

IGCSE Chemistry 0620 Paper 4 (Extended) Mock Paper (10 questions, 75 marks)

IGCSE (Year 10-11) Chemistry | 時限：75 分鐘 | 總分：75 分 | 共 10 題

All questions (75 marks) — Questions 1 to 10

Answer ALL questions. Write your answers in the spaces provided and show all working in calculations.

- 25.0 g of pure calcium carbonate (CaCO_3 , $M_r = 100$) is heated and decomposes: $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$. (a) Calculate the number of moles of CaCO_3 . (b) Calculate the volume of CO_2 formed at room temperature and pressure (1 mol of gas = 24.0 dm^3). (c) Calculate the mass of CaO formed ($M_r(\text{CaO}) = 56$).
- Aqueous copper(II) sulfate is electrolysed using copper electrodes. A current of 2.0 A flows for 30.0 minutes (1 faraday = 96,500 C). (a) Calculate the quantity of charge passed in coulombs. (b) Calculate the number of moles of electrons. (c) Calculate the mass of copper deposited at the cathode ($\text{Cu} = 63.5$). (d) Calculate the volume of oxygen released at the anode at room temperature and pressure, in cm^3 .
- Marble chips are added to excess dilute hydrochloric acid and the volume of carbon dioxide collected is measured: 0 s: 0 cm^3 , 20 s: 48 cm^3 , 40 s: 90 cm^3 , 60 s: 120 cm^3 (reaction complete). (a) Calculate the average rate over the first 20 s in cm^3/s . (b) Calculate the average rate between 20 s and 40 s in cm^3/s . (c) Explain why the rate decreases with time. (d) Suggest two ways to increase the initial rate without changing the amounts of reactants used.
- 25.0 cm^3 of 0.100 mol/dm^3 sodium hydroxide solution is titrated with hydrochloric acid of unknown concentration; 20.0 cm^3 of the acid is needed to reach the end-point. (a) Calculate the number of moles of NaOH . (b) Calculate the concentration of the acid in mol/dm^3 . (c) Calculate the mass of HCl in that 20.0 cm^3 of acid ($M_r = 36.5$). (d) Name a suitable indicator and state the colour change at the end-point.
- 1.00 g of ethanol is burned and the heat released raises the temperature of 200 g of water by 12.0°C (specific heat capacity of water = $4.2 \text{ J/(g} \cdot ^\circ \text{C)}$, $M_r(\text{C}_2\text{H}_5\text{OH}) = 46$). (a) Calculate the heat absorbed by the water in kJ. (b) Calculate the number of moles of ethanol. (c) Calculate the enthalpy of combustion ΔH in kJ/mol. (d) Explain why the experimental value is lower than the data book value of 1,370 kJ/mol.
- Consider ethanol ($\text{C}_2\text{H}_5\text{OH}$) and ethanoic acid (CH_3COOH). (a) Name the homologous series each belongs to and the functional group each contains. (b) Write the equation, with conditions, for making ethanol by fermentation of glucose. (c) Ethanol reacts with ethanoic acid with concentrated sulfuric acid as catalyst: name the product and give its molar mass. (d) Describe a chemical test to distinguish an alkene from an alkane, including the observation.
- 2.4 g of magnesium burns in oxygen to form magnesium oxide ($A_r(\text{Mg}) = 24$, $M_r(\text{MgO}) = 40$). (a) Calculate the number of moles of magnesium. (b) Calculate the mass of MgO formed. (c) State the type of bonding in MgO and explain why molten MgO conducts electricity.

8. Dry air is about 21% oxygen and 78% nitrogen by volume. A sample of 250 cm³ of dry air is taken. (a) Calculate the volume of oxygen in cm³. (b) Calculate the volume of nitrogen in cm³. (c) Give the test for carbon dioxide and its observation. (d) Name two air pollutants and their main sources.
9. In a blast furnace, iron(III) oxide is reduced by carbon monoxide: $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ ($M_r(\text{Fe}_2\text{O}_3) = 160$, $A_r(\text{Fe}) = 56$). (a) State the change in oxidation number of iron in this reaction. (b) Calculate the mass of iron, in tonnes, that can be extracted from 100 tonnes of ore containing 80% Fe_2O_3 . (c) State two functions of coke in the blast furnace.
10. The Haber process: $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ ($M_r(\text{N}_2) = 28$, $M_r(\text{NH}_3) = 17$). (a) State the temperature, pressure and catalyst used industrially. (b) Calculate the mass of ammonia, in g, obtained from 28 g of nitrogen reacting completely. (c) Calculate the percentage by mass of nitrogen in ammonium nitrate (NH_4NO_3 , $M_r = 80$). (d) Explain how the overuse of nitrogenous fertilisers causes water pollution.