

Name:	Index Number:	Class:
-------	---------------	--------



HUA YI SECONDARY SCHOOL

Summative Review

3-G3
6092/1

Paper 1

2 October 2023

1 hour 45 minutes Paper 1 and 2

Candidates answer on the Multiple Choice Answer Sheet provided.
Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you have done.

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **twenty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

**For Examiner's
Use**

Paper 1

This document consists of **9** printed pages including the cover page.

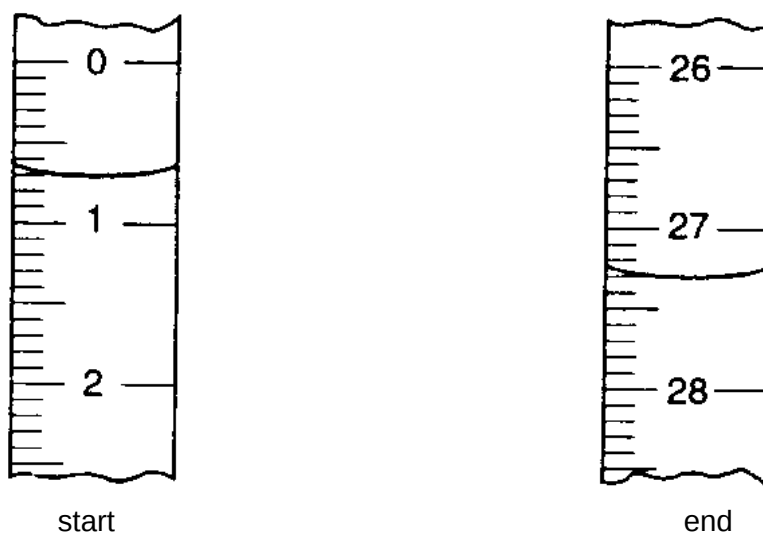
© HYSS 2023

No part of this document may be reproduced in any form or transmitted in any form or by any means without the prior permission of Hua Yi Secondary School.

[Turn Over

Setter: Ms Tok Peilin

- 1 The diagram shows the reading on a burette at the start and end of an experiment.



What volume of the liquid was removed from the burette?

- A** 25.80 cm³ **B** 26.60 cm³ **C** 27.40 cm³ **D** 28.20 cm³
- 2 Which of the following best describes a pure substance?
- A** A colourless solution obtained from filtration.
B A white solid with a density of 2 g/cm³.
C A white solid that does not dissolve in water or organic solvents.
D A yellow solid that melts at 60 °C.
- 3 The boiling point of water is 100 °C. The melting point of sodium chloride is 800 °C.
- What is the most likely boiling point of a sample of water that contains a small quantity of sodium chloride?
- A** 96 °C **B** 104 °C **C** 450 °C **D** 804 °C
- 4 Mercury is a liquid at 25 °C.

What is the melting point and the boiling point for mercury?

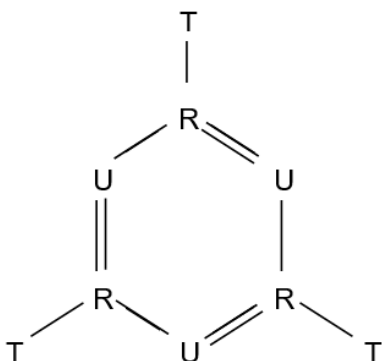
	melting point / °C	boiling point / °C
A	–39	357
B	–22	–3
C	–8	20
D	30	103

- 5 The solubility of three solids in two solvents, water and methylbenzene, is given in the following table.

solid	solubility in water	solubility in methylbenzene
P	insoluble	insoluble
Q	good	insoluble
R	insoluble	good

What method would be suitable for obtaining P from a mixture of the three solids?

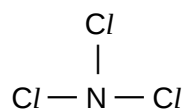
- A** Add methylbenzene and stir; then filter.
B Add methylbenzene and stir; then filter; then add the residue to water and stir; and then filter this mixture.
C Add water and stir; then filter; then add methylbenzene to the filtrate and stir; then evaporate the solvent.
D Add water and stir; then filter; then evaporate the filtrate to dryness.
- 6 Which statement about an atom is true?
- A** The proton number can be more than the nucleon number.
B The proton number of all atoms of an element is the same.
C The nucleon number cannot be equal to the proton number.
D The nucleon number cannot be equal to the number of electrons.
- 7 A stable molecule contains atoms of the elements R, T and U.



Which of the following is a possible combination of the elements?

	R	T	U
A	C	H	N
B	F	H	C
C	P	Si	O
D	Si	N	S

- 8** Nitrogen and chlorine atoms combine to form the molecule shown.



How many valence electrons are **not** shared in the molecule?

- | | | | |
|----------|----|----------|----|
| A | 3 | B | 6 |
| C | 18 | D | 20 |

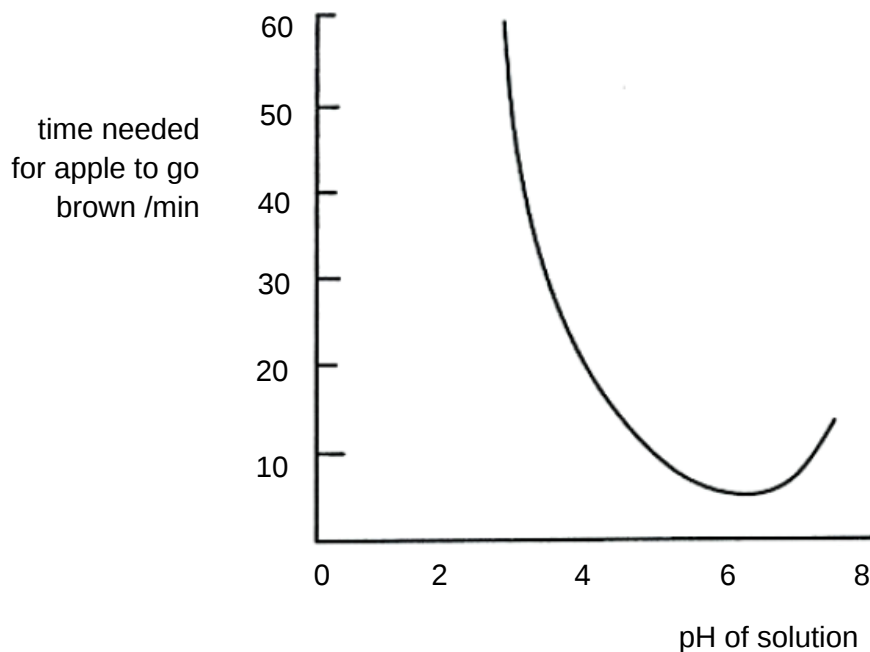
- 9 Salt ST is to be prepared by reacting the carbonate of S with the acid HT using titration.

What are the solubilities of the carbonate, acid and salt?

	carbonate of S	acid HT	salt ST
A	insoluble	soluble	insoluble
B	insoluble	soluble	soluble
C	soluble	insoluble	insoluble
D	soluble	soluble	soluble

- 10** Pieces of apples usually go brown when they are left in the air for a few minutes. In food-processing factories, it is important to stop this browning.

The graph shows how browning is controlled by the pH of a solution. To stop this browning, cut apples are contained in solutions with different pH.



Which of these solutions is most effective in preventing the browning of apples?

- A** citric acid, pH 4
- B** sodium hydrogencarbonate, pH 9
- C** sodium hydrogen sulfate, pH 3
- D** water, pH 7

- 11** A new indicator has just been produced in the laboratory. It changes colour at different pH range.

pH range	colour
0 – 2	yellow
3 – 6	blue
7 – 14	colourless

Which pair of substances can be distinguished by adding this indicator to each sample separately?

- A** aqueous ammonia and water
- B** aqueous ammonia and sodium hydroxide solution
- C** dilute ethanoic acid and water
- D** dilute hydrochloric acid and dilute sulfuric acid

- 12** An aqueous solution has a pH value of 1.

What information does this fact imply about the ions present in the solution?

	concentration of H^+ ions	concentration of OH^- ions
A	high	low
B	high	none
C	low	high
D	low	none

- 13** A student made four statements about elements, compounds and mixtures.

statement 1: Elements and compounds have fixed melting points.

statement 2: Mixtures can be separated into their components by physical means.

statement 3: Elements can exist as atoms or molecules.

statement 4: The properties of a compound are similar to that of its constituent elements.

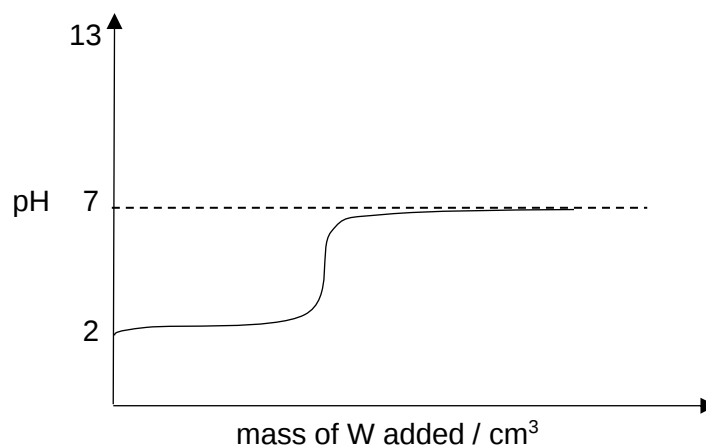
How many of the above statement(s) is/are incorrect?

- A** 1 **B** 2 **C** 3 **D** 4

14 Which statement about an alkali is incorrect?

- A** It reacts with a carbonate to form carbon dioxide.
- B** It reacts with an acid to form a salt.
- C** It reacts with an ammonium salt to form ammonia.
- D** It turns Universal Indicator blue.

15 An excess of substance W was added slowly, with stirring, to solution X. The pH changes of the mixture are shown in the graph.



What could W and X be?

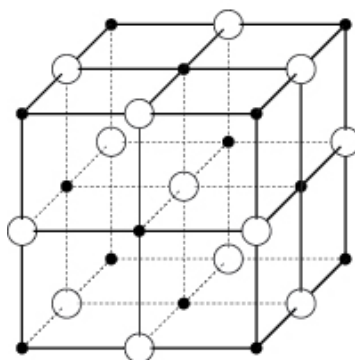
	W	X
A	insoluble metal oxide	dilute nitric acid
B	insoluble non-metal oxide	sodium hydroxide
C	soluble metal oxide	dilute nitric acid
D	soluble non-metal oxide	sodium hydroxide

16 Rat poison needs to be insoluble in rainwater, but soluble in the low pH of stomach contents.

Which is a suitable barium compound to use as rat poison?

- A** barium carbonate
- B** barium chloride
- C** barium nitrate
- D** barium sulfate

- 17 The diagram shows the arrangement of ions in a simplified structure.



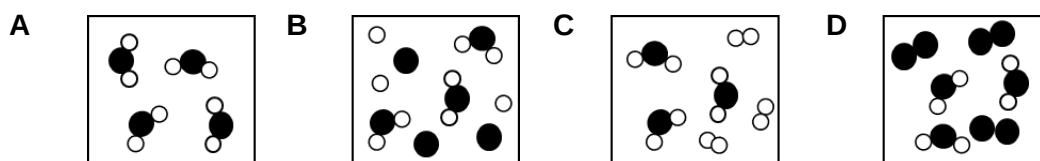
Which compound **do not** have this arrangement of its ions?

- A calcium oxide, CaO
 - B copper(II) sulfate, CuSO_4
 - C magnesium chloride, MgCl_2
 - D sodium chloride, NaCl
- 18 In a titration, 26.4 cm^3 of 0.2 mol/dm^3 aqueous calcium hydroxide was required to completely neutralise 19.0 cm^3 dilute hydrochloric acid.

What is the concentration of the acid used?

- A 0.28 mol/dm^3
 - B 0.36 mol/dm^3
 - C 0.56 mol/dm^3
 - D 0.84 mol/dm^3
- 19 30 cm^3 of hydrogen is mixed and burnt in 30 cm^3 of oxygen.

Which diagram represents the particles that remain in the reaction vessel?



- 20** 8 g of an oxide of element Z, Z_2O_3 , contains 5.6 g of Z.

How many moles of Z does 5.6 g of the element contain?

A $\frac{2.4}{16} \times \frac{2}{3}$

B $\frac{8}{16} \times \frac{2}{3}$

C $\frac{2.4}{16} \times \frac{3}{2}$

D $\frac{8}{16} \times \frac{3}{2}$

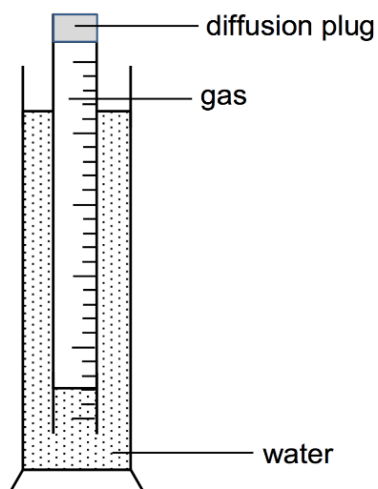
End of Paper

Section A

Answer **all** the questions in this section in the spaces provided.

The total mark for this section is **50**.

- 1 Fig. 1.1 shows an experimental set-up by a student to determine the rate of diffusion of gases. For this method to work, the gases must only diffuse through the diffusion plug.



The time taken for 100 cm³ of the different gases to diffuse through the diffusion plug is recorded in Table 1.2.

Table 1.2

gas	relative molecular mass	time taken for 100 cm ³ of gas to diffuse / s
ammonia	17	unable to determine
argon	40	51
carbon monoxide	28	32
methane	16	35
nitrogen	28	32

- (a) The student made a mistake in the time taken for one of the gases.

Identify the gas. Use the information in Table 1.2 to explain your reasoning.

.....

 [2]

- (b) Suggest why the rate of diffusion for ammonia cannot be determined.

..... [1]

- (c) In an industrial process, ammonia gas is condensed to liquid state.

Describe the arrangement and movement of ammonia in liquid state.

.....

..... [2]

[Total: 5]

- 2 Ethanol, $\text{C}_2\text{H}_5\text{OH}$, and propylene glycol, $\text{C}_3\text{H}_8\text{O}_2$, can be separated by the set-up shown in Fig. 2.1. Ethanol has a boiling point of 78°C and propylene glycol has a boiling point 188°C .

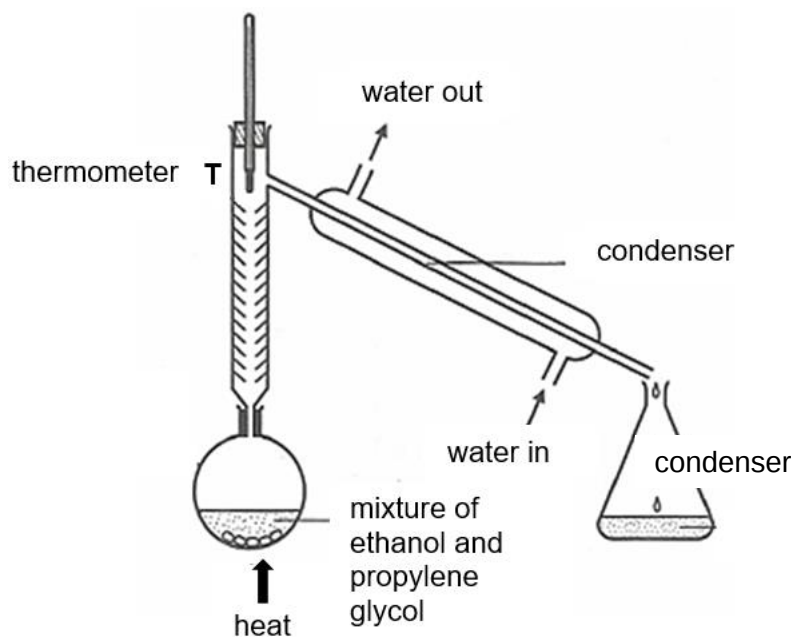


Fig. 2.1

- (a) (i) State the liquid which will be collected first.

..... [1]

- (ii) Explain why water must enter the condenser from the bottom.

.....

..... [1]

- (iii) Explain why the bulb of the thermometer is placed at point T.

.....

..... [1]

- (iv) The mixture of ethanol and propylene glycol was heated from 25 °C to 188 °C during the fractional distillation process.

Complete the graph to show how the temperature at point **T** changes over time. Indicate any key temperature on the graph.

temperature / °C



[2]

- (v) Suggest if this method is suitable for a mixture containing water and oil.

Explain your answer.

.....
 [1]

- (b) With reference to its structure and bonding, explain why ethanol has a low boiling point.

.....

 [2]

[Total: 8]

- 3 This table shows some information about atoms of the elements **W**, **X**, **Y** and **Z**.
(The letters do not represent the chemical symbols of the elements.)

element	atomic number	number of protons	number of neutrons	mass number	electronic configuration
W	16	16	16	32	2, 8, 6
X	7	7	7	14	2, 5
Y	2		2		
Z	11	11	12	23	2,8,1

- (a) Complete the table by filling in the information for element **Y**. [2]

- (b) Suggest which element is most likely to be a metal.

Explain your reasoning.

.....

 [2]

- (c) Describe the change in electronic configuration that occurs to an atom of element **W** when it forms an ion.

.....
 [1]

[Total: 5]

- 4 Fig.4.1 shows a set up to study the products formed when hydrochloric acid was added to zinc metal. A colourless solution and a gas are produced.

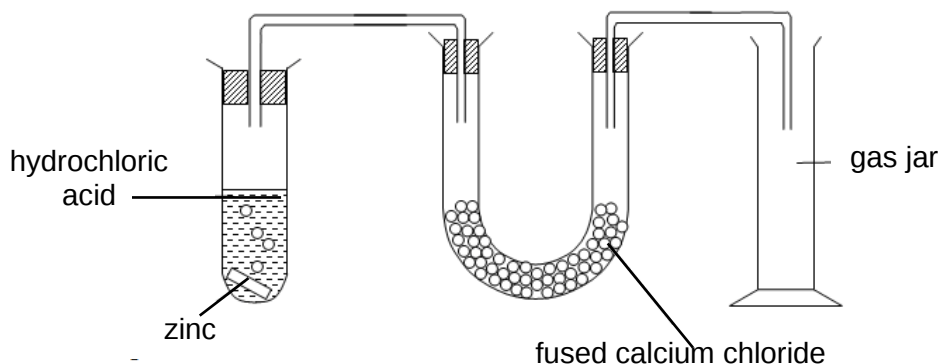


Fig. 4.1

- (a) (i) Write a balanced chemical equation, with state symbols, for the reaction between zinc and hydrochloric acid.

..... [2]

- (ii) Write the ionic equation for the reaction in **a(i)**.

..... [1]

- (b) Explain why the set-up is not suitable to collect the gas produced.

..... [1]

- (c) State the function of fused calcium chloride in the apparatus.

..... [1]

- (d) Describe how the observation will be different if ethanoic acid, of the same concentration and volume, was used instead.

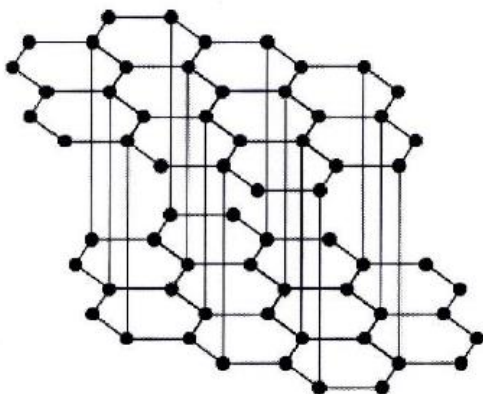
Explain your answer.

..... [3]

[Total: 8]

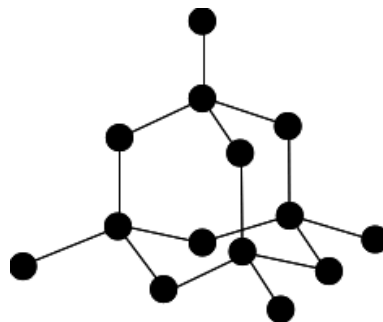
- 5 The structures of two substances, **M** and **N**, are shown in Fig. 5.1 and Fig. 5.2.

Both substances consist solely of carbon.



substance **M**

Fig. 5.1



substance **N**

Fig. 5.2

- (a) Predict and explain the electrical conductivity of substance **M**.

.....

.....

.....

..... [2]

- (b) (i) Suggest one industrial application of substance **N**.

..... [1]

- (ii) Explain your answer in (c)(i).

.....

.....

.....

..... [2]

- (c) Fullerene, C_{60} , is molecule that is formed from carbon atoms alone.

Suggest if fullerene has a simple or giant molecular structure.

..... [1]

[Total: 6]

- 6 The following procedure is an account of an experiment to prepare pure copper(II) sulfate crystals, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ from a given quantity of acid.

Only the first three steps of the procedure are given.

Procedure:

- 1 A measuring cylinder was used to transfer 100 cm^3 of a 2.00 mol/dm^3 acid solution to a beaker.
- 2 20.0 g of a copper compound was weighed out.
- 3 The acid was heated and the copper compound was added a little at a time, with stirring until the copper compound was present in excess.

- (a) Name the acid and a suitable copper compound to prepare copper(II) sulfate.

acid

copper compound [1]

- (b) (i) State a way to determine if the reaction between the reactants named in (a) is complete.

..... [1]

- (ii) Which measurement in the procedure was unnecessary?

..... [1]

- (iii) Explain why the acid was heated.

..... [1]

- (iv) Describe the **subsequent** steps of the procedure to obtain pure and dry copper(II) sulfate crystals.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

- (c) The mass of copper(II) sulfate crystals obtained was 4.0 g.

Suggest one way of modifying the experiment to obtain more than 4.0 g of copper(II) sulfate crystals with the same quantities of reactants.

.....

..... [1]

[Total: 8]

7 Read the information about aluminium metal.

Aluminium is a material often used to store commercial food products including soft drink and food cans.

According to the Aluminum Association, "...nearly 75 percent of all aluminum produced is still in use today." This reflects aluminium's recyclability as well as its ability to withstand corrosion.

Production of Aluminium Cans

The production of aluminium starts from the aluminium ore named bauxite which is a mixture containing aluminium oxide and other impurities. The main steps in the extraction of aluminium are shown in Fig 7.1.

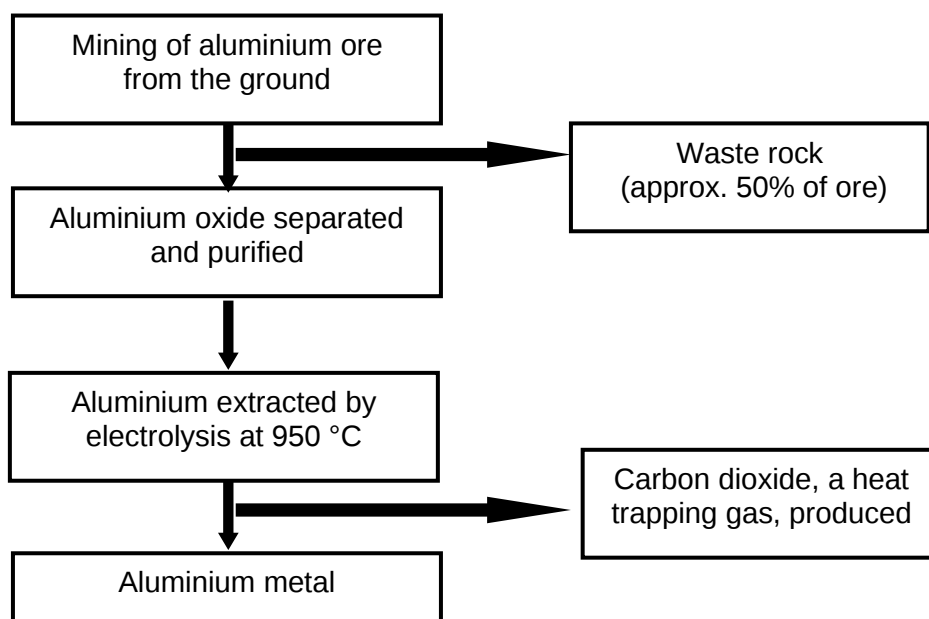


Fig. 7.1

Recycling Aluminium Cans

The used aluminium food and drink cans are often recycled. Recycling 1 kg of aluminium saves 14 kWh (kilowatt hours) of electricity.

- (a) Suggest why aluminium is commonly used as a material to store commercial food products.

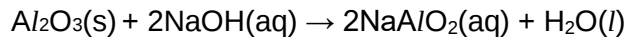
.....
 [1]

- (b) Bauxite contains between 15% and 25% aluminium.

How does this show that bauxite is a mixture and not a compound?

.....
 [1]

- (c) Aluminium oxide can react with sodium hydroxide.



State the nature of aluminium oxide in this reaction.

Explain your reasoning.

.....
 [2]

- (d) Use the information in Fig. 7.1 to suggest **two** benefits of recycling aluminium.

.....

 [2]

- (e) Calculate the electricity saved, in kilowatt hours (kWh), for **one mole** of aluminium recycled.

.....kWh [2]

- (f) Pure aluminium is rarely used for the construction of large objects. Small amounts of other metals are usually mixed with aluminium.

Explain why.

.....

 [2]

[Total: 10]

Section B

Answer **one** question from this section.

- 8** Magnesium is an element found in Group II of the Periodic Table. It can undergo different reactions with different elements. Some of the common magnesium compounds formed from reactions include magnesium chloride, magnesium oxide and magnesium silicide.

- (a)** Suggest a physical property that is common for all the three magnesium compounds listed above.

.....

[1]

- (b)** Magnesium has three stable isotopes magnesium-24, magnesium-25 and magnesium-26.

Elements can have unstable isotopes. The nuclei of these isotopes break up spontaneously and are said to disintegrate or decay. These isotopes are described as radioactive and are called radioisotopes.

The half-life of a radioisotope is the time taken for half a sample of radioactive material to decay, or to fall to half its original value. For example, iodine-135 has a half-life of 6.5. With 20 g of this isotope, 10 g will be left in 6.5 hours and 5 g will be left after 13 hours.

Fig. 8.1 shows the percentage abundance of the three stable magnesium isotopes.

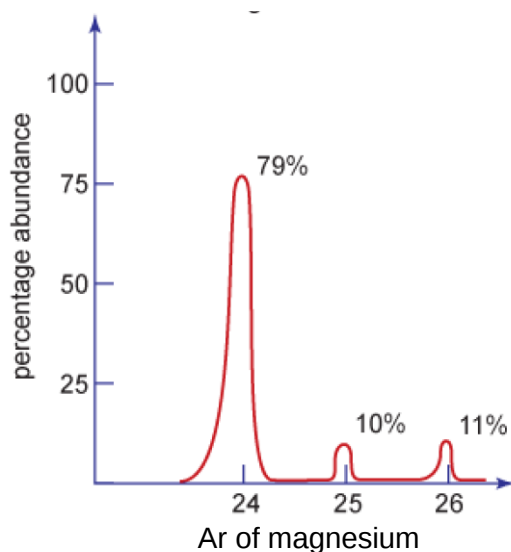


Fig. 8.1

- (i)** Use the information from Fig. 8.1 to calculate the relative atomic mass of magnesium.

[1]

- (ii) Magnesium has a radioactive isotope, magnesium-28, which has a half-life of 21 hours.

Calculate the mass of 2 g of magnesium-28 that remains after 84 hours.

[1]

- (iii) Explain why the various isotopes of magnesium show similar chemical properties.

[1]

- (c) A magnesium ribbon, magnesium-24, was heated in a crucible, which produced magnesium oxide.

The following data is given:

- mass of crucible + lid = 26.52 g
- mass of crucible + lid + magnesium = 27.72 g
- mass of crucible + lid + magnesium oxide = 28.52 g

Calculate the empirical formula of magnesium oxide

[3]

- (d) When magnesium is heated with silicon, magnesium silicide, Mg_2Si is formed. Magnesium silicide reacts with water to form silane, SiH_4 , and magnesium oxide.

Write a balanced equation for the reaction of magnesium silicide with water.

[1]

- (e) Draw a 'dot-and-cross' diagram for silane, SiH_4 , showing only the outer shell electrons.

[2]

- 9(a)** Chromium is a metal that is widely used for making stainless steel as well as a plating on car bodies to make cars corrosion resistant.

Chromium can be obtained from chromite, a chromium compound.

- (i) If chromite contains 46.4% chromium, 25.0% iron and oxygen only, calculate the empirical formula of chromite.

[3]

- (ii) 10 kg of chromite was obtained by miners from a mining site. The ore was sent for extraction and 3 kg of pure chromium sample was obtained.

Calculate the percentage purity of the chromite mined from the site.

[2]

- (b) An experiment was carried out to study the precipitation reaction between aqueous barium chloride, BaCl_2 , and aqueous potassium chromate(VI), K_2CrO_4 .

Seven test tubes of equal diameter were filled with 5.0 cm^3 of 0.5 mol/dm^3 potassium chromate (VI) solution. 0.5 mol/dm^3 of barium chloride was added into each test tube in incremental volumes. The test tubes were then shaken and left to stand in the rack before the height of precipitate in each test tube measured.

Table 9.1 shows the results of the experiment.

Table 9.1

test tube	1	2	3	4	5	6	7
volume of $\text{K}_2\text{CrO}_4 / \text{cm}^3$	5.0	5.0	5.0	5.0	5.0	5.0	5.0
volume of $\text{BaCl}_2 / \text{cm}^3$	1.0	2.0	3.0	4.0	5.0	6.0	7.0
colour of solution above precipitate	yellow	yellow	yellow	yellow	colourless	colourless	colourless
height of precipitate/ cm	0.3	0.6	0.9	1.2	1.5	1.5	

- (i) State the colour of potassium chromate(VI) solution.

..... [1]

- (ii) Name the precipitate formed.

..... [1]

- (iii) To allow for a fair comparison of the results obtained, some factors were kept constant.

State one factor that was kept constant.

..... [1]

- (iv) Predict the height of the precipitate in test tube 7.

Explain your answer.

.....

 [2]

[Total: 10]

End of Paper