

Section B [20 marks]

Answer any **two** questions in this section.

Write your answers in the spaces provided.

8 Nitrogen, oxygen and argon gases can be extracted from compressed liquefied air (mixture of miscible liquids) at $-200\text{ }^{\circ}\text{C}$.

(a) (i) State the separation method used to obtain the gases separately at $-200\text{ }^{\circ}\text{C}$.

.....
[1]

(ii) Describe the changes in movement of the air particles as it is compressed and cooled from room temperature to $-200\text{ }^{\circ}\text{C}$.

.....
.....
[1]

(b) Oxygen is a reactive non-metal.

Describe, in terms of the number of electrons gained, lost or shared, what happens when

(i) an oxygen atom combines with magnesium atom(s).

.....
.....
[2]

(ii) an oxygen atom combines with fluorine atom(s).

.....
.....
[2]

(c) (i) Draw a 'dot-and-cross' diagram for nitrogen gas.

[2]

(ii) Draw a 'dot-and-cross' diagram for oxygen gas.

[2]

[Total: 10 marks]

9 (a) State **two** physical properties of copper metal.

Property 1:

Property 2:

[2]

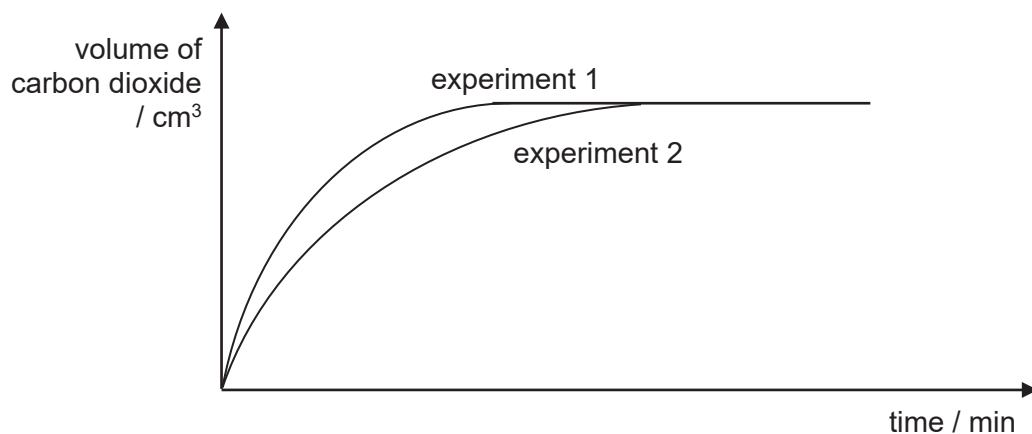
(b) Describe a way to prepare a pure sample of copper(II) sulfate crystals, from copper metal. Use the following information to help you

- copper does not react with dilute acids
- copper burns in oxygen to form a black solid, which is copper(II) oxide
- copper(II) oxide is insoluble in water
- copper(II) sulfate is soluble in water

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[4]

(c) 10 g of copper(II) carbonate lumps were reacted with excess 1.0 mol/dm³ hydrochloric acid and the carbon dioxide gas produced was collected. The experiment was repeated again but using excess 2.0 mol/dm³ hydrochloric acid. The graph of the data collected is plotted and shown below.



experiment 1: 10 g of copper(II) carbonate lumps with excess 2.0 mol/dm³ hydrochloric acid

experiment 2: 10 g of copper(II) carbonate lumps with excess 1.0 mol/dm³ hydrochloric acid

(i) State why the production of carbon dioxide gas stopped after a period of time.

..... [1]

- (ii) Use your knowledge of reacting particles to explain why a higher concentration of acid results in a faster rate of reaction.

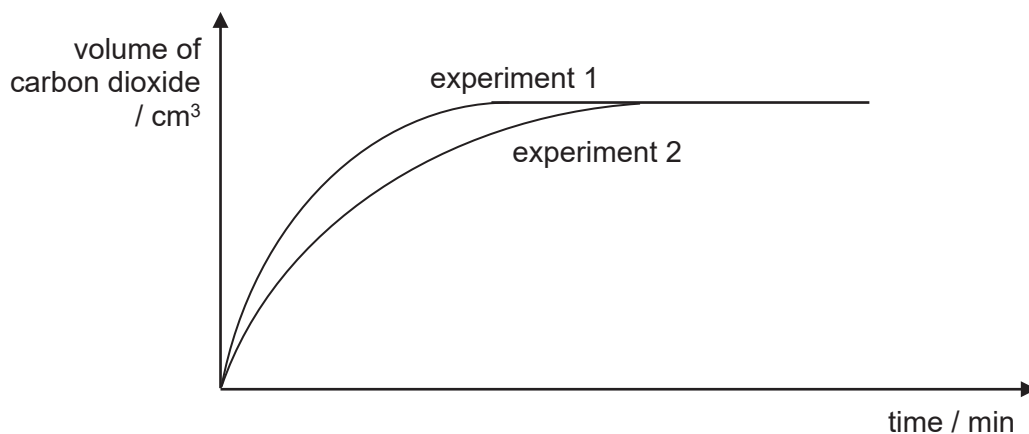
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[2]

- (iii) The experiment is repeated using 5 g of **powdered** copper(II) carbonate and excess 2.0 mol/dm^3 hydrochloric acid. Add to **Fig. 9.1** the graph you would expect. The original graphs are already included. Label the new graph as **3**.

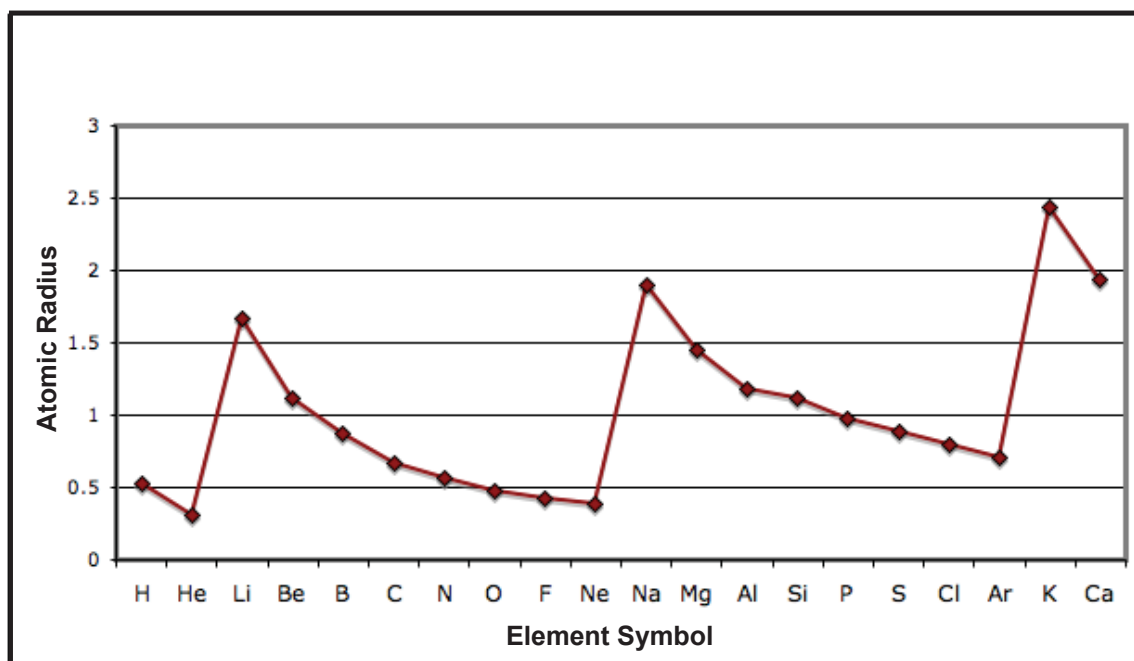


[1]

Fig. 9.1

[Total: 10 marks]

10 (a) The diagram below shows the atomic radius of the first 20 elements in the Periodic Table.



(i) Use the diagram above to describe the change in atomic radius **across** the Period and **down** the Group.

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 [2]

(ii) Describe the change in the character of the elements across Period 3 and how it affects the respective oxides formed.

.....
 [2]

(b) Lithium, potassium and sodium are Group I elements.
 State **one** physical property trend and **one** chemical property trend of these elements.

physical property trend

chemical property trend [2]

- (c) Describe a laboratory investigation that can be used to justify the relative positions of iron, magnesium and silver in the reactivity series. You may include a diagram if it helps you to answer the question.

Diagram

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[4]

[Total: 10 marks]

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