

Section B

For
Examiner's
Use

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

Write your answers in the spaces provided.

9 Read the information about chlorine.

Chlorine ranks among the top ten chemicals produced today. Chlorine is produced by passing an electric current through a concentrated solution of sodium chloride or through molten sodium chloride. This process is one of the most important commercial processes in industry. Chlorine, in one form or another, is added to most swimming pools, spas, and public water supplies because it kills bacteria that cause disease. Many people also use chlorine to bleach their clothes. Large paper and pulp mills use chlorine to bleach their products.

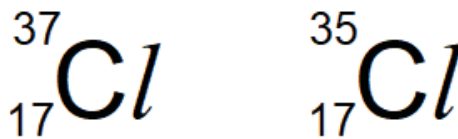
Two naturally occurring isotopes of chlorine exist, chlorine-35 and chlorine-37. Chlorine exists commonly both in the Earth's crust and in seawater as sodium chloride. Smaller amounts of potassium chloride and magnesium chloride also occur in seawater.

Chlorine is very reactive. The reaction between chlorine and other elements can often be vigorous. For example, chlorine reacts explosively with hydrogen to form hydrogen chloride.

- (a) The information contains examples of a mixture.
Identify **two** mixtures in the information.

..... [1]

- (b) The chemical symbols of the two chlorine isotopes are shown below.



Compare and contrast the structures of the nuclei in chlorine isotopes.

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

(c) Magnesium burns in chlorine gas to produce magnesium chloride.

(i) Complete Table 9.1 which gives information about the two ions in magnesium chloride.

Table 9.1

name of ion	number of protons	number of neutrons	number of electrons	electronic structure
magnesium ion	12			2,8
chloride ion	17	18		

[2]

(ii) Draw a 'dot' and cross diagram to show the arrangement of electrons in magnesium chloride. Show only outer shell electrons.

[2]

(d) Chlorine can react with hydrogen to form hydrogen chloride. Hydrogen chloride is a gas at room temperature.

(i) In terms of electrons, describe the bonding in hydrogen chloride.

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[1]

(ii) At room temperature, magnesium chloride is a solid while hydrogen chloride is a gas.

Use your knowledge of the bonding in magnesium chloride and hydrogen chloride to explain the difference in physical state.

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[2]

10 (a) Hydrochloric acid is used for rust removal while sodium hydroxide is used in detergents.

(i) State the colour of Universal Indicator in dilute hydrochloric acid and in aqueous sodium hydroxide.

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[2]

(ii) Explain briefly, in terms of ions in solution, the reason for the difference in acidity and alkalinity of hydrochloric acid and sodium hydroxide solutions.

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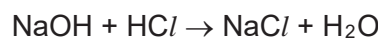
[2]

(iii) The reaction between hydrochloric acid and magnesium metal produces a soluble salt, magnesium chloride.
 Describe the steps to obtain a pure sample of magnesium chloride from the reaction.

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[4]

(b) In an experiment, 20.0 cm³ of 1.50 mol/dm³ sodium hydroxide exactly neutralised 25.0 cm³ of hydrochloric acid. Using the chemical equation provided for the reaction, calculate the concentration of the hydrochloric acid used.



[2]

- 11 (a) Fig. 11.1 shows the speed of reaction between calcium carbonate and hydrochloric acid in two different experiments.

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Experiment 1 was performed using 10 g of powdered calcium carbonate.
Experiment 2 was performed using 10 g calcium carbonate in lumps.

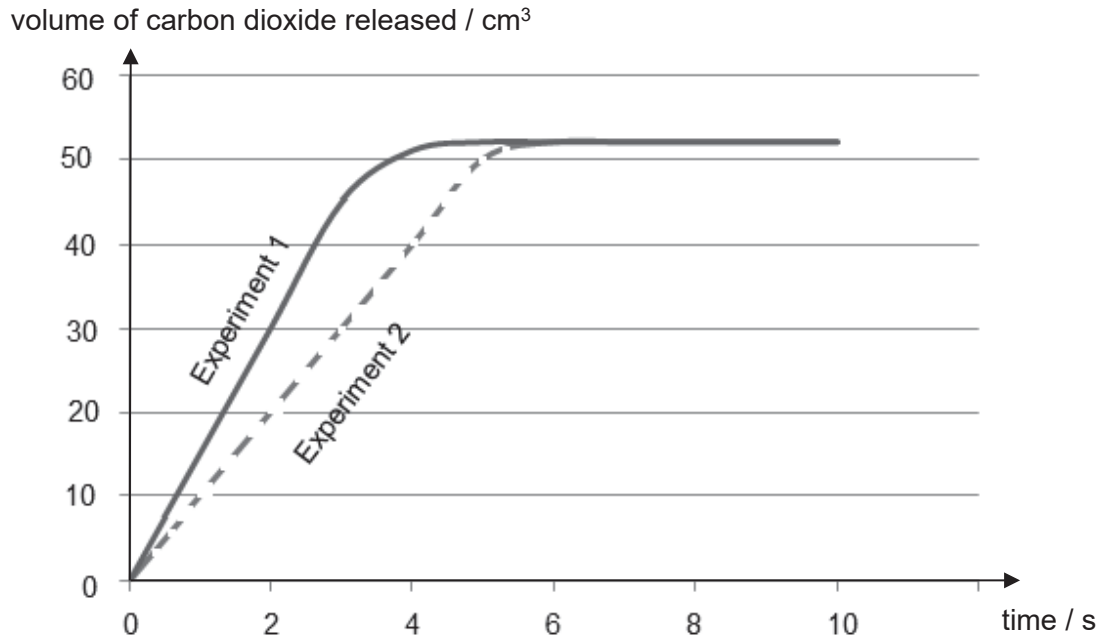


Fig. 11.1

- (i) Based on the graphs, compare the speed of reaction for the two experiments.

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[1]

- (ii) Use your knowledge of reacting particles to explain why the particle size of calcium carbonate affects the speed of reaction.

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[2]

- (iii) Write a balanced chemical equation, including state symbols, for the reaction between calcium carbonate and hydrochloric acid.

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[2]

(b) Sketch on Fig. 11.1 the speed of reaction for **5 g of powdered calcium carbonate**. Label this 'Experiment 3'. [1]

(c) The temperature of the mixtures increased during the reaction in both experiments 1 and 2.

(i) Suggest whether the reactions are exothermic or endothermic.

..... [1]

(ii) Explain in terms of bond breaking and bond forming for your answer in c (i).

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..... [2]

(iii) Suggest a method that can be used to accurately determine that all the acid has been used up during the reaction.

..... [1]

End of Paper