

FOR OFFICIAL USE

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Total  
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**0500/31/01**

NATIONAL  
QUALIFICATIONS  
2013

WEDNESDAY, 1 MAY  
10.50 AM – 12.20 PM

CHEMISTRY  
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

- 1 All questions should be attempted.
- 2 Necessary data will be found in the Data Booklet provided for Chemistry at Standard Grade and Intermediate 2.
- 3 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.
- 4 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.
- 5 Additional space for answers and rough work will be found at the end of the book.
- 6 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.
- 7 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.



## PART 1

In Questions 1 to 8 of this part of the paper, an answer is given by circling the appropriate letter (or letters) in the answer grid provided.

In some questions, two letters are required for full marks.

If more than the correct number of answers is given, marks will be deducted.

A total of 20 marks is available in this part of the paper.

### SAMPLE QUESTION

|   |                 |   |                                  |   |                 |
|---|-----------------|---|----------------------------------|---|-----------------|
| A | CH <sub>4</sub> | B | H <sub>2</sub>                   | C | CO <sub>2</sub> |
| D | CO              | E | C <sub>2</sub> H <sub>5</sub> OH | F | C               |

(a) Identify the hydrocarbon.

|                                    |                         |                         |
|------------------------------------|-------------------------|-------------------------|
| <input checked="" type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| <input type="radio"/> D            | <input type="radio"/> E | <input type="radio"/> F |

The one correct answer to part (a) is A. This should be circled.

(b) Identify the **two** elements.

|                         |                                    |                                    |
|-------------------------|------------------------------------|------------------------------------|
| <input type="radio"/> A | <input checked="" type="radio"/> B | <input type="radio"/> C            |
| <input type="radio"/> D | <input type="radio"/> E            | <input checked="" type="radio"/> F |

As indicated in this question, there are **two** correct answers to part (b). These are B and F.

Both answers are circled.

If, after you have recorded your answer, you decide that you have made an error and wish to make a change, you should cancel the original answer and circle the answer you now consider to be correct. Thus, in part (a), if you want to change an answer A to an answer D, your answer sheet would look like this:

|   |                         |                         |
|---|-------------------------|-------------------------|
| <input checked="" type="radio"/> <del>A</del> | <input type="radio"/> B | <input type="radio"/> C |
| <input checked="" type="radio"/> D            | <input type="radio"/> E | <input type="radio"/> F |

If you want to change back to an answer which has already been scored out, you should enter a tick (✓) in the box of the answer of your choice, thus:

|   |                         |                         |
|---|-------------------------|-------------------------|
| <input checked="" type="radio"/> <del>A</del> | <input type="radio"/> B | <input type="radio"/> C |
| <input checked="" type="radio"/> <del>D</del> | <input type="radio"/> E | <input type="radio"/> F |

Marks

1. The grid shows the names of some elements.

|               |                |             |
|---------------|----------------|-------------|
| A<br>hydrogen | B<br>copper    | C<br>oxygen |
| D<br>iron     | E<br>magnesium | F<br>iodine |

(a) Identify the element which melts at 1083 °C.

You may wish to use the data booklet to help you.

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

1

(b) Identify the element produced in a blast furnace.

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

1

(c) Identify the element which burns with a pop.

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

1

(3)

[Turn over

Marks

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| 1   |    |    |
| (3) |    |    |

2. The grid shows some ions.

|   |                  |   |               |   |               |
|---|------------------|---|---------------|---|---------------|
| A | $\text{Al}^{3+}$ | B | $\text{Cl}^-$ | C | $\text{Li}^+$ |
| D | $\text{H}^+$     | E | $\text{Br}^-$ | F | $\text{OH}^-$ |

(a) Identify the ion with the same electron arrangement as a helium atom.

You may wish to use the data booklet to help you.

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

1

(b) Identify the **two** ions which combine to form an insoluble compound.

You may wish to use the data booklet to help you.

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

1

(c) Identify the ion present in all alkaline solutions.

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

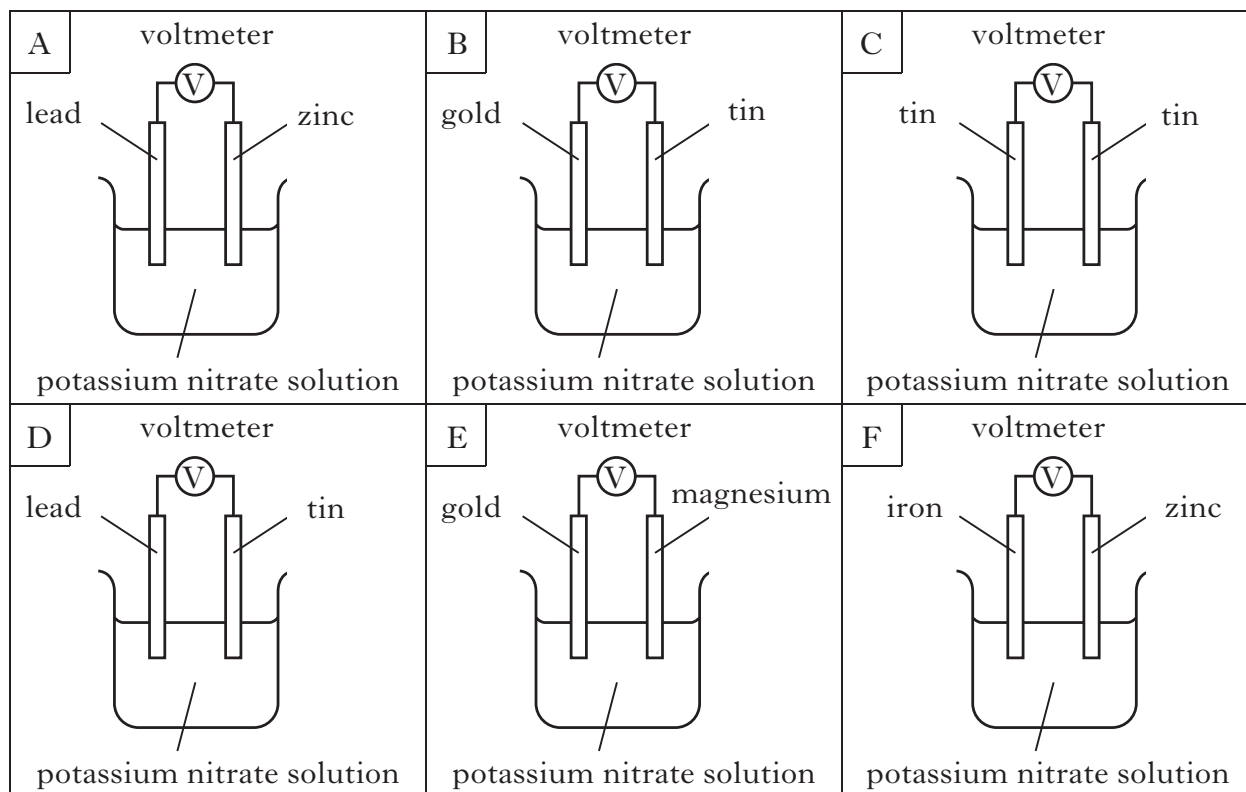
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(3)

Marks

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| KU | PS |
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3. Electricity can be produced using electrochemical cells.



(a) Identify the arrangement which would **not** produce electricity.

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

1

(b) Identify the **two** cells which could be used to compare the reactivity of gold and lead.

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

1  
(2)

[Turn over

Marks

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| 1   |    |    |
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| (3) |    |    |

4. The grid shows the names of some carbohydrates.

|   |          |
|---|----------|
| A | fructose |
| B | glucose  |
| C | maltose  |
| D | starch   |
| E | sucrose  |

(a) Identify the condensation polymer.

|   |
|---|
| A |
| B |
| C |
| D |
| E |

(b) Identify the **two** disaccharides.

|   |
|---|
| A |
| B |
| C |
| D |
| E |

(c) Identify the **two** carbohydrates which **cannot** be hydrolysed.

|   |
|---|
| A |
| B |
| C |
| D |
| E |



Marks

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|----|----|
|----|----|

6. The grid shows the structural formulae of some monomers.

|  |  |  |  |   |  |  |   |  |
|--|--|--|--|---|--|--|---|--|
| <table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <tr> <td style="width: 30px; text-align: center;">A</td> <td style="padding: 10px;"> <math display="block">\begin{array}{c} \text{CN} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}</math> </td> </tr> </table>  | A  | $\begin{array}{c} \text{CN} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$  | <table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <tr> <td style="width: 30px; text-align: center;">B</td> <td style="padding: 10px;"> <math display="block">\begin{array}{c} \text{Cl} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{Cl} \end{array}</math> </td> </tr> </table> | B | $\begin{array}{c} \text{Cl} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{Cl} \end{array}$ | <table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <tr> <td style="width: 30px; text-align: center;">C</td> <td style="padding: 10px;"> <math display="block">\begin{array}{c} \text{CH}_3 \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{CH}_3 \end{array}</math> </td> </tr> </table> | C | $\begin{array}{c} \text{CH}_3 \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{CH}_3 \end{array}$ |
| A  | $\begin{array}{c} \text{CN} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$      |  |  |   |  |  |   |  |
| B  | $\begin{array}{c} \text{Cl} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{Cl} \end{array}$     |  |  |   |  |  |   |  |
| C  | $\begin{array}{c} \text{CH}_3 \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{CH}_3 \end{array}$ |  |  |   |  |  |   |  |
| <table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <tr> <td style="width: 30px; text-align: center;">D</td> <td style="padding: 10px;"> <math display="block">\begin{array}{c} \text{Cl} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{Cl} \quad \text{H} \end{array}</math> </td> </tr> </table> | D  | $\begin{array}{c} \text{Cl} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{Cl} \quad \text{H} \end{array}$ | <table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <tr> <td style="width: 30px; text-align: center;">E</td> <td style="padding: 10px;"> <math display="block">\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}</math> </td> </tr> </table>   | E | $\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$   | <table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <tr> <td style="width: 30px; text-align: center;">F</td> <td style="padding: 10px;"> <math display="block">\begin{array}{c} \text{CH}_3 \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}</math> </td> </tr> </table>    | F | $\begin{array}{c} \text{CH}_3 \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$    |
| D  | $\begin{array}{c} \text{Cl} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{Cl} \quad \text{H} \end{array}$     |  |  |   |  |  |   |  |
| E  | $\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$       |  |  |   |  |  |   |  |
| F  | $\begin{array}{c} \text{CH}_3 \quad \text{H} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$    |  |  |   |  |  |   |  |

(a) Identify the monomer which would form poly(propene).

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

1

(b) Identify the monomer which reacts with hydrogen to form ethane.

|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

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(c) Identify the **two** isomers.

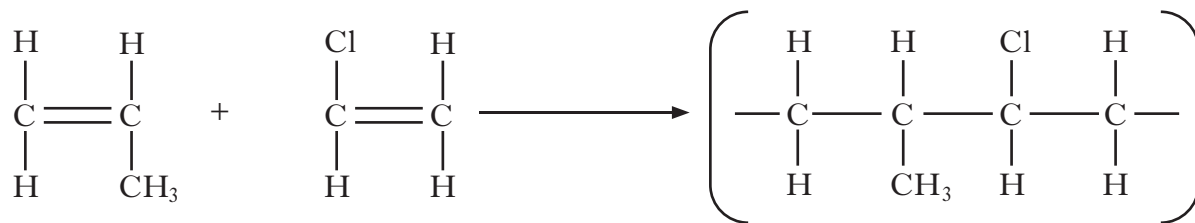
|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

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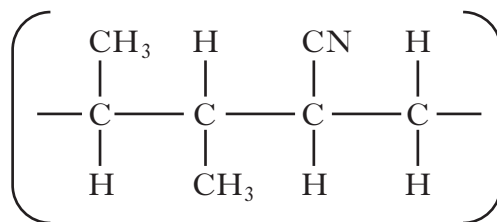


## 6. (continued)

(d) When two **different** monomers polymerise a copolymer is formed as shown.



Identify the **two** monomers which would polymerise to give the copolymer below.



|   |   |   |
|---|---|---|
| A | B | C |
| D | E | F |

1  
(4)

[Turn over

Marks

KU PS

7. A student made some statements about particles found in atoms.

|   |                              |
|---|------------------------------|
| A | Relative mass is almost zero |
| B | Charge = $1+$                |
| C | Charge = 0                   |
| D | Found inside the nucleus     |
| E | Relative mass = 1            |

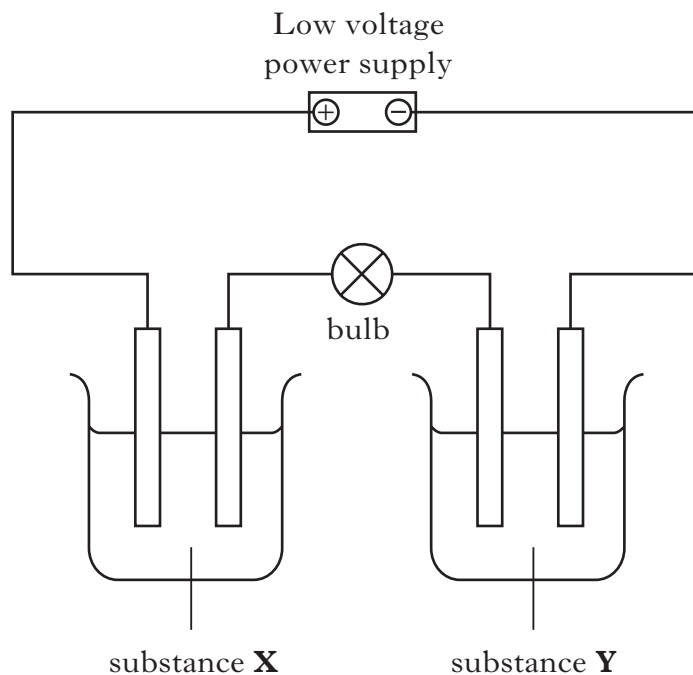
Identify the **two** statements which apply to **both** a proton and a neutron.

|   |
|---|
| A |
| B |
| C |
| D |
| E |

(2)

Marks

8. Several conductivity experiments were carried out using the apparatus below.



| Experiment | Substance X                 | Substance Y              |
|------------|-----------------------------|--------------------------|
| A          | glucose solution            | sodium chloride solution |
| B          | copper nitrate solution     | solid potassium nitrate  |
| C          | molten tin                  | liquid mercury           |
| D          | potassium sulphate solution | liquid hexane            |
| E          | lithium chloride solution   | molten nickel bromide    |

Identify the **two** experiments in which the bulb would light.

|   |
|---|
| A |
| B |
| C |
| D |
| E |

(2)

[Turn over for Part 2 on Page twelve

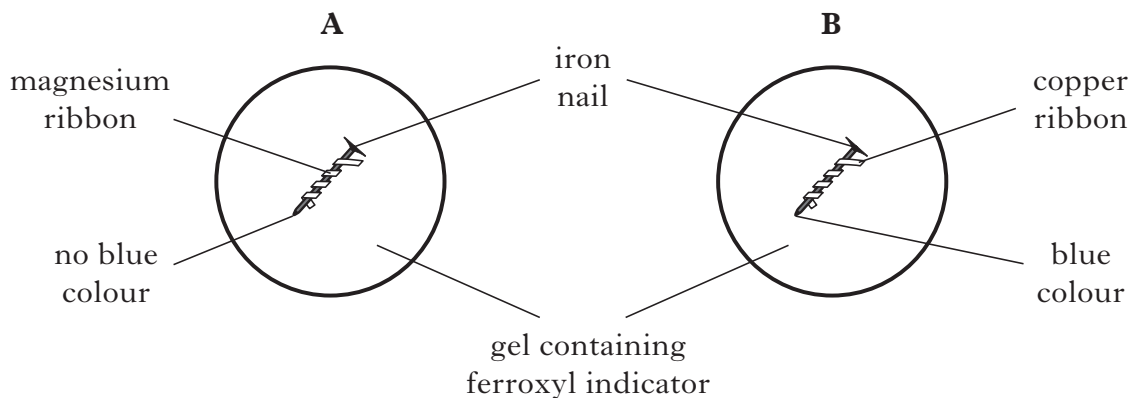
**PART 2**

Marks

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| 1   |    |
| (4) |    |

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

9. A student carried out an experiment to investigate the rusting of iron.



- (a) Write the formula for the **ion** which turns ferroxyl indicator blue.
- \_\_\_\_\_
- (b) Name the **ion** formed from water and oxygen, when they accept electrons during rusting.
- \_\_\_\_\_
- (c) Explain why magnesium prevents iron from rusting.
- \_\_\_\_\_
- \_\_\_\_\_
- (d) Salt, which is spread on roads in winter, speeds up rusting. Ethylene glycol is used instead of salt on the roadways of iron bridges because it does **not** speed up rusting. Suggest the **type** of bonding present in ethylene glycol.
- \_\_\_\_\_

Marks

| KU  | PS |
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| (3) |    |

10. The nuclide notation for an isotope of hydrogen is  ${}^1_1\text{H}$ .

(a) An isotope of copper has atomic number 29 and mass number 63.

(i) Write the nuclide notation for this isotope of copper.

(ii) How many neutrons are present in this isotope of copper?

\_\_\_\_\_

(b) A sample of copper was found to contain **equal** amounts of two isotopes. One has mass number 63 and the other has mass number 65.

What is the relative atomic mass of this sample of copper?

\_\_\_\_\_

[Turn over

Marks

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| (4) |    |

11. The table shows information about some useful compounds.

| Compound         | Formula                  |
|------------------|--------------------------|
| <b>Y</b>         | $\text{Na}_3\text{PO}_4$ |
| ammonia          | $\text{NH}_3$            |
| ammonium nitrate | $\text{NH}_4\text{NO}_3$ |

(a) (i) Name compound **Y**.

\_\_\_\_\_

(ii) Compound **Y** can be used as a fertiliser.

Why are fertilisers added to soil?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(b) Name the catalyst used in the industrial manufacture of ammonia.

\_\_\_\_\_

(c) What is present in the root nodules of some plants which convert nitrogen from the atmosphere into nitrogen compounds?

\_\_\_\_\_



Marks

13. Dilute hydrochloric acid reacts with sodium thiosulphate,  $\text{Na}_2\text{S}_2\text{O}_3$ , as shown in the equation below.



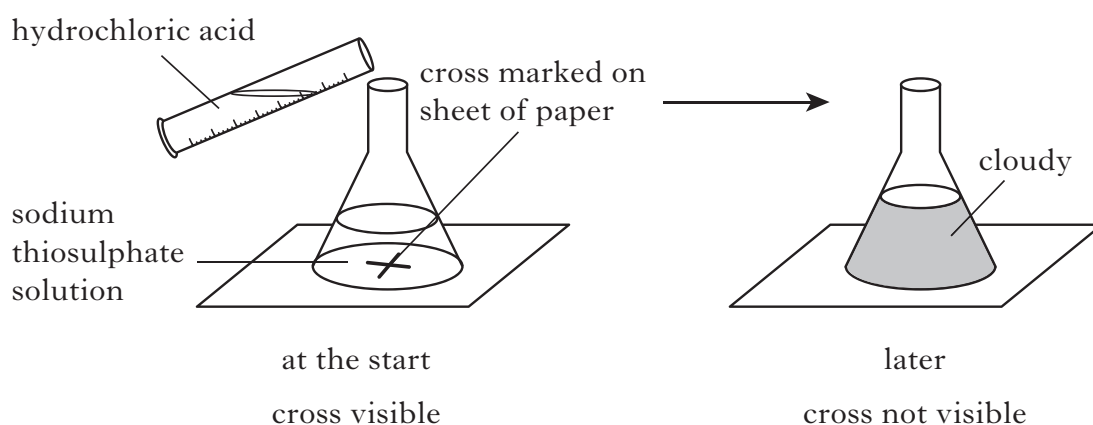
- (a) Suggest a name for the **type** of chemical reaction taking place.

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- (b) A student investigated the effect of temperature on the rate of the reaction.

The student measured the time taken for enough sulphur to form to make the cross disappear.



The results are shown.

| Temperature/ $^{\circ}\text{C}$ | Time/s |
|---------------------------------|--------|
| 25                              | 89     |
| 30                              | 64     |
| 35                              | 44     |
| 40                              | 33     |
| 45                              | 27     |

Write a general statement describing the effect of temperature on the **rate** of the reaction.

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(2)

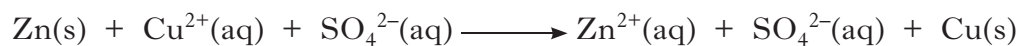


Marks

KU PS

14. Zinc displaces copper from copper(II) sulphate solution.

The equation for the reaction is:



(a) Circle the spectator ion in the above equation.

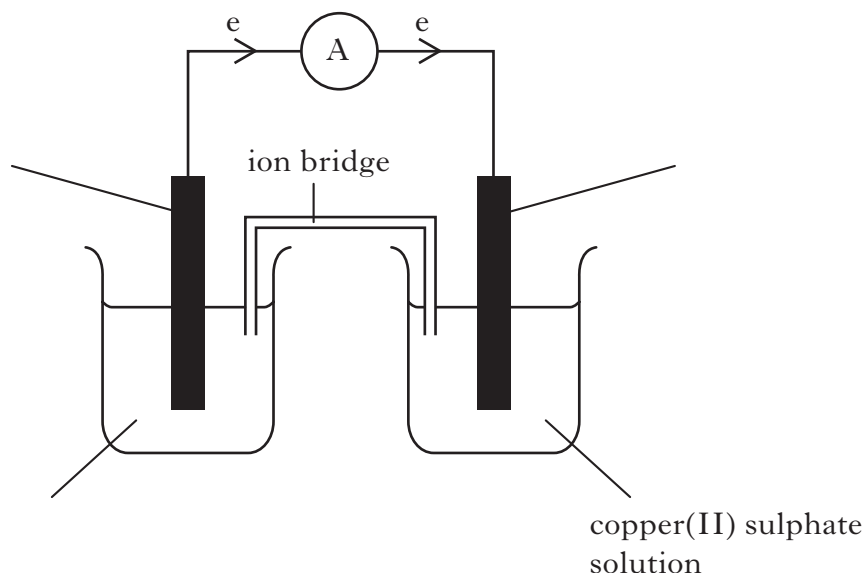
1

(b) Write the ion-electron equation for the **oxidation** step in this reaction.

You may wish to use the data booklet to help you.

1

(c) The reaction can also be carried out in a cell.



(i) Complete the **three labels** on the diagram.

(An additional diagram, if required, can be found on page 24.)

1

(ii) What is the purpose of the ion bridge?

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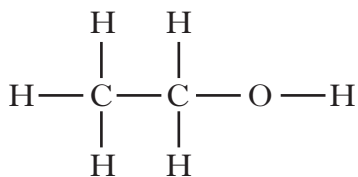
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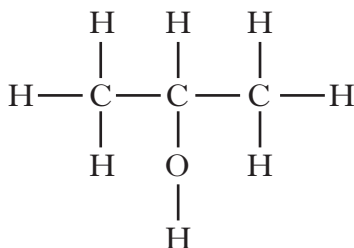
[Turn over

Marks

15. An antibacterial hand gel contains two alkanols, ethanol and propan-2-ol.



ethanol



propan-2-ol

- (a) Alkanols are a homologous series containing carbon, hydrogen and oxygen.

Suggest a general formula for alkanols.

- (b) Ethanol can be produced by the fermentation of glucose.

- (i) Name the gas produced during the fermentation of glucose.

\_\_\_\_\_

- (ii) Name the process used to increase the ethanol concentration of fermentation products.

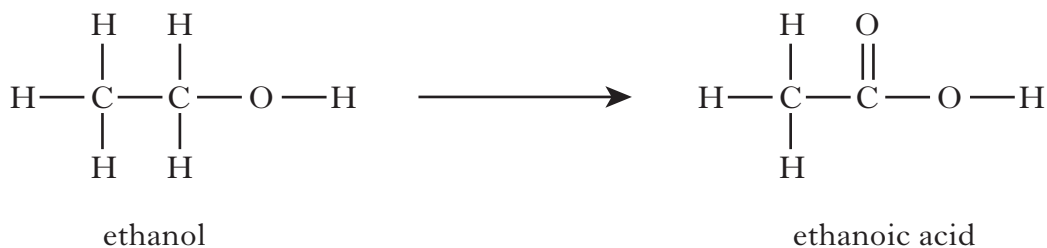
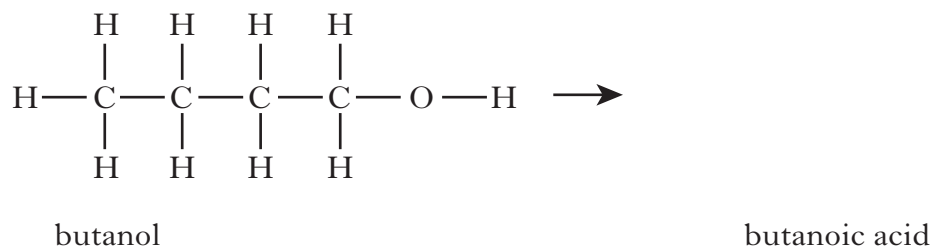
\_\_\_\_\_

|   | KU | PS |
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Marks

## 15. (continued)

(c) When alkanols are oxidised alkanolic acids are produced.

Draw the **full** structural formula for the alkanolic acid produced when butanol is oxidised.

1

(d) Esters are produced when alkanols react with alkanolic acids.

The table gives information on esters.

| Alkanol  | Alkanolic acid | Ester             |
|----------|----------------|-------------------|
| methanol | ethanoic acid  | methyl ethanoate  |
| ethanol  | propanoic acid | ethyl propanoate  |
| propanol | methanoic acid | propyl methanoate |
| butanol  | ethanoic acid  | butyl ethanoate   |
| pentanol | butanoic acid  | <b>X</b>          |

Suggest a name for **X**.

\_\_\_\_\_

1  
(5)

[Turn over

16. Metals can be extracted from their ores by different methods.

(a) Place the following methods in the correct space in the table.

You may wish to use the data booklet to help you.

**reacting with carbon**  
**electrolysis**  
**heat alone**

| Metal     | Method |
|-----------|--------|
| mercury   |        |
| iron      |        |
| magnesium |        |

1

(b) Mercury can be extracted from the ore cinnabar, **HgS**.

(i) Calculate the percentage by mass of mercury in cinnabar.

\_\_\_\_\_ % 2

(ii) Write the formula for the mercury ion in cinnabar.

\_\_\_\_\_

1

(4)



Marks

| KU | PS |
|----|----|
|----|----|

18. A student investigated the reaction between dilute sulphuric acid and sodium carbonate.

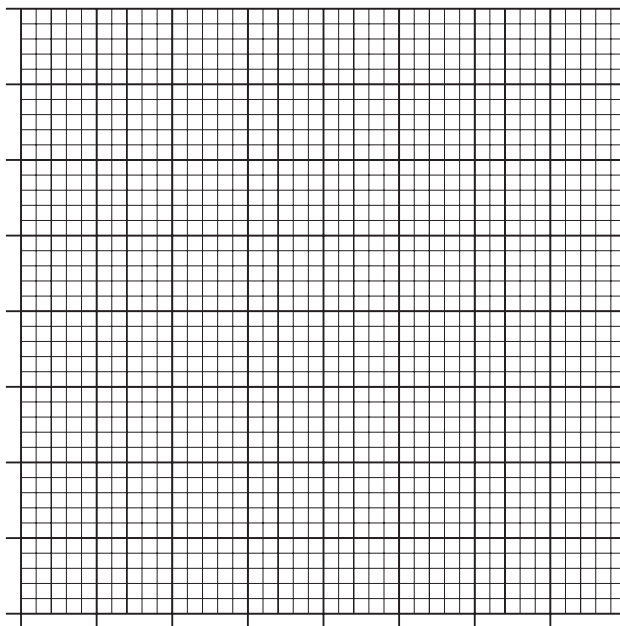
- (a) One experiment involved measuring the volume of carbon dioxide produced when solid sodium carbonate was used.

| Time/s                                   | 0 | 10 | 30 | 40 | 50 | 60 | 70 |
|--|---|----|----|----|----|----|----|
| Volume of carbon dioxide/cm <sup>3</sup> | 0 | 12 | 29 | 34 | 36 | 37 | 37 |

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

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

(Additional graph paper, if required, will be found on page 24.)



2

- (ii) The experiment was repeated at a higher temperature.

The volume and concentration of sulphuric acid and the mass of sodium carbonate were kept the same.

Predict the final volume of carbon dioxide produced at this temperature.

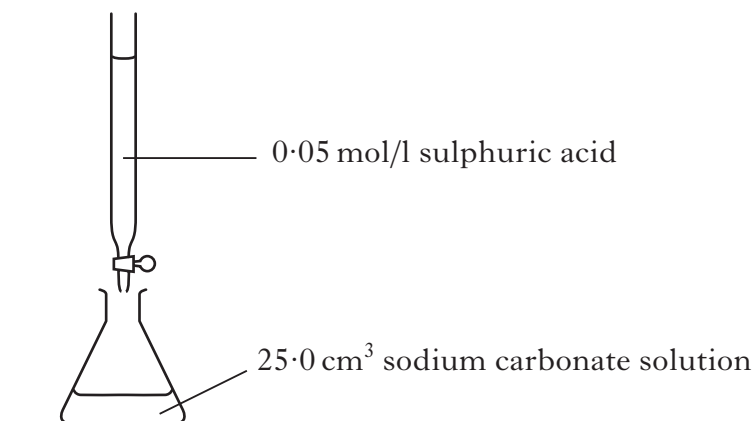
\_\_\_\_\_ cm<sup>3</sup>

1

Marks

## 18. (continued)

- (b) Another experiment involved determining the concentration of sodium carbonate solution by titration.



The results showed that 20 cm<sup>3</sup> of sulphuric acid was required to neutralise the sodium carbonate solution.

- (i) Calculate the number of moles of sulphuric acid in this volume.

\_\_\_\_\_ mol

1

- (ii) One mole of sulphuric acid reacts with one mole of sodium carbonate.

Using your answer from part (b)(i), calculate the concentration, in mol/l, of the sodium carbonate solution.

\_\_\_\_\_ mol/l

1

- (c) Name the salt produced when dilute sulphuric acid reacts with sodium carbonate.

\_\_\_\_\_

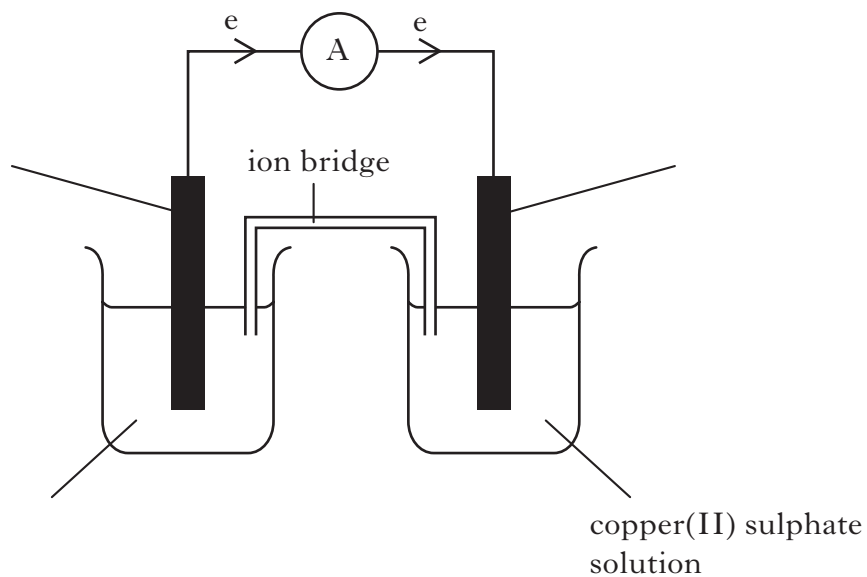
1

(6)

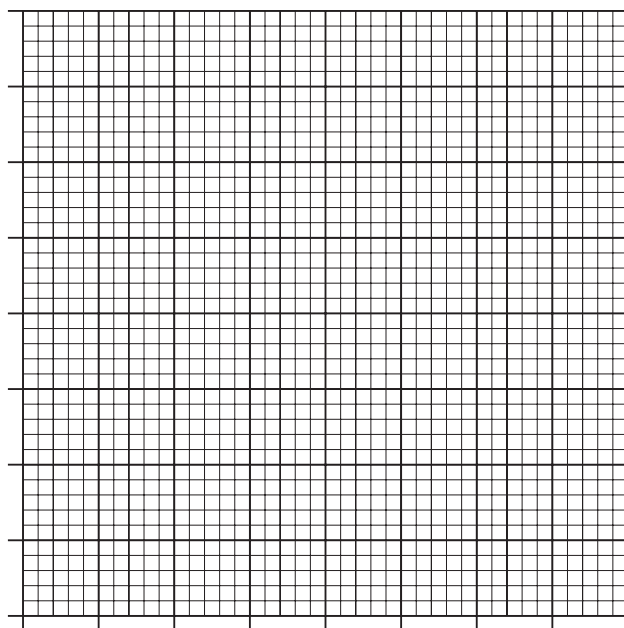
[END OF QUESTION PAPER]

**ADDITIONAL SPACE FOR ANSWERS**

ADDITIONAL DIAGRAM FOR QUESTION 14(c)



ADDITIONAL GRAPH PAPER FOR QUESTION 18(a)(i)





**ADDITIONAL SPACE FOR ANSWERS**

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