Paper Reference(s) **1CH0/1F**

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Chemistry

Paper 1
Foundation Tier

Thursday 16 May 2019 – Morning

Time: 1 hour 45 minutes plus your additional time allowance

INSTRUCTIONS TO CANDIDATES
Write your centre number, candidate number, surname, other names and your signature in the boxes below. Check that you have the correct question paper.

Centre No.						
Candidate No.						
Surname						
Other names						
Signature						
Paper Reference	1	C	H	0	/	1	F

- **Use BLACK ink or ball-point pen.**
- **Answer ALL questions.**
- **Answer the questions in the spaces provided – there may be more space than you need.**
- **Any diagrams may NOT be accurately drawn, unless otherwise indicated.**
- **You must SHOW ALL YOUR WORKING OUT with YOUR ANSWER CLEARLY IDENTIFIED at the END OF YOUR SOLUTION.**

MATERIALS REQUIRED FOR EXAMINATION
Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS
Periodic Table

(Continues on next page)

INFORMATION FOR CANDIDATES

- The total mark for this paper is 100.
- The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.
- In questions marked with an ASTERISK (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- Candidates may use a calculator.

ADVICE TO CANDIDATES

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

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

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The three states of matter are solid, liquid and gas.

(a) What is the name of the change of state when a liquid changes into a solid? (1 mark)

☐ **A condensation**

☐ **B evaporation**

☐ **C freezing**

☐ **D melting**

(Question continues on next page)

(b) A gas was left to cool to form a liquid.

Figure 1 shows how the temperature of the substance changed with time.

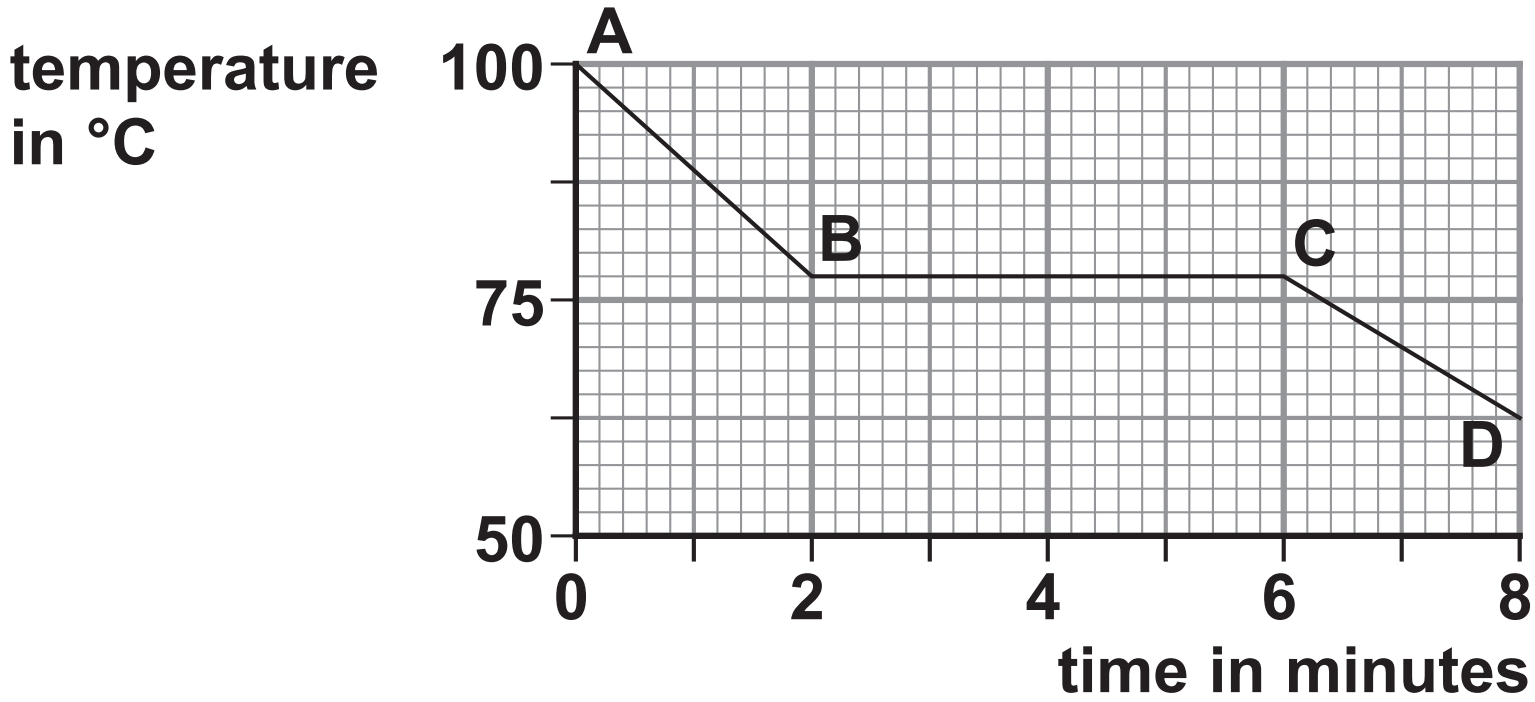


Figure 1

(Question continues on next page)

From A to B the substance is a gas.

From C to D the substance is a liquid.

(i) State the time when the gas first started to form a liquid. (1 mark)

_____ minutes

(ii) Calculate the number of minutes it took from the gas first starting to form a liquid until the substance was completely liquid. (1 mark)

_____ minutes

(Question continues on next page)

(c) Figure 2 shows the melting points and boiling points of four substances, W, X, Y and Z.

substance	melting point in °C	boiling point in °C
W	−220	−188
X	−101	−34
Y	−7	59
Z	114	184

Figure 2

Using the information in Figure 2

(i) give the letter of the substance that is a solid at 20 °C (1 mark)

_____

(ii) give the letter of a substance that is a liquid at 50 °C (1 mark)

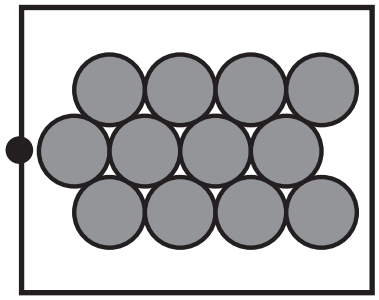
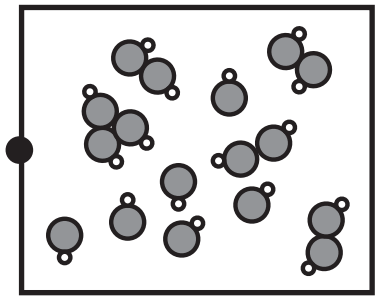
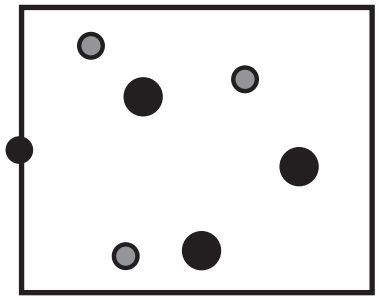
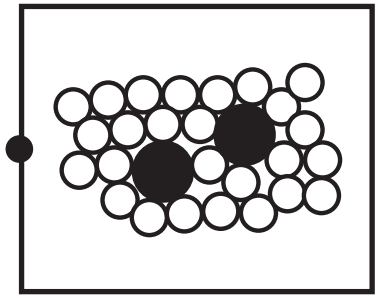
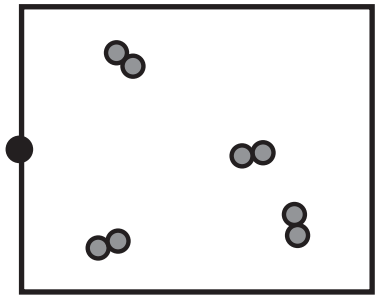
_____

(Question continues on next page)

(d) The diagrams on page 9 show particles in five different structures. The different circles show different particles.

Draw one straight line from each substance to its structure. (2 marks)

(Question continues on next page)

substance	particles in structures
solid zinc metal, Zn(s)	
	
	
hydrogen gas, $H_2(g)$	
	

(TOTAL FOR QUESTION 1 = 7 MARKS)

(Questions continue on next page)

(Turn over)

2 Alloys are mixtures of two or more metals.

(a) Alloy steels are formed when other metals are mixed with iron.

Cutlery is made of stainless steel.

Give TWO reasons why cutlery is made of stainless steel rather than iron. (2 marks)

1 _____

_____

_____

2 _____

_____

_____

(Question continues on next page)

(b) Brass is an alloy of copper.

Figure 3 shows the brass pins of an electric plug.

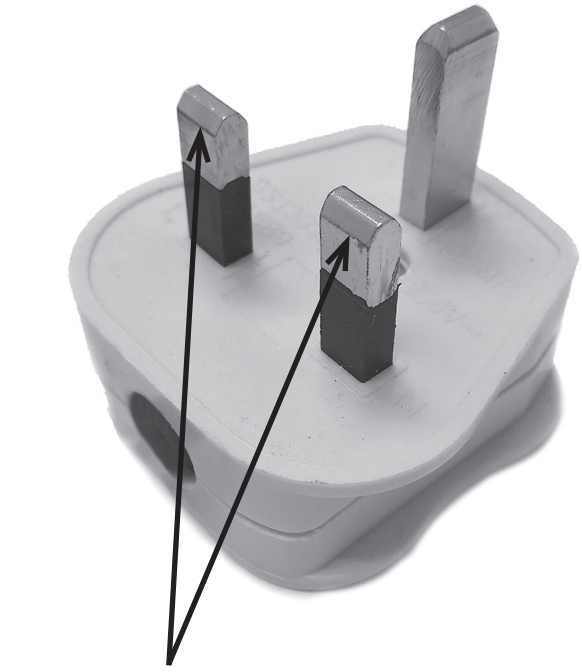


Figure 3

(Question continues on next page)

Brass is harder than copper.

Give a reason why using a harder substance for the pins is an advantage. (1 mark)

(Question continues on next page)

(c) Magnalium is an alloy of magnesium and aluminium.
It is often used for aircraft parts.

(i) Figure 4 shows information about pure aluminium and magnalium.

substance	density in $g\,cm^{-3}$	relative strength	resistance to corrosion
aluminium	2·7	low	high
magnalium	2·0	high	very high

Figure 4

(Question continues on next page)

Explain, using the information in Figure 4, why magnalium, rather than pure aluminium, is used for aircraft parts. (3 marks)

(Question continues on next page)

(ii) 63·0 g of magnalium contains 3·15 g of magnesium.

Calculate the percentage by mass of magnesium in the magnalium. (2 marks)

percentage of magnesium in the magnalium = _____

(TOTAL FOR QUESTION 2 = 8 MARKS)

(Questions continue on next page)

3 (a) Transition metals and group 1 metals have many properties in common because they are all metals.

However some properties of transition metals are different from properties of group 1 metals.

Which is a property of transition metals but not of group 1 metals? (1 mark)

☐ A good conductor of electricity

☐ B high melting point

☐ C malleable

☐ D shiny when cut or polished

(Question continues on next page)

(b) Copper is a transition metal.

Magnesium reacts with copper sulfate solution to form copper and a solution of magnesium sulfate.

Magnesium sulfate solution is colourless.

Describe TWO changes you would SEE during this reaction. (2 marks)

1 _____

_____

_____

2 _____

_____

_____

(Question continues on next page)

(c) Rusting is the corrosion of iron.

(i) Water is one of two substances needed for iron to rust.

Give the name of the OTHER substance needed for iron to rust. (1 mark)

(Question continues on next page)

(ii) The rate of rusting can be increased by using sea water.

Describe a simple experiment to compare how much an iron nail rusts in sea water when compared to water. (3 marks)

(Question continues on next page)

(iii) Rusting can be prevented by galvanising iron which involves coating the iron with a layer of zinc.

A small iron bucket was galvanised. The surface area of the bucket was $0{\cdot}68\,m^2$.

Calculate the mass of zinc required to coat the surface of the bucket with a layer of zinc of $200\,g\,m^{-2}$.
(1 mark)

mass of zinc = _____ g

(TOTAL FOR QUESTION 3 = 8 MARKS)

(Questions continue on next page)

4 Mixtures of substances can be separated using different techniques.

(a) Which of the following is a mixture of substances? (1 mark)

- ☐ **A air**
- ☐ **B carbon dioxide**
- ☐ **C gold**
- ☐ **D titanium**

(Question continues on next page)

(b) Figure 5 shows the apparatus that a student set up to obtain pure water from ink.

There are three mistakes in the way the apparatus has been set up.

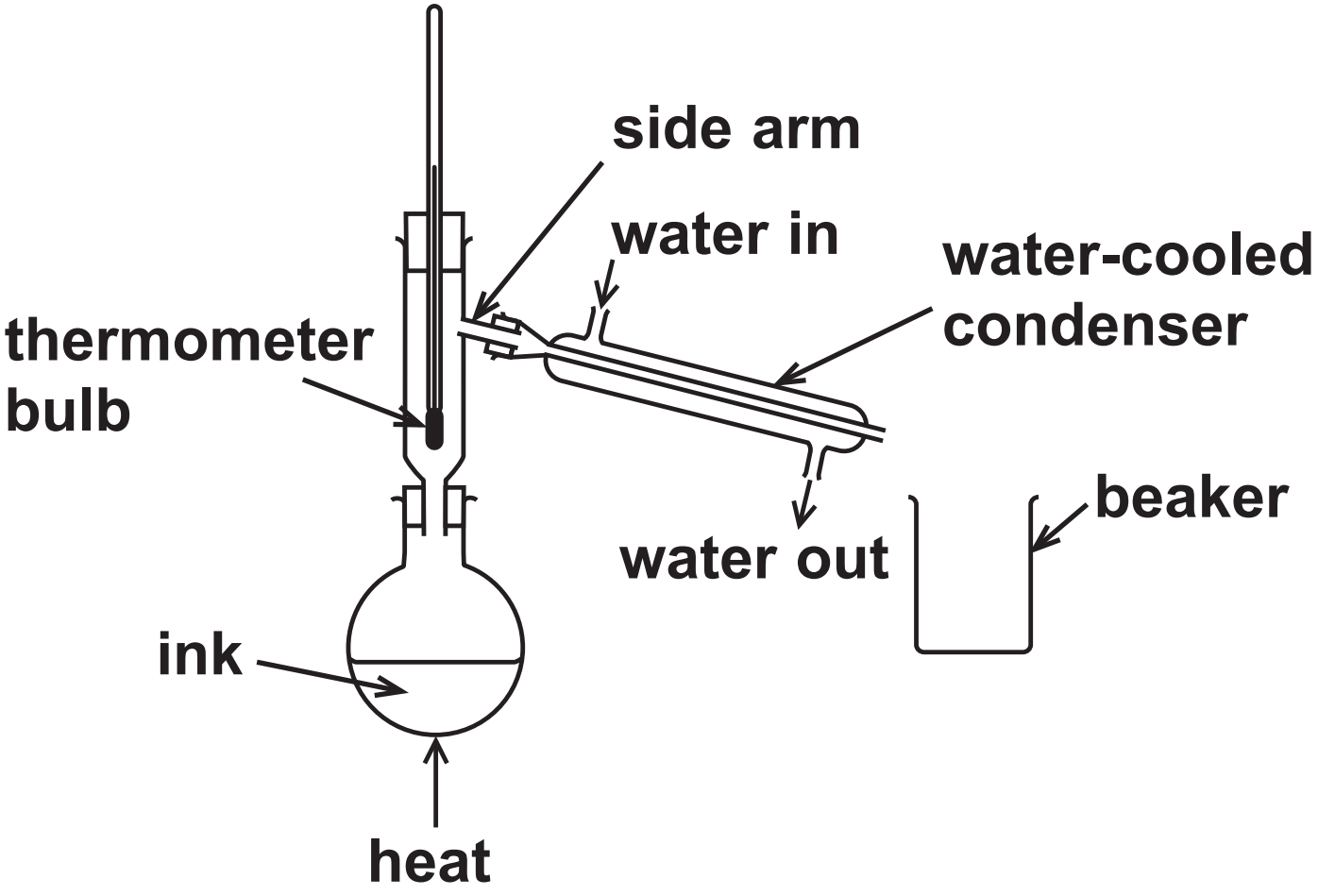


Figure 5

(Question continues on next page)

(i) One mistake is that the bulb of the thermometer is too low.

The bulb of the thermometer should be level with the side arm.

Give a reason why the bulb of the thermometer should be level with the side arm. (1 mark)

(Question continues on next page)

(ii) State ONE other mistake in Figure 5. (1 mark)

_____

_____

_____

(Question continues on next page)

(c) Paper chromatography is used to separate the substances in five different food colourings, P, Q, R, S and T.

Figure 6 shows the chromatogram at the end of the experiment.

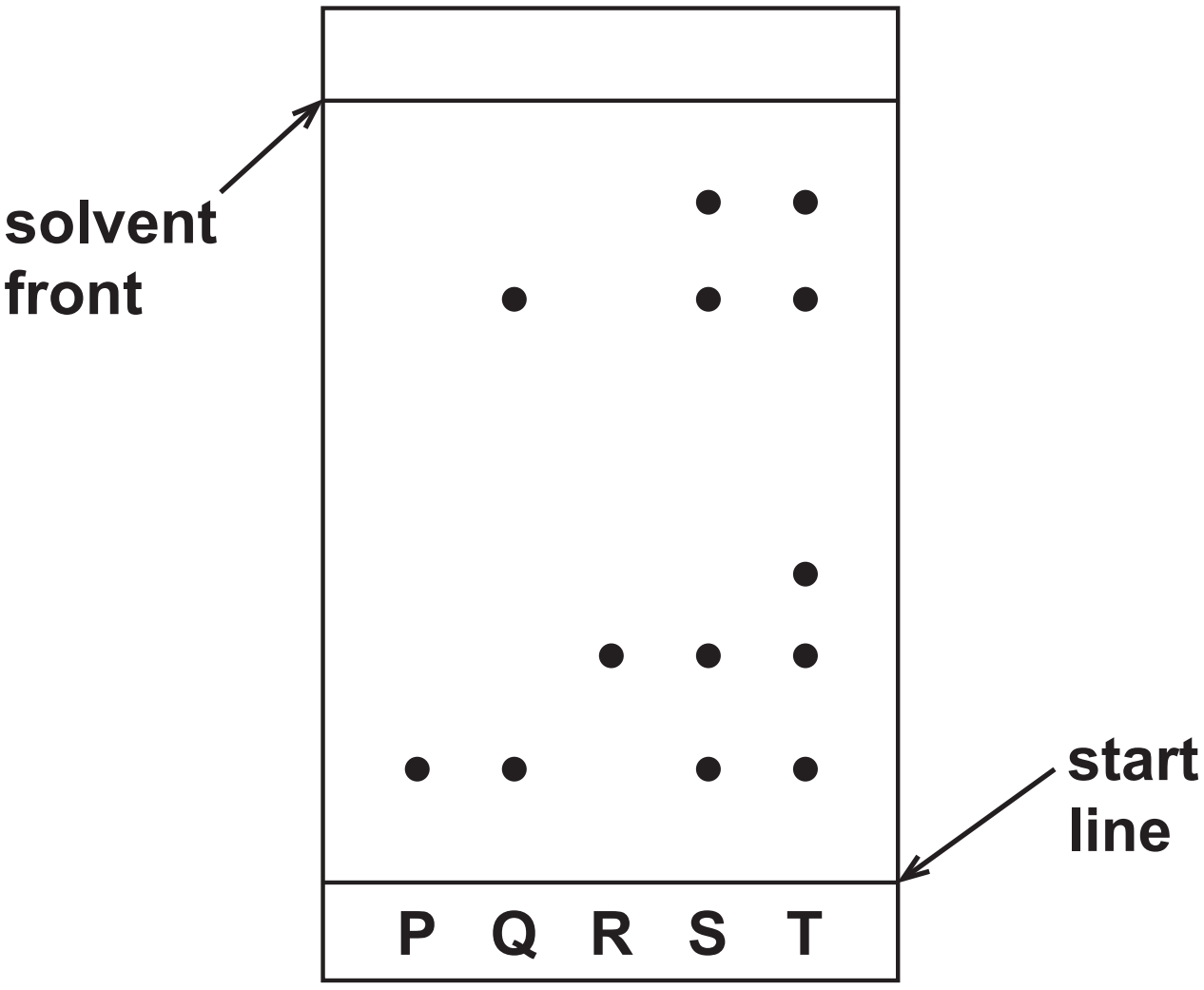


Figure 6

(Question continues on next page)

(i) The steps needed to carry out the chromatography experiment are listed below.
They are not in the correct order.

1 leave the solvent to rise up the paper

2 put solvent in the beaker

3 draw a start line on the piece of paper

4 place the paper in the beaker

5 remove the paper when the solvent is near the top

6 put small spots of the food colourings on the start line

List the steps in the correct order.

The first two steps have been done for you. (2 marks)

2	3				

(Question continues on next page)

(ii) Explain, using Figure 6, which food colouring contains the greatest number of coloured substances. (2 marks)

(Question continues on next page)

(iii) During chromatography of the food colourings, the solvent front moved 8·00 cm and the food colouring R moved 2·30 cm.

Calculate the R_f value for food colouring R.
Give your answer to two significant figures. (2 marks)

R_f value = _____

(TOTAL FOR QUESTION 4 = 9 MARKS)

(Questions continue on next page)

5 (a) The reactivity of copper, magnesium and zinc was investigated.
Each metal was placed separately in dilute hydrochloric acid.
The amount of effervescence was observed.

(i) The same mass of metal was used in each experiment.
Which piece of apparatus should be used to find the mass of metal used? (1 mark)

☐ A a balance

☐ B a pipette

☐ C a stopwatch

☐ D a thermometer

(Question continues on next page)

(ii) State TWO variables, apart from the mass of the metals, that should be controlled in this investigation. (2 marks)

1 _____

_____

_____

2 _____

_____

_____

(Question continues on next page)

(iii) Magnesium produces the most vigorous effervescence. Copper does not produce any effervescence.

Give the reason why copper does not produce any effervescence. (1 mark)

_____

_____

(Question continues on next page)

(iv) The magnesium reacts with dilute hydrochloric acid to form magnesium chloride solution and hydrogen gas.

The equation for the reaction is

$$Mg(s) + 2HCl(aq) \longrightarrow MgCl_2(\_\_\_\_\_) + H_2(\_\_\_\_\_)$$

Fill in the missing state symbols in the spaces provided. (2 marks)

(b) Potassium carbonate reacts with dilute sulfuric acid to form potassium sulfate.

(i) Potassium sulfate contains potassium ions, K^+, and sulfate ions, SO_4^{2-}.

Write the formula of potassium sulfate. (1 mark)

_____

(Question continues on next page)

(ii) Equal volumes of a solution of potassium carbonate were reacted separately with an excess of dilute sulfuric acid solution. Pure dry samples of potassium sulfate were obtained from the resulting solutions.

The experiment was repeated three times using the same conditions.

The masses of potassium sulfate obtained were

experiment 1 = 5·22 g

experiment 2 = 5·24 g

experiment 3 = 5·21 g

(Question continues on next page)

Calculate the mean mass of potassium sulfate obtained, giving your answer to two decimal places. (2 marks)

mean mass of potassium sulfate = _____ g

(TOTAL FOR QUESTION 5 = 9 MARKS)

(Questions continue on next page)

6 Metals are extracted from substances naturally occurring in the Earth's crust.

(a) Which of these metals is usually found uncombined in the Earth's crust? (1 mark)

☐ A calcium

☐ B gold

☐ C iron

☐ D magnesium

(Question continues on next page)

(b) Zinc can be extracted by heating zinc oxide with carbon.

The products are zinc and carbon dioxide.

(i) Write the word equation for this reaction. (2 marks)

_____

_____

_____

(ii) In this reaction zinc oxide loses oxygen.

State the type of reaction taking place when an oxide loses oxygen. (1 mark)

_____

(Question continues on next page)

(c) Aluminium is extracted from aluminium oxide by electrolysis. Aluminium oxide is made up of ions.

(i) The formula of aluminium oxide is Al_2O_3.

Give the number of ions in the formula Al_2O_3. (1 mark)

_____

(ii) Complete the balanced equation for the overall reaction by putting numbers in the spaces. (2 marks)

$2Al_2O_3 \longrightarrow$ _____ Al + _____ O_2

(Question continues on next page)

(d) (i) The environmental impact of a product is assessed in a life-cycle assessment.

The stages in this assessment are given below.
They are not in the correct order.

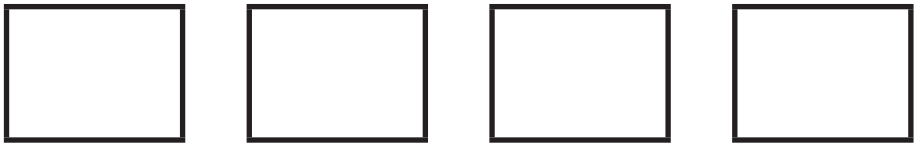
A disposal of the product

B manufacturing the product

C obtaining and processing the raw materials

D using the product

List the stages of the life-cycle assessment, using letters A, B, C, D, in the correct order from start to finish. (2 marks)



(Question continues on next page)

(ii) **Aluminium can be obtained by recycling aluminium waste.**

Give TWO advantages of obtaining aluminium by recycling aluminium waste rather than mining the raw material and extracting aluminium from that raw material. (2 marks)

1 _____

_____

_____

2 _____

_____

_____

(TOTAL FOR QUESTION 6 = 11 MARKS)

(Questions continue on next page)

7 (a) Fertilisers contain compounds that promote plant growth.

(i) State the name of an element in these compounds that promotes plant growth. (1 mark)

_____

(ii) Potassium nitrate is present in some fertilisers.

Potassium nitrate is formed by the reaction of potassium hydroxide solution with nitric acid.

Complete the balanced equation for this reaction. (2 marks)

$KOH + HNO_3 \longrightarrow$

_____ + _____

(Question continues on next page)

(b) In the Haber process, hydrogen and nitrogen react to form ammonia.

hydrogen + nitrogen $\rightleftharpoons$ ammonia

(i) The $\rightleftharpoons$ symbol in the word equation shows that the reaction goes forwards and backwards at the same time.

Give the name of this type of reaction. (1 mark)

_____

(ii) State the formula of a molecule of ammonia. (1 mark)

_____

(Question continues on next page)

(iii) Figure 7 shows a graph of world ammonia production, in millions of tonnes, from 1945 to 2015.

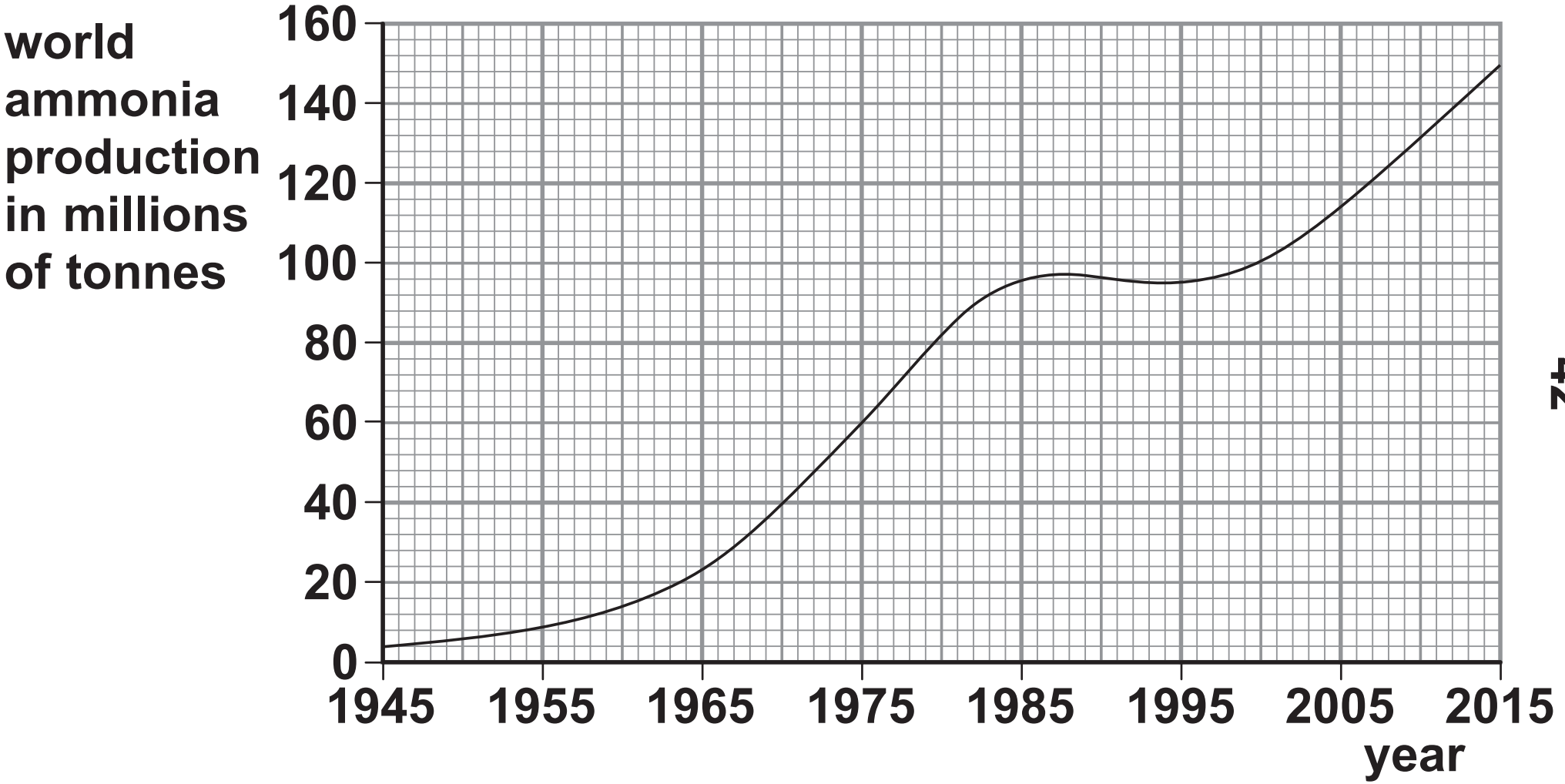


Figure 7

(Question continues on next page)

State the overall trend in world ammonia production from 1945 to 2015. (1 mark)

(c) Hydrogen can also be used in a hydrogen-oxygen fuel cell.

Give the name of the product formed in this fuel cell. (1 mark)

(Question continues on next page)

*(d) Ammonia solution and dilute sulfuric acid are used to prepare pure, dry ammonium sulfate crystals.

In an experiment a titration is carried out to determine the volumes of ammonia solution and dilute sulfuric acid that react together.
Then an ammonium sulfate solution is prepared from which the pure, dry crystals are obtained.

Describe in detail, using suitable apparatus, how this experiment should be carried out. (6 marks)

(Continue your answer on next page)

(Continue your answer on next page)

(Continue your answer on next page)

(Continue your answer on next page)

(Continue your answer on next page)

(TOTAL FOR QUESTION 7 = 13 MARKS)

(Questions continue on next page)

8 In Figure 8, the letters A, E, G, J, X and Z show the positions of six elements in the periodic table.

These letters are not the symbols of the atoms of these elements.

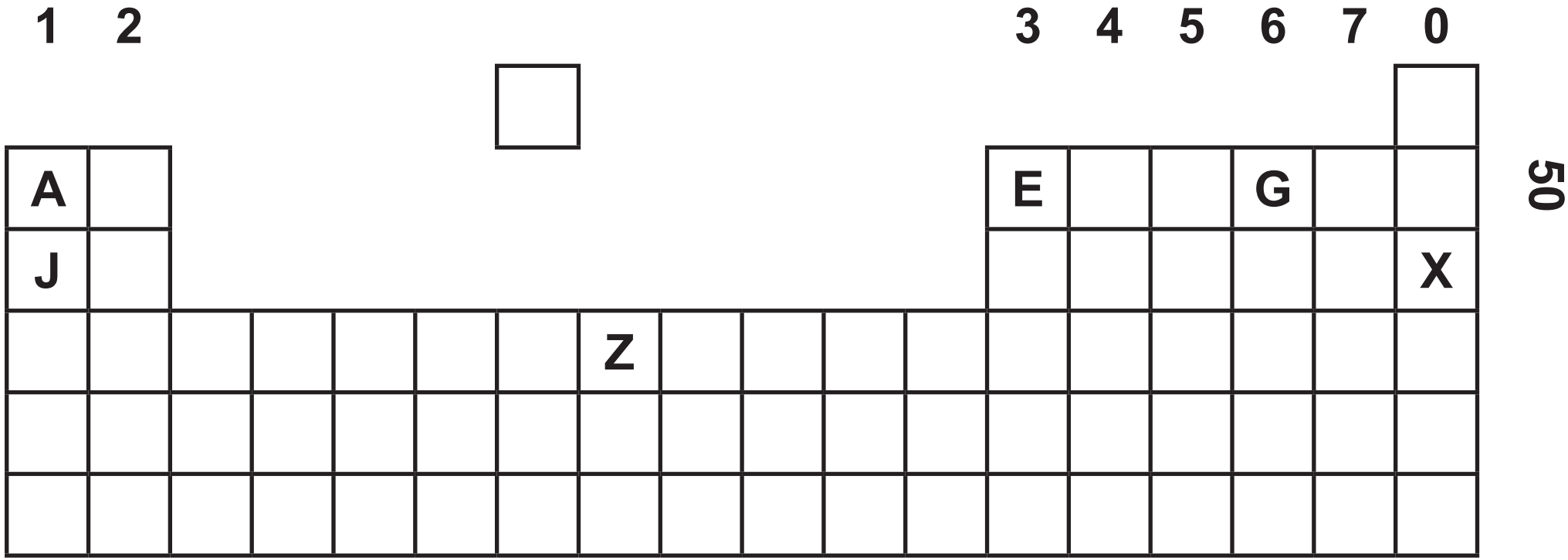


Figure 8

(a) Using the letters A, E, G, J, X and Z

(i) give the letters of the TWO elements that are non-metals (1 mark)

_____

(ii) give the letters of TWO elements in period 2 (1 mark)

_____

(iii) give the letter of an element that normally forms an ion with a charge of +1. (1 mark)

_____

(Question continues on next page)

(b) Element E has an atomic number of 5. In a sample of E there are two isotopes. One isotope has a mass number of 10 and the other isotope has a mass number of 11.

(i) Explain, in terms of subatomic particles, what is meant by the term ISOTOPES. (2 marks)

(Question continues on next page)

(ii) All atoms of element E in this sample contain (1 mark)

☐ A 5 protons

☐ B 5 neutrons

☐ C 6 protons

☐ D 6 neutrons

(Question continues on next page)

(c) Element X has an atomic number of 18.

State the electronic configuration of an atom of element X. (1 mark)

(d) In an experiment, 3·5 g of element A reacted with 4·0 g of element G to form a compound.

Calculate the empirical formula of this compound.
(relative atomic masses: A = 7, G = 16)

You must show your working.
(3 marks)

(Continue your answer on next page)

empirical formula of this compound = _____

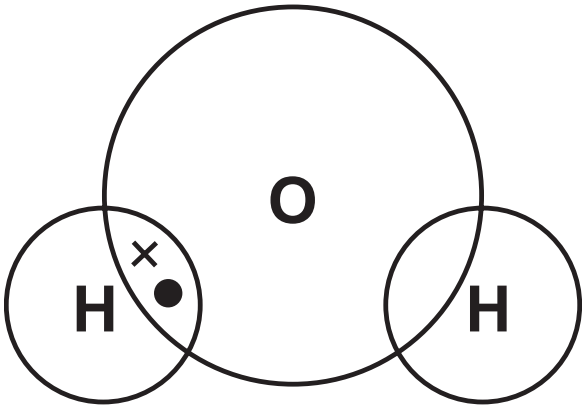
(Question continues on next page)

(e) An oxygen atom has six electrons in its outer shell.

A hydrogen atom has one electron in its outer shell.

Complete the dot and cross diagram of a molecule of water, H_2O.

Show outer shell electrons only.
(2 marks)



(TOTAL FOR QUESTION 8 = 12 MARKS)

(Questions continue on next page)

9 (a) Water, acidified with sulfuric acid, is decomposed by electrolysis.
The water is decomposed to produce hydrogen and oxygen.

(i) A sample of hydrogen is mixed with air and ignited.

State what would happen.
(1 mark)

(Question continues on next page)

(ii) Throughout the experiment the volume of hydrogen and the volume of oxygen are measured at two-minute intervals.

The results are shown in Figure 9.

time in minutes	volume of hydrogen in cm^3	volume of oxygen in cm^3
0	0	0
2	4	2
4	8	4
6	12	6
8	16	8

Figure 9

(Question continues on next page)

Describe, using the data in Figure 9, what the results show about the volumes of hydrogen and of oxygen produced in this experiment. (2 marks)

(Question continues on next page)

(b) Molten lead bromide is electrolysed.

The products of this electrolysis are (1 mark)

☐ A hydrogen and bromine

☐ B hydrogen and oxygen

☐ C lead and bromine

☐ D lead and oxygen

(Question continues on next page)

(c) Calcium nitrate and calcium carbonate are both ionic compounds.

Calcium nitrate mixed with water behaves as an electrolyte.
Calcium carbonate mixed with water does not behave as an electrolyte.

Explain, in terms of solubility and movement of ions, this difference in behaviour. (2 marks)

(Question continues on next page)

*(d) Impure copper can be purified using electrolysis.

In this electrolysis

- the anode is made of impure copper
- the cathode is made from pure copper
- the electrolyte is copper sulfate solution.

The apparatus at the start of the experiment is shown in Figure 10.

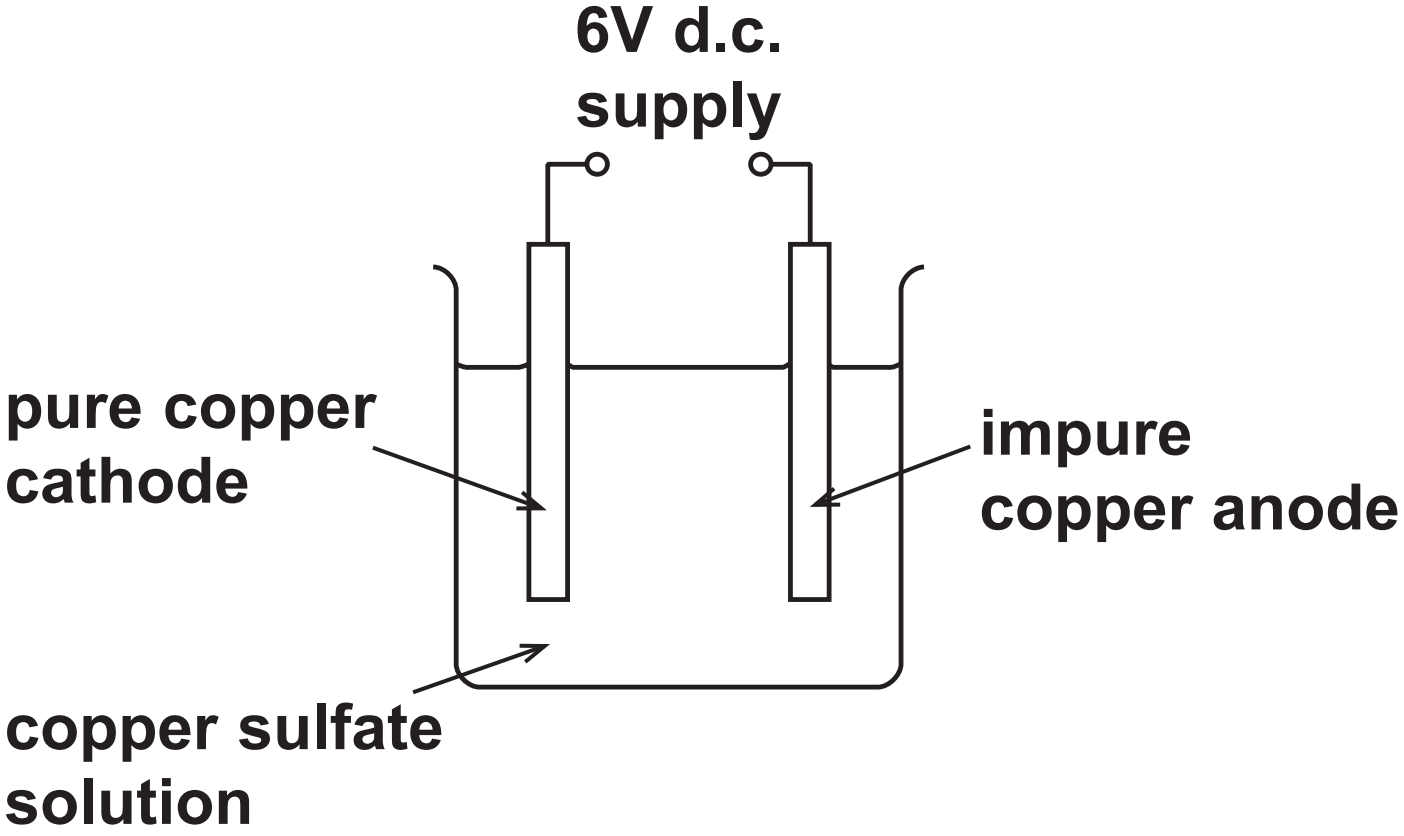


Figure 10

(Question continues on next page)

During the electrolysis three observations are made

- the sizes of both the anode and the cathode change
- a solid appears directly beneath the anode
- the colour of the copper sulfate solution does not change.

Explain all three observations.
(6 marks)

(Continue your answer on next page)

(Continue your answer on next page)

(Turn over)

(Continue your answer on next page)

(Turn over)

(Continue your answer on next page)

(Turn over)

(TOTAL FOR QUESTION 9 = 12 MARKS)

(Questions continue on next page)

10 Calcium carbonate decomposes on heating to form calcium oxide and carbon dioxide.

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$$

(a) 8·000 g of $CaCO_3$ was heated strongly for about 10 minutes. 6·213 g of solid remained. Calculate the mass of carbon dioxide gas given off. (1 mark)

mass of carbon dioxide = _____ g

(Question continues on next page)

(b) A second sample of calcium carbonate is strongly heated in a crucible until there is no further loss in mass.
The mass of calcium oxide remaining in the crucible is 5·450 g.

(Question continues on next page)

(i) The theoretical yield of calcium oxide in this experiment is 5·600 g.

Calculate the percentage yield of calcium oxide. (2 marks)

percentage yield = _____

(Question continues on next page)

(ii) The mass of solid left in the crucible is less than the theoretical mass of calcium oxide that should be obtained.

A possible reason for this is that (1 mark)

☐ A some solid was lost from the crucible

☐ B the solid remaining absorbed some water from the air

☐ C some carbon dioxide remained in the crucible

☐ D the decomposition was incomplete

(Question continues on next page)

(c) Another sample of calcium carbonate is heated and the mass of solid remaining is measured each minute.

The results are shown in Figure 11.

time in minutes	0	1	2	3	4	5	6	7
mass of solid remaining in g	9·0	8·1	7·2	6·4	6·0	5·6	5·3	5·2

Figure 11

(Question continues on next page)

(i) Explain the trend shown by the data in Figure 11. (2 marks)

(Question continues on next page)

(ii) It is impossible to be sure from this data that the reaction is complete.

State why. (1 mark)

(Question continues on next page)

(d) (i) Calculate the relative formula mass of calcium carbonate, $CaCO_3$.
(relative atomic masses: C = 12, O = 16, Ca = 40) (2 marks)

relative formula mass = _____

(Question continues on next page)

(ii) Calculate the atom economy for the formation of calcium oxide in this reaction.

$CaCO_3 \longrightarrow CaO + CO_2$

You must show your working.
(relative atomic masses:
C = 12, O = 16, Ca = 40;
relative formula mass:
calcium oxide = 56) (2 marks)

atom economy = _____ %

(TOTAL FOR QUESTION 10 = 11 MARKS)

TOTAL FOR PAPER = 100 MARKS

END