

FOR OFFICIAL USE

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Total  
Marks

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**0500/402**NATIONAL  
QUALIFICATIONS  
2005MONDAY, 9 MAY  
10.50 AM – 12.20 PMCHEMISTRY  
STANDARD GRADE  
Credit Level

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

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Scottish candidate number

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Number of seat

- All questions should be attempted.
- Necessary data will be found in the Data Booklet provided for Chemistry at Standard Grade and Intermediate 2.
- The questions may be answered in any order but all answers are to be written in this answer book, and must be written clearly and legibly in ink.
- Rough work, if any should be necessary, as well as the fair copy, is to be written in this book.  
Rough work should be scored through when the fair copy has been written.
- Additional space for answers and rough work will be found at the end of the book.
- The size of the space provided for an answer should not be taken as an indication of how much to write. It is not necessary to use all the space.
- Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.

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1. The grid shows the names of some elements.

A	argon	B	potassium	C	magnesium
D	chlorine	E	phosphorus	F	sulphur

- (a) Identify the element which produces a lilac flame colour.  
You may wish to use the data booklet to help you.

A	B	C
D	E	F

- (b) Identify the element with atoms which have the same electron arrangement as a  $\text{Ca}^{2+}$  ion.

A	B	C
D	E	F

- (c) Identify the **two** elements which would form a covalent compound with a formula of the type  $\text{X}_3\text{Y}_2$ .

A	B	C
D	E	F

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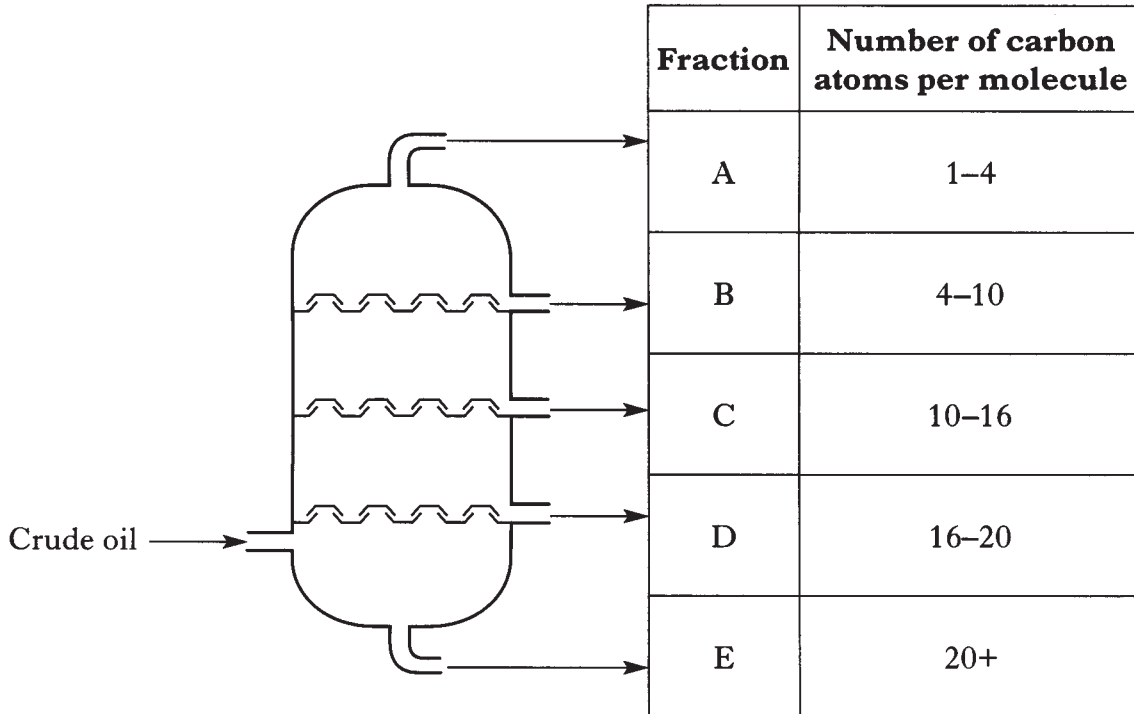
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2. Distillation of crude oil produces several fractions.

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(a) Identify the fraction which is used as a fuel in camping gas stoves.

A
B
C
D
E

1

(b) Identify the fraction with the highest viscosity.

A
B
C
D
E

1  
(2)

3. The names of some carbohydrates are shown.

A	glucose
B	fructose
C	maltose
D	sucrose
E	starch

(a) Identify the carbohydrate which does not dissolve well in water.

A
B
C
D
E

(b) Identify the **two** carbohydrates which are disaccharides.

A
B
C
D
E

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4. The table contains information about some substances.

Substance	Melting point/ $^{\circ}\text{C}$	Boiling point/ $^{\circ}\text{C}$	Conducts as a solid	Conducts as a liquid
A	-7	59	no	no
B	98	883	yes	yes
C	-39	357	yes	yes
D	547	1265	no	yes
E	-78	-33	no	no
F	1700	2230	no	no

(a) Identify the substance which is a gas at  $0^{\circ}\text{C}$ .

A
B
C
D
E
F

(b) Identify the **two** substances which exist as molecules.

A
B
C
D
E
F

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5. The grid shows the formulae of some hydrocarbons.

<p>A</p> $\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_3 \\   \\ \text{CH}_3 \end{array}$	<p>B</p> $\begin{array}{c} \text{CH}_2 \\ / \quad \backslash \\ \text{CH}_2 - \text{CH}_2 \end{array}$	<p>C</p> $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
<p>D</p> $\begin{array}{c} \text{CH}_3 \\ \backslash \\ \text{C} = \text{CH}_2 \\ / \\ \text{CH}_3 \end{array}$	<p>E</p> $\begin{array}{c} \text{CH}_2 - \text{CH}_2 \\   \quad   \\ \text{CH}_2 - \text{CH}_2 \end{array}$	<p>F</p> $\begin{array}{c} \text{CH}_3 \quad \quad \text{H} \\ \backslash \quad \quad / \\ \text{C} = \text{C} \\ / \quad \quad \backslash \\ \text{H} \quad \quad \quad \text{H} \end{array}$

- (a) Identify the hydrocarbon which can be used to make poly(propene).

A	B	C
D	E	F

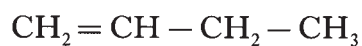
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- (b) Identify the **two** hydrocarbons with the general formula  $\text{C}_n\text{H}_{2n}$  which do **not** react quickly with bromine solution.

A	B	C
D	E	F

1

- (c) Identify the **two** isomers of



A	B	C
D	E	F

2

(4)

[Turn over

6. There are many different types of chemical reaction.

A	B	C
reduction	precipitation	displacement
D	E	F
hydrolysis	neutralisation	oxidation

Identify the following type of reaction.



A	B	C
D	E	F

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7. The grid shows some statements which could be applied to a solution.

A	It does not react with magnesium.
B	It has a pH less than 7.
C	It does not conduct electricity.
D	It produces chlorine gas when electrolysed.
E	It contains more $H^+$ ions than pure water.

Identify the **two** statements which are true for **both** dilute hydrochloric acid and dilute sulphuric acid.

A
B
C
D
E

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8. David was studying the reactions of some metals and their compounds. He carried out experiments involving magnesium, copper, zinc, nickel, silver and an unknown metal **X**. Listed below are some of the observations he recorded.

A	<b>X</b> was more readily oxidised than copper.
B	<b>X</b> oxide was more stable to heat than silver oxide.
C	Magnesium displaced <b>X</b> from a solution of <b>X</b> nitrate.
D	<b>X</b> reacted more vigorously than nickel with dilute acid.
E	Compounds of <b>X</b> were more readily reduced than compounds of zinc.

From his observations, David produced the following order of reactivity.

magnesium, zinc, nickel, copper, **X**, silver  
 -----  
 decreasing activity →

Identify the **two** observations which can be used to show that **X** has been wrongly placed.

A
B
C
D
E

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9. Equations are used to represent chemical reactions.

A	$\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\ell)$
B	$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$
C	$\text{Fe}(\text{s}) \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{e}^-$
D	$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Fe}(\text{s})$
E	$\text{H}_2(\text{g}) \rightarrow 2\text{H}^+(\text{aq}) + 2\text{e}^-$
F	$2\text{H}_2\text{O}(\ell) + \text{O}_2(\text{g}) + 4\text{e}^- \rightarrow 4\text{OH}^-(\text{aq})$

Identify the **two** equations which are involved in the corrosion of iron.

A
B
C
D
E
F

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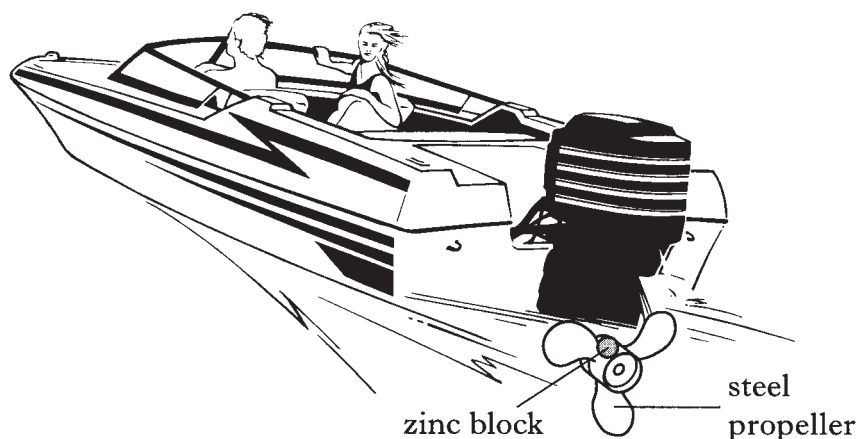
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## PART 2

A total of 40 marks is available in this part of the paper.

10. On some boats the steel propellers have zinc blocks attached to help prevent rusting. The zinc is oxidised, protecting the steel.



- (a) (i) Write the ion-electron equation for the oxidation of zinc.  
You may wish to use the data booklet to help you.

---

1

- (ii) What name is given to the **type** of protection provided by the zinc?

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1

- (b) If cobalt is used instead of zinc the steel propeller rusts quickly.  
What does this suggest about the reactivity of cobalt compared to iron?

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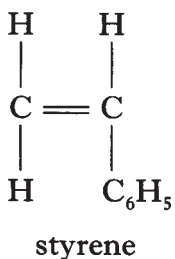
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11. Polystyrene is an addition polymer. It is made from the monomer styrene.



- (a) Draw a section of the polystyrene structure, showing three monomer units joined together.

- (b) Calculate the percentage by mass of carbon in a molecule of styrene.

Answer \_\_\_\_\_ %

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12. Methane (CH<sub>4</sub>), ethane (C<sub>2</sub>H<sub>6</sub>) and propane (C<sub>3</sub>H<sub>8</sub>) are the first three members of the alkanes.

(a) State the general formula for the alkanes.

\_\_\_\_\_

(b) The ninth member of the alkanes is nonane (C<sub>9</sub>H<sub>20</sub>).

(i) Predict the boiling point of nonane.

You may wish to use page 6 of the data booklet to help you.

\_\_\_\_\_ °C

(ii) Nonane can be cracked to produce smaller, more useful hydrocarbons. A catalyst is used to speed up this reaction.

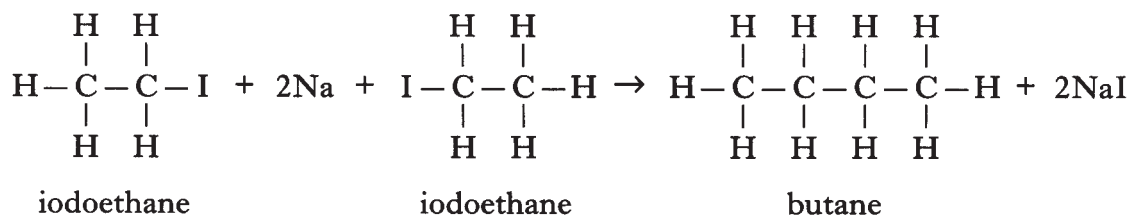
Suggest another reason for using a catalyst.

\_\_\_\_\_

\_\_\_\_\_

(c) Alkanes can be made by the reaction of sodium with iodoalkanes.

For example, butane can be made from iodoethane.



Butane can also be made using two **different** iodoalkanes.

Name the **two** iodoalkanes.

\_\_\_\_\_

\_\_\_\_\_

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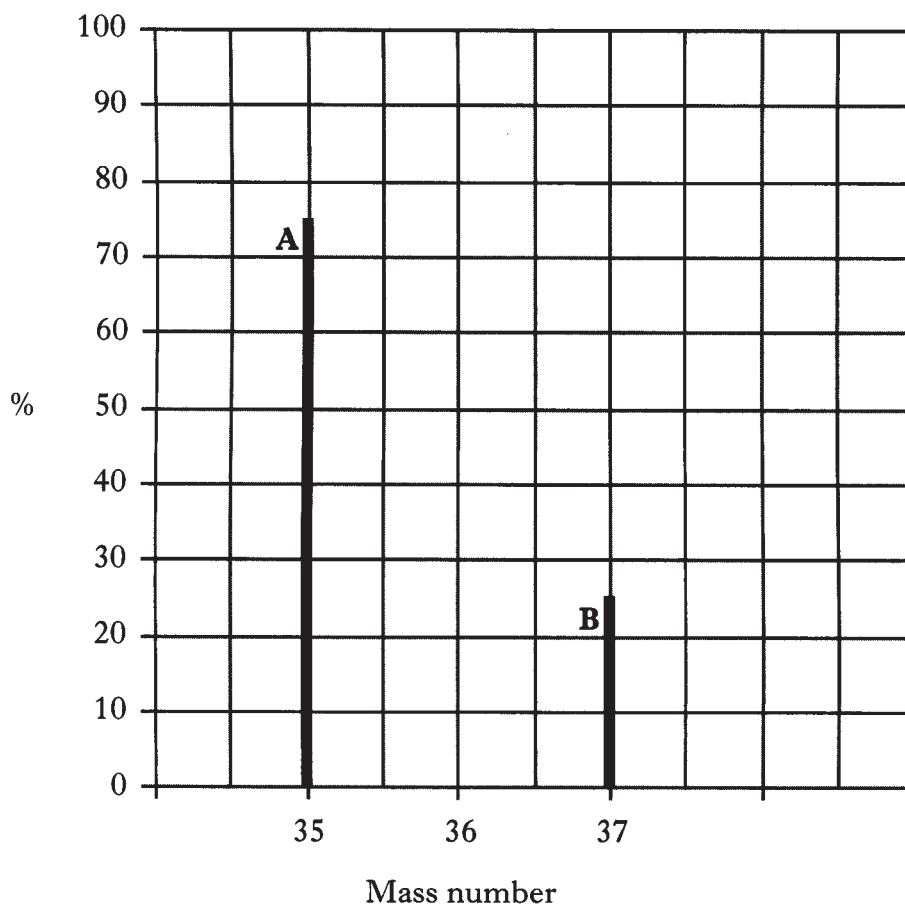
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13. A mass spectrometer is an instrument that can be used to measure the percentage of isotopes in a sample of an element.

When a sample of chlorine is passed through a mass spectrometer the following graph is obtained.

Each spike on the graph shows the presence of an isotope.



The **relative atomic mass** of an element can be calculated using the formula:

$$\frac{(\text{mass of isotope A} \times \%) + (\text{mass of isotope B} \times \%)}{100}$$

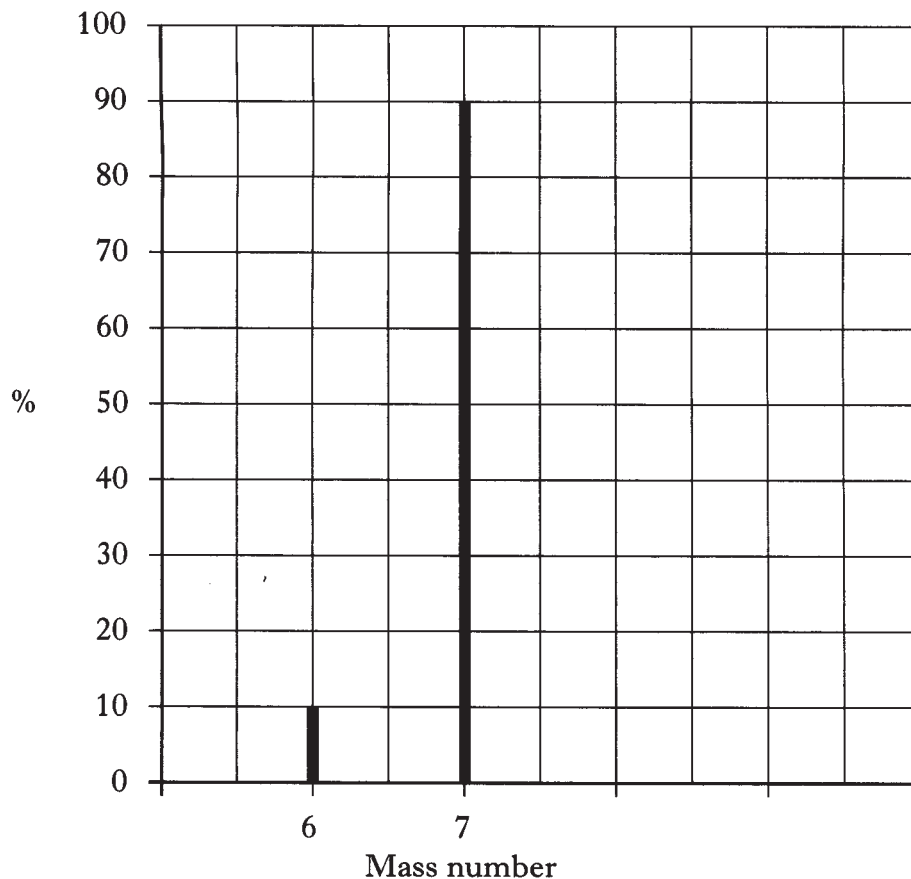
$$\begin{aligned} \text{The relative atomic mass of chlorine} &= \frac{(35 \times 75) + (37 \times 25)}{100} \\ &= 35.5 \end{aligned}$$

## 13. (continued)

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(a) The following graph was obtained for a sample of lithium.



(i) How many isotopes are present in the sample of lithium?

\_\_\_\_\_

1

(ii) Using the information in the graph calculate the relative atomic mass of lithium.

**Show your working clearly.**

1

(b) Complete the table to show the number of each type of particle in the ion,  ${}^7_3\text{Li}^+$ .

Particle	Number
proton	
neutron	

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14. Clare carried out an experiment to make copper chloride crystals.

**Instructions for preparation of copper chloride crystals**

**Step 1** Add 25 cm<sup>3</sup> of dilute hydrochloric acid to a beaker.

**Step 2** Add a spatulaful of copper carbonate powder to the acid and stir.

**Step 3** Continue adding copper carbonate until some of the solid remains.

**Step 4**

**Step 5**

- (a) Why did Clare continue to add copper carbonate until some solid remained?

---



---

- (b) Name the **two** techniques which Clare would have carried out in steps 4 and 5 to prepare a sample of copper chloride crystals.

**Step 4** \_\_\_\_\_

**Step 5** \_\_\_\_\_

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15. Two atoms of nitrogen share electrons to form a nitrogen molecule.

(a) Draw a diagram to show how the outer electrons are arranged in a molecule of nitrogen,  $N_2$ .

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1		
(3)		

(b) Oxides of nitrogen dissolve in water to produce nitric acid.

(i) Name the industrial process used to manufacture nitric acid.

\_\_\_\_\_

(ii) A platinum catalyst is used in the industrial manufacture of nitric acid.

Why is it **not** necessary to continue heating the platinum once the reaction has started?

\_\_\_\_\_

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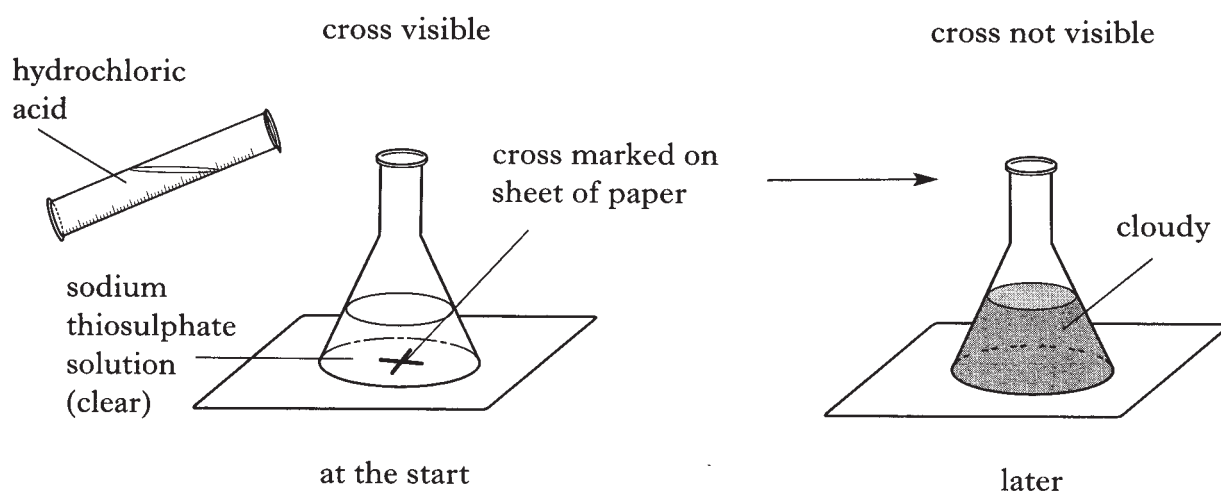
16. Dilute hydrochloric acid reacts with sodium thiosulphate solution ( $\text{Na}_2\text{S}_2\text{O}_3$ ) to produce a precipitate of sulphur.



- (a) Balance this equation.

1

- (b) A pupil investigated the effect of temperature on the speed of the reaction. She measured the time taken for enough sulphur to form to make the cross disappear.



Her results are shown in the table.

Temperature/°C	Time/s
25	89
30	64
35	44
40	33
45	27
50	21

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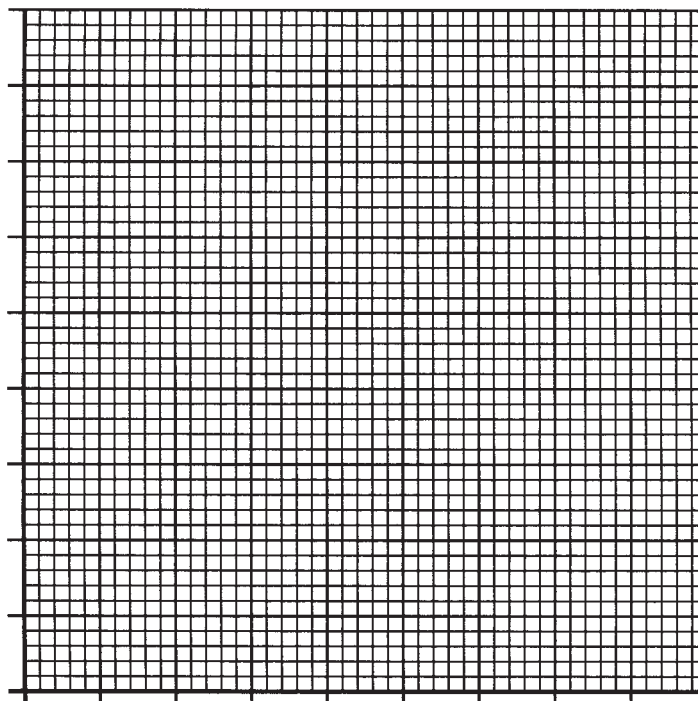
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**16. (b) (continued)**

- (i) Draw a line graph of the results.

*Use appropriate scales to fill most of the graph paper.*

(Additional graph paper, if required, will be found on page 27.)



- (ii) Use your graph to estimate the time taken, in seconds, for the cross to disappear at 60 °C.

\_\_\_\_\_

- (iii) Describe the relationship between the temperature and the **speed** of the reaction.

\_\_\_\_\_  
\_\_\_\_\_

- (c) State **one** factor that must be kept constant throughout this investigation.

\_\_\_\_\_

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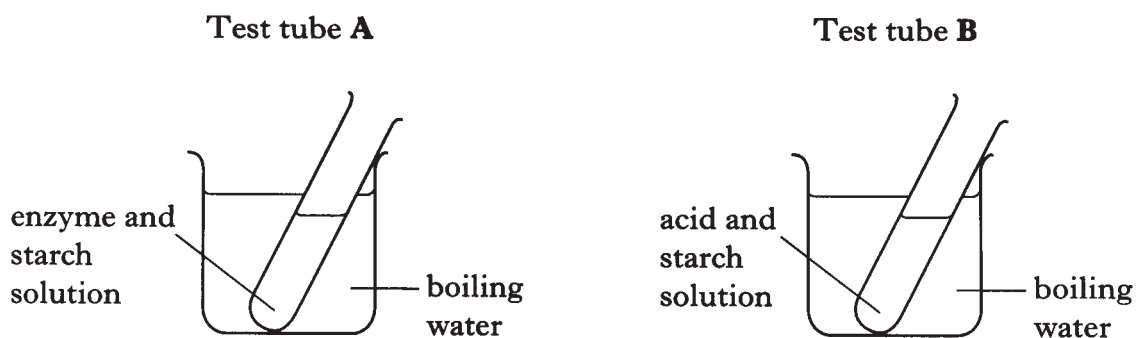
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17. Glucose and starch are both carbohydrates.

(a) Write the molecular formula for glucose.

\_\_\_\_\_

(b) A pupil set up the following experiment to turn starch into glucose.



(i) Name the type of chemical reaction which takes place when starch is broken down to glucose.

\_\_\_\_\_

(ii) Suggest why glucose would **not** be formed in test tube A.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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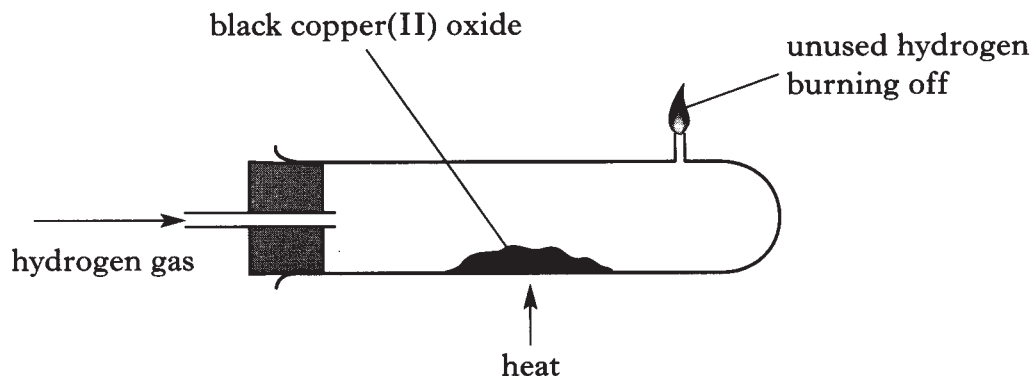
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18. Copper can be extracted from its oxide by heating copper(II) oxide with hydrogen gas. Water is also formed during the reaction.



- (a) Write an equation, using symbols and formulae, for the reaction between copper(II) oxide and hydrogen gas.  
There is no need to balance the equation.

\_\_\_\_\_

- (b) Suggest the colour change which would be seen in the copper(II) oxide during the reaction.

\_\_\_\_\_

- (c) Suggest why calcium cannot be extracted from its oxide by heating with hydrogen gas.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

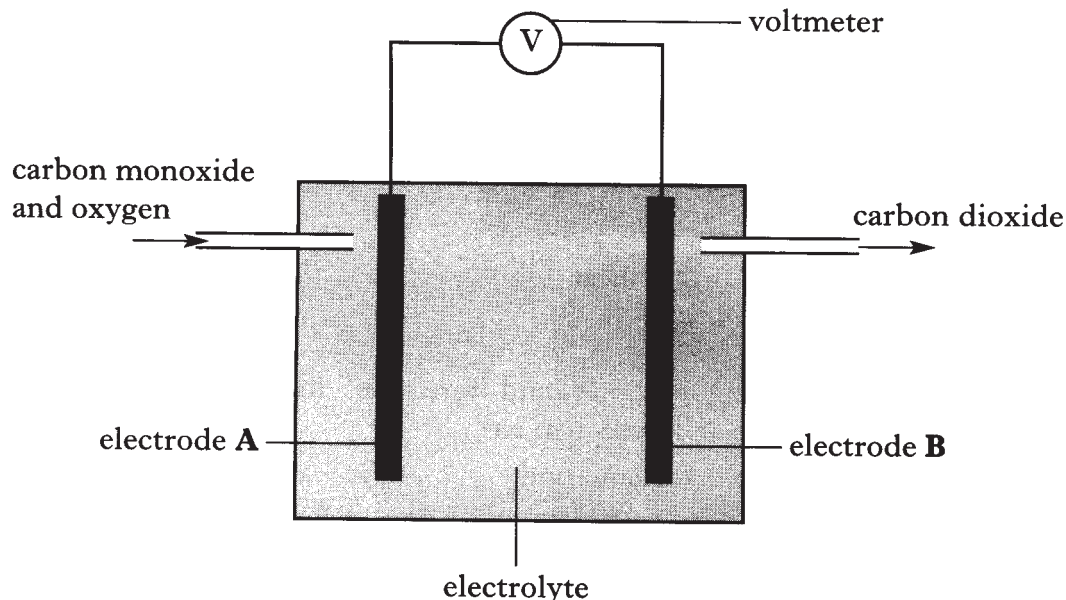
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19. The cell below can be used in a carbon monoxide detector.  
Carbon monoxide enters the cell along with oxygen from the air at electrode A.

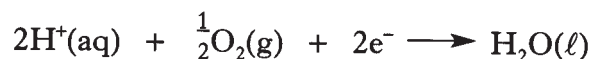


The reactions occurring at each electrode are:

**Electrode A**



**Electrode B**



- (a) **On the diagram**, clearly mark the path and direction of electron flow.
- (b) What is the purpose of the electrolyte in the above cell?

---



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<b>1</b>		
<b>1</b>		
<b>(5)</b>		

**19. (continued)**

- (c) Sugar solution cannot be used as an electrolyte.  
What does this indicate about the bonding in sugar?

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- (d) Platinum is used for the electrodes in this cell.

- (i) To which family of metals does platinum belong?

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- (ii) Platinum is also used as a catalyst in a catalytic converter in car exhausts.

What does a catalytic converter do?

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20. Aluminium powder reacts with dilute sulphuric acid.



(a) Circle the formula for the salt in the above equation.

(b) Calculate the mass of hydrogen produced when 1.35 g of aluminium reacts with dilute sulphuric acid.

Marks

	KU	PS
1		
2		
(3)		

Answer \_\_\_\_\_ g

**[END OF QUESTION PAPER]**