reduced |
| 102 | Does oxidation happen at the anode or cathode? | Anode |
| 103 | When purifying copper using electrolysis would you make the impure copper the anode or the cathode? | Anode |
| 104 | Write the half equation for the formation of copper at the cathode. | Cu2+ + 2e- → Cu |
| 105 | Magnesium produces small bubbles of gas when placed in water; it reacts rapidly with steam and acid. Lithium bubbles fizzes on the surface of water. Which is more reactive? | Lithium. |
| 106 | What is a displacement reaction? | A redox reaction in which a more reactive element displaces a less reactive element from its compound. Both metals and non-metals take part in displacement reactions. |
| 107 | In metal displacement reactions, is the reactive metal oxidised or reduced? | Oxidised |
| 108 | Where are most metals obtained from? | Ores found in the Earth’s crust. |
| 109 | Name a metal that is not extracted from an ore and explain why. | Gold because it is so unreactive it doesn’t combine with oxygen in the environment. |
| 110 | When metals are extracted are ores oxidised or reduced? | Reduced |
| 111 | Describe how iron is extracted from its ore. | Iron ore (iron oxide) is heated with carbon (the carbon displaces the iron. The iron is reduced – loses its oxygen to the carbon). |
| 112 | Describe how aluminium is extracted from its ore. | Aluminium is extracted by electrolysis. |
| 113 | Explain why aluminium is extracted in this way, and not by simply heating it with carbon. | Aluminium is a reactive metal.  Reactive metals bond strongly to the other elements in their ores. It requires a lot of energy to break these chemical bonds. Electrolysis can provide large amounts of electrical energy to separate the metal from the other elements in the ore.  All reactive metals have to be extracted by electrolysis. The disadvantage is that this method is expensive. |
| 114 | Why is iron not extracted from its ore using electrolysis? | It is cheaper to displace it with carbon. |
| 115 | How does the phyto extraction of copper work? | Some plants absorb copper compounds through their roots, the plant is then burnt and the copper extracted from the ash. |
| 116 | What is bioleaching? | A method of extracting copper that involves bacteria absorbing copper compounds. The bacteria then produce solutions called leachates which contain copper compounds from which the copper can be extracted. |
| 117 | Would you expect a metal low down the reactivity series to be susceptible to oxidation? | No, unreactive metals are much less likely to react with oxygen. |
| 118 | Why do we recycle scrap metal? | 1. It can often be cheaper to recycle rather than extract new metal from its ore. 2. Recycling cuts waste which could otherwise harm the environment. 3. Preserves the remaining raw materials on the planet. |
| 119 | What does a lifetime assessment of a product involve? | Evaluating the effect on the environment of:   1. Manufacturing 2. Using 3. Disposing |
| 120 | What does this symbol mean?  ⇌ | It shows a reaction is reversible |
| 121 | What is meant by the term ‘dynamic equilibrium’? | A reversible reaction is said to be in dynamic equilibrium when the rate of the forward reaction is equal to the rate of the backward reaction. |
| 122 | How can you change the equilibrium of a reversible reaction? | By changing the conditions, for example temperature and pressure. |
| 123 | What is the equation for the Haber process? | N2 (g) + 3H2 (g) ⇌ 2NH3 (g) |
| 124 | Where are the reactants obtained from in the Haber process? | The nitrogen is extracted from air and the hydrogen is obtained from natural gas. |
| 125 | What is the chemical formula for ammonia? | NH3 |
| 126 | What are the conditions used in the Haber process? | * temperature 450 °C * pressure 200 atmospheres * iron catalyst |
| 127 | How does increasing the temperature affect the yield of ammonia? | The production of ammonia is exothermic so increasing the temperature reduces the yield. |
| 128 | If increasing the temperature reduces the yield of ammonia why is a temperature of 450 oC used? | 450 oC is a compromise, the temperature is raised to increase the rate of reaction even though it decreases the yield. |
| 129 | How does increasing the pressure affect the yield of ammonia? | 4 molecules of reactants are needed to make 2 molecules of ammonia. If the pressure is raised more ammonia is produced because that would reduce the number of particles present. |
| 130 | How does adding a catalyst affect the yield of ammonia? | It does not affect the yield it just increases the rate. |
| 131 | How would the position of a dynamic equilibrium be affected by?   1. temperature? 2. pressure? 3. concentration? | 1. Increasing the temperature will move the dynamic equilibrium in the direction of the endothermic reaction. 2. Increasing the pressure will move the dynamic equilibrium towards the side where there are less gas molecules. 3. Increasing the centration of a substance will move the equilibrium to reduce the concentration of that substance. |

Qr code

Description automatically generatedQr code

Description automatically generatedBonding Summary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Ionic | Covalent | | | Metallic |
| Description |  |  | | |  |
| Atoms Involved |  |  | | |  |
| Example |  | Qr code  Description automatically generated | | |  |
| Charges |  |
| Formula |  |
| Name |  |
| Structure |  | Simple Molecular | Giant Molecular | |  |
|  | Diamond | Graphite |  |
| Melting Point |  |  |  |  |  |
| Qr code  Description automatically generatedElectrical Conductivity |  |  |  |  |  |
| Solubility in water |  |  |  |  |  |

Diagram

Description automatically generated with medium confidence