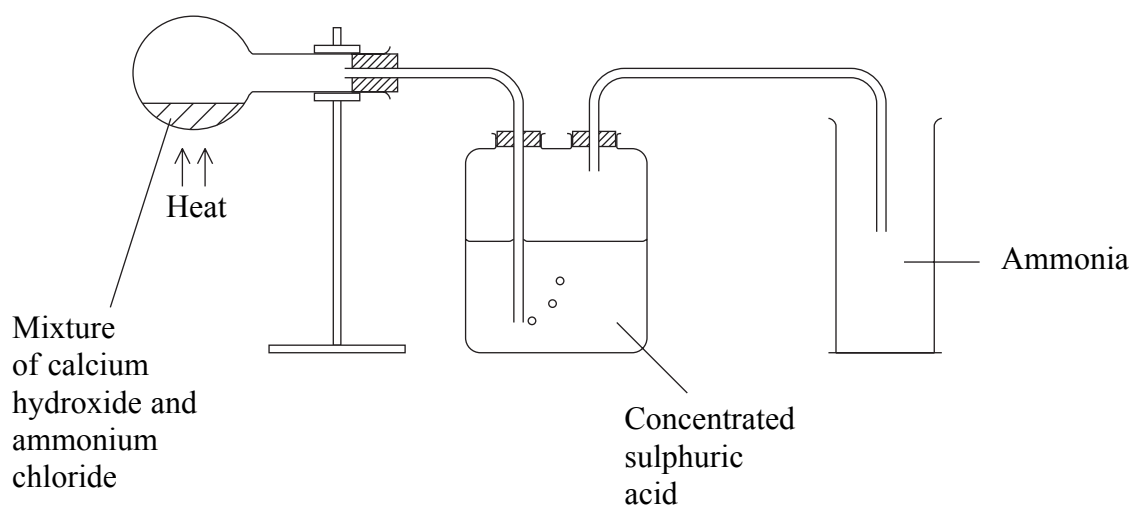


SECTION A

Answer ALL the questions in this section. Write your answers in the spaces provided.

There is useful data on the front cover, and a Periodic Table is printed on the back of this booklet.

1. The following diagram shows the apparatus assembled to make a sample of dry ammonia gas in the laboratory.



- (a) There are two reasons why this method would **not** work. State what they are and how the method should be modified.

1

.....

.....

.....

2

.....

.....

.....

(4)

- (b) Write an equation for the reaction between calcium hydroxide and ammonium chloride.

.....

(2)



Leave
blank

(c) Describe a chemical test to identify ammonia gas.

.....
(1)

(d) Describe what is seen when aqueous ammonia is added drop by drop to copper(II) sulphate solution until present in excess. Give the formula of the final product.

.....
.....
.....
.....
.....
.....
.....
(3)

Q1

(Total 10 marks)

--	--



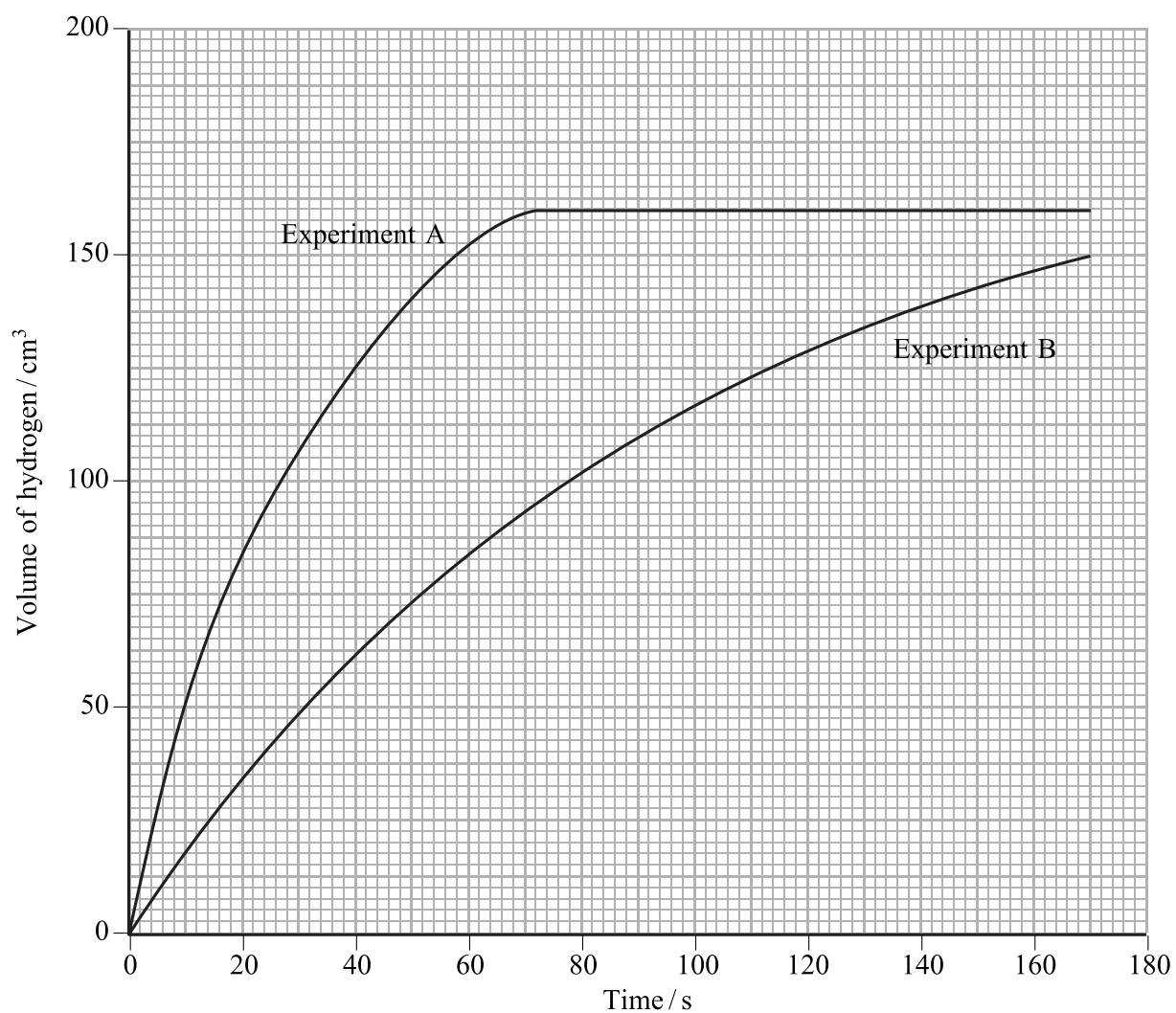
2. Two experiments were carried out in which magnesium was reacted with acid.

Experiment A	x g of magnesium ribbon was reacted with an excess of hydrochloric acid of concentration 1 mol dm^{-3} at $25 \text{ }^\circ\text{C}$
Experiment B	x g of magnesium ribbon was reacted with an excess of ethanoic acid of concentration 1 mol dm^{-3} at $25 \text{ }^\circ\text{C}$

(a) Write an ionic equation for the reaction that takes place in both experiments.

..... (1)

(b) The following graphs show the volume of hydrogen produced at 10 s intervals up to 170 s for both experiments.



Leave
blank

(i) How many seconds did it take for all the magnesium to react in Experiment A?

.....
(1)

(ii) What was the final volume of gas produced in Experiment A?

.....
(1)

(iii) Predict the final volume of gas produced in Experiment B.

.....
(1)

(iv) How many seconds did it take for half the magnesium to react in Experiment B?

.....
(1)

(c) Calculate the mass of magnesium, x , used in the experiment.

.....
.....
(2)

(d) Suggest why the graphs for the two experiments are different.

.....
.....
(1)

(e) On the grid opposite draw the graph you would expect to obtain if Experiment A was repeated at a temperature of $40\text{ }^{\circ}\text{C}$, the volume of hydrogen produced being measured at the original temperature of $25\text{ }^{\circ}\text{C}$.

(2)

Q2

(Total 10 marks)



3. An alkane, A, contains three carbon atoms. It undergoes catalytic cracking, each molecule of A breaking in an identical way, to form an alkene, B, and an alkane, C, as the only products.

(a) Identify compounds A, B and C.

(i) Compound A is **(1)**

(ii) Compound B is **(1)**

(iii) Compound C is **(1)**

(b) (i) What type of polymer is formed by alkene B?

..... **(1)**

(ii) Draw a diagram to show the structure of this polymer.

(1)

(c) In an industrial process, alkene B reacts with steam to give ethanol.

(i) Write an equation for this reaction.

..... **(1)**

(ii) State three conditions for this reaction.

1

2

3

(3)



(d) Ethanol ($\text{CH}_3\text{CH}_2\text{OH}$) and propane ($\text{CH}_3\text{CH}_2\text{CH}_3$) have similar relative molecular masses. Explain, in terms of intermolecular forces, why ethanol is a liquid at room temperature while propane is a gas.

.....
.....
.....

(1)

(Total 10 marks)

Leave
blank

Q3

--	--



N 2 5 2 2 4 A 0 7 2 8

4. (a) Glucose has the following composition: C = 40%, H = 6.7%, O = 53.3%.

(i) Calculate the empirical formula of glucose. Working must be shown.

.....
.....
.....
.....
.....
.....

(3)

(ii) The relative molecular mass of glucose is 180. What is the molecular formula of glucose?

.....
.....
.....
.....

(2)

(b) Describe how ethanol can be made from glucose solution by fermentation.

.....
.....
.....
.....
.....
.....

(3)



Leave
blank

(c) Glucose can be represented as HO-□-OH. Glucose molecules can combine to form a polymer.

(i) What type of polymer is formed?

.....
(1)

(ii) Draw a diagram to represent this polymer.

(1)

Q4

(Total 10 marks)

--	--

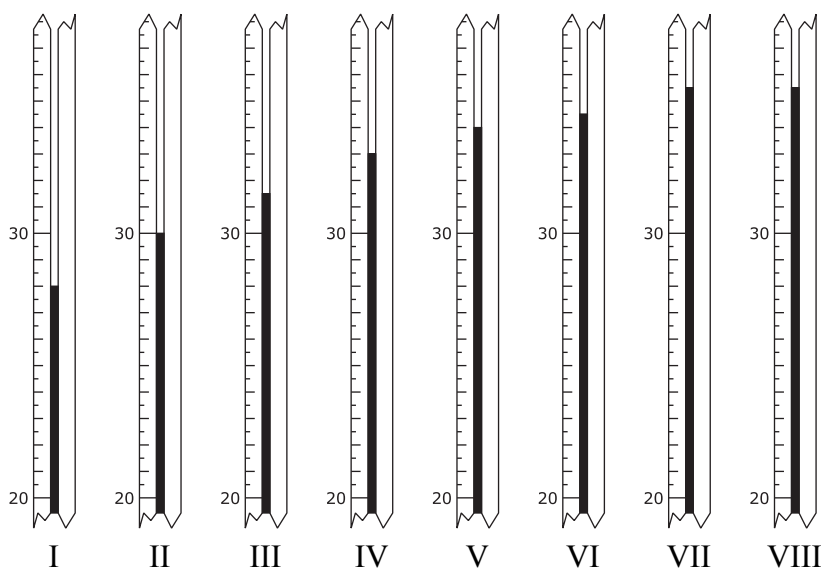


5. A series of experiments was carried out using hydrochloric acid of unknown concentration and sodium hydroxide solution of concentration 2 mol dm^{-3} .

Different proportions of hydrochloric acid and water were added to 25 cm^3 of sodium hydroxide in a polystyrene beaker, all at the same temperature. The following table shows the proportions used each time.

Experiment	Volume of hydrochloric acid of unknown concentration	Volume of water
I	0	35
II	5	30
III	10	25
IV	15	20
V	20	15
VI	25	10
VII	30	5
VIII	35	0

After stirring, the maximum temperature of the mixture was recorded. The readings on the thermometer are shown in the following diagram.



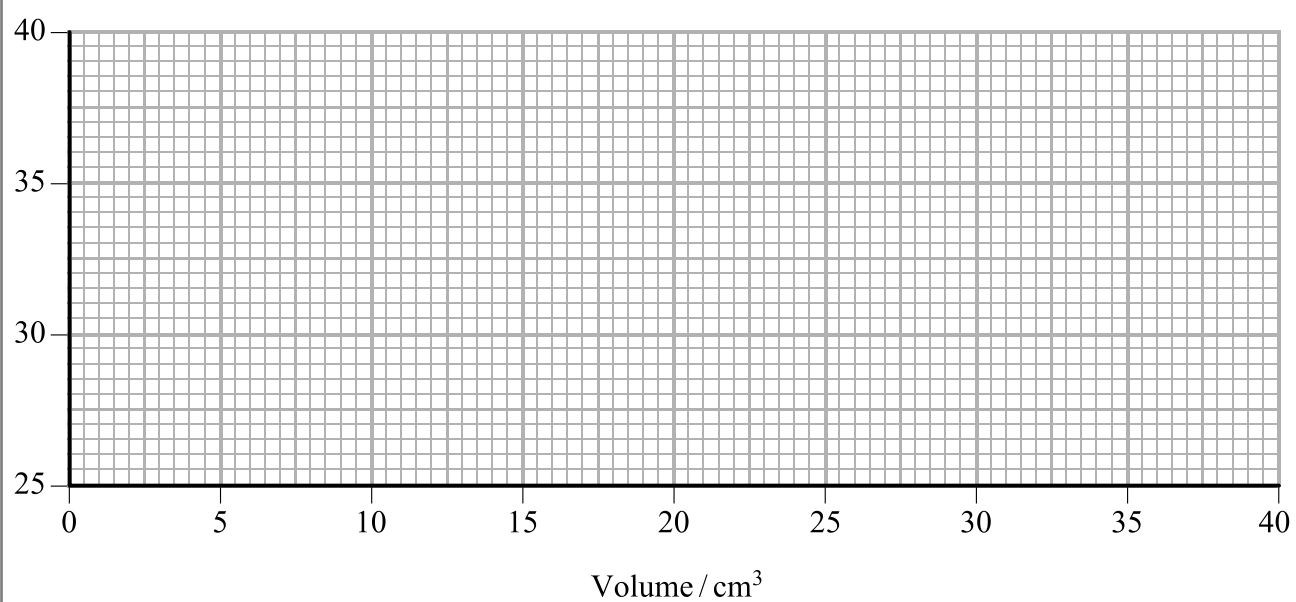
Leave
blank

(a) Draw a suitable table and record the thermometer readings with the corresponding volumes of hydrochloric acid.

(3)

(b) Plot a graph of temperature against volume of hydrochloric acid added.

Temperature / °C



(3)



Leave
blank

(c) Use the graph to estimate the volume of hydrochloric acid that reacted completely with 25 cm³ of sodium hydroxide solution and the temperature at the end point of the reaction.

(i) Volume of hydrochloric acid (1)

(ii) Temperature (1)

(d) Calculate the concentration of the hydrochloric acid in mol dm⁻³.

.....
.....
.....
..... (2)

(Total 10 marks)

Q5

TOTAL FOR SECTION A: 50 MARKS

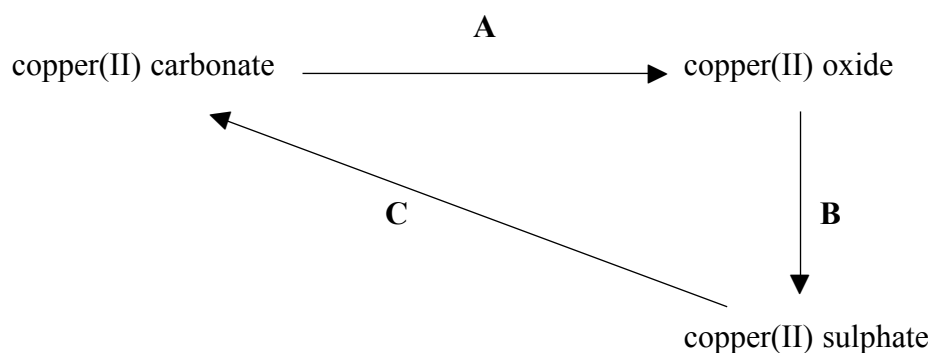


SECTION B

Answer TWO questions in this section. Where appropriate, equations and diagrams should be given to clarify your answers.

If you answer Question 6, put a cross in this box (☑).

6. The following diagram shows some reactions of copper(II) compounds.



(a) For each of the reactions, **A**, **B** and **C**:

- outline how you could carry out the reaction
- state any observations you would expect to make
- write a chemical equation.

Reaction **A**

.....

Reaction **B**

.....



Reaction C

.....
.....
.....
.....
.....

(12)

(b) How could you obtain metallic copper from copper(II) oxide and from copper(II) sulphate solution using chemical reactions (not electrolysis)?

For each starting material:

- give brief details of how you could carry out the reaction
- state any observations you would expect to make
- write a chemical equation.

Copper(II) oxide

.....
.....
.....
.....
.....

Copper(II) sulphate

.....
.....
.....
.....
.....

(8)



Leave
blank

(c) Briefly describe how impure copper can be purified by electrolysis and write an equation for the reaction that takes place at each electrode.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(5)

Q6

(Total 25 marks)

--	--



N 2 5 2 2 4 A 0 1 5 2 8

Leave
blank

BLANK PAGE



Leave
blank

If you answer Question 7, put a cross in this box (☒).

7. Describe how you would show that each of the following statements is true using the reactant(s) given. For each experiment you should include:

- what you would do
- what you would expect to observe
- an equation where a chemical reaction takes place.

(a) Statement: Some chemical reactions are reversible.
Reactant: Blue copper(II) sulphate crystals.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

(5)

(b) Statement: Increasing surface area increases the rate of a reaction.
Reactants: Calcium carbonate and dilute hydrochloric acid.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

(5)



(c) Statement: Non-metals form acidic oxides.
Reactant: Sulphur.

.....
.....
.....
.....
.....
.....
.....
.....

(5)

(d) Statement: Displacement reactions are exothermic.
Reactants: Magnesium and iron(II) sulphate solution.

.....
.....
.....
.....
.....
.....
.....
.....

(5)



Leave
blank

(e) Statement: Different gases diffuse at different rates.
Reactants: Concentrated ammonia solution and concentrated hydrochloric acid.

.....

.....

.....

.....

.....

.....

.....

.....

(5)

Q7

(Total 25 marks)

--	--



If you answer Question 8, put a cross in this box (☒).

8. (a) Pentane has the molecular formula C_5H_{12} , and the structural formula $CH_3CH_2CH_2CH_2CH_3$.

(i) Calculate the percentage by mass of carbon in pentane.

.....

(3)

(ii) Draw and name two other structural isomers which have the molecular formula C_5H_{12} .

(4)

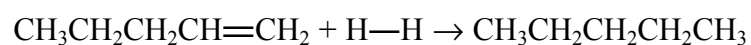
(iii) Name the homologous series to which pentane belongs. State the general formula for this series and give the molecular formula for the member which has 10 carbon atoms.

.....

(3)



- (b) Pent-1-ene has the structural formula $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2$. It can be converted to pentane by reaction with hydrogen.



Use the information in the following table to calculate the net energy change for this reaction and state whether the reaction is exothermic or endothermic.

Bond	Bond energy/kJ per mole of bonds
C—C	+346
C=C	+610
C—H	+413
H—H	+432

.....

.....

.....

.....

.....

.....

.....

.....

.....

(7)



Leave
blank

- (b) Give experimental details of how aluminium can be used in a thermite reaction to obtain a named metal from its ore. Describe any observations you would expect to make and write an equation for the reaction.

.....
.....
.....
.....
.....
.....
.....
.....

(5)

- (c) Aluminium reacts with oxygen to form aluminium oxide. State the electron configurations of the atoms and ions involved in this reaction. Give the formula of the two types of ions present in the oxide, and state the ratio in which these ions are formed.

.....
.....
.....
.....
.....
.....

(6)



Leave
blank

(d) Draw a diagram to show the metallic lattice of aluminium and explain how aluminium is able to conduct an electric current.

.....

.....

.....

.....

.....

.....

.....

.....

(5)

(Total 25 marks)

Q9

TOTAL FOR SECTION B: 50 MARKS

TOTAL FOR PAPER: 100 MARKS

END



BLANK PAGE



BLANK PAGE



N 2 5 2 2 4 A 0 2 7 2 8

