

FOR OFFICIAL USE

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0500/402NATIONAL
QUALIFICATIONS
2006MONDAY, 8 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

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Town

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Forename(s)

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Surname

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Date of birth

Day Month Year

Scottish candidate number

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Number of seat

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- 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.

1. The grid shows the names of some metals.

| | | |
|-----------|----------|-----------|
| A | B | C |
| potassium | platinum | iron |
| D | E | F |
| tin | copper | magnesium |

(a) Identify the metal used as a catalyst in the Ostwald Process.

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

1

(b) Identify the metal produced in a Blast Furnace.

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

1

(c) Identify the metal which has a density of 8.92 g/cm³.

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

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

1

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2. The structures of some hydrocarbons are shown in the grid below.

| | | | |
|---|---|--|--|
| A | $ \begin{array}{c} \text{H} & \text{CH}_3 & \text{H} \\ & & \\ \text{H}-\text{C} & -\text{C} & -\text{C}-\text{H} \\ & & \\ \text{H} & \text{CH}_3 & \text{H} \end{array} $ | $ \begin{array}{c} \text{H} & \text{H} \\ & \\ \text{C} \\ & \\ \text{H}-\text{C} & -\text{C}-\text{H} \\ & \\ \text{H} & \text{H} \end{array} $ | $ \begin{array}{c} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C} & -\text{C} & -\text{C}-\text{H} \\ & & \\ \text{H} & \text{H} & \text{H} \end{array} $ |
| D | $ \begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{H}-\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{H} \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array} $ | $ \begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{H}-\text{C} & -\text{C} & -\text{C} & =\text{C} \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array} $ | $ \begin{array}{c} \text{H} & \text{H} \\ & \\ \text{H}-\text{C} & -\text{C}-\text{H} \\ & \\ \text{H}-\text{C} & -\text{C}-\text{H} \\ & \\ \text{H} & \text{H} \end{array} $ |

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

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

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(b) Identify the hydrocarbon which is the first member of a homologous series.

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

1

(2)

3. The grid shows the formulae for some gases.

| | | |
|-----------------|-----------------|-----------------|
| A | B | C |
| O ₂ | N ₂ | CO |
| D | E | F |
| SO ₂ | NO ₂ | CO ₂ |

(a) Identify the poisonous gas produced during the **incomplete combustion** of hydrocarbons.

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

1

(b) Identify the gas produced in air during a lightning storm.

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

1

(c) Identify the gas which is a reactant in the manufacture of ammonia (Haber Process).

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

1

(3)

[Turn over

4. The names of some oxides are shown in the grid.

| | | |
|----------------|-----------------|------------------|
| A | B | C |
| sodium oxide | potassium oxide | copper(II) oxide |
| D | E | F |
| carbon dioxide | zinc oxide | sulphur dioxide |

(a) Identify the **two** oxides which dissolve in water to form alkaline solutions.

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

(b) Identify the **two** oxides which are covalent.

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

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5. The Periodic Table lists all known elements.

The grid shows the names of six common elements.

| | | |
|--------|-----------|-----------|
| A | B | C |
| oxygen | calcium | aluminium |
| D | E | F |
| sodium | magnesium | fluorine |

(a) Identify the **two** elements with similar chemical properties.

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

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(b) Identify the element which can form ions with the same electron arrangement as argon.

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

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(c) Identify the **two** elements which form an ionic compound with the formula of the type \mathbf{XY}_3 , where \mathbf{X} is the metal.

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

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[Turn over]

6. There are many different types of chemical reaction.

| | | |
|----------------|--------------|-----------|
| A | B | C |
| precipitation | hydrolysis | oxidation |
| D | E | F |
| neutralisation | condensation | addition |

(a) Identify the type of chemical reaction that occurs when ethene reacts with hydrogen to form ethane.

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

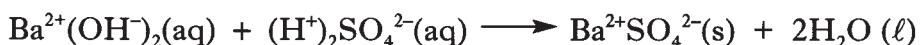
1

(b) Identify the type of chemical reaction which occurs when a metal corrodes.

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

1

(c) Identify the **two** types of chemical reaction represented by the following equation.



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

2

(4)

Marks

KU PS

7. The grid shows pairs of chemicals.

| | | | |
|-------------------------------------|--|--|--|
| A | | B | |
| $\text{CuO} + \text{C}$ | | $\text{Na} + \text{H}_2\text{O}$ | |
| C | | D | |
| $\text{Cu} + \text{NaNO}_3$ | | $\text{C}_5\text{H}_{12} + \text{O}_2$ | |
| E | | F | |
| $\text{Mg} + \text{H}_2\text{SO}_4$ | | $\text{Ag} + \text{HCl}$ | |

(a) Which box contains a pair of chemicals that react to form water?

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

1

(b) Which **two** boxes contain pairs of chemicals that do **not** react together?

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

2

(3)

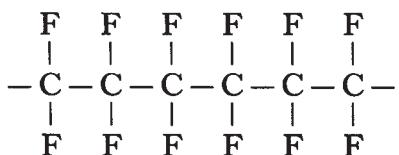
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| <i>Marks</i> | KU | PS |
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PART 2**A total of 40 marks is available in this part of the paper.**

8. Teflon is the brand name for the plastic, poly(tetrafluoroethene).

The structure of part of a poly(tetrafluoroethene) molecule is shown below.



(a) Draw the full structural formula for the monomer used to make poly(tetrafluoroethene).

1

(b) Teflon is a plastic which melts on heating.

What name is given to this type of plastic?

 1
(2)

| Marks | KU | PS |
|-------|----|----|
| | | |
| 1 | | |
| 1 | | |
| 1 | | |
| 1 | | |
| (4) | | |

9. A sample of hydrogen was found to contain two different types of atom; ^2_1H and ^1_1H .

(a) (i) What term is used to describe these different types of hydrogen atom?

(ii) This sample of hydrogen has an average atomic mass of 1.1. What is the mass number of the most common type of atom in this sample of hydrogen?

(iii) Complete the table to show the number of protons and neutrons in each type of hydrogen atom.

| Type of atom | Number of protons | Number of neutrons |
|----------------|-------------------|--------------------|
| ^2_1H | | |
| ^1_1H | | |

(b) In a methane molecule (CH_4), hydrogen atoms form bonds with a carbon atom.

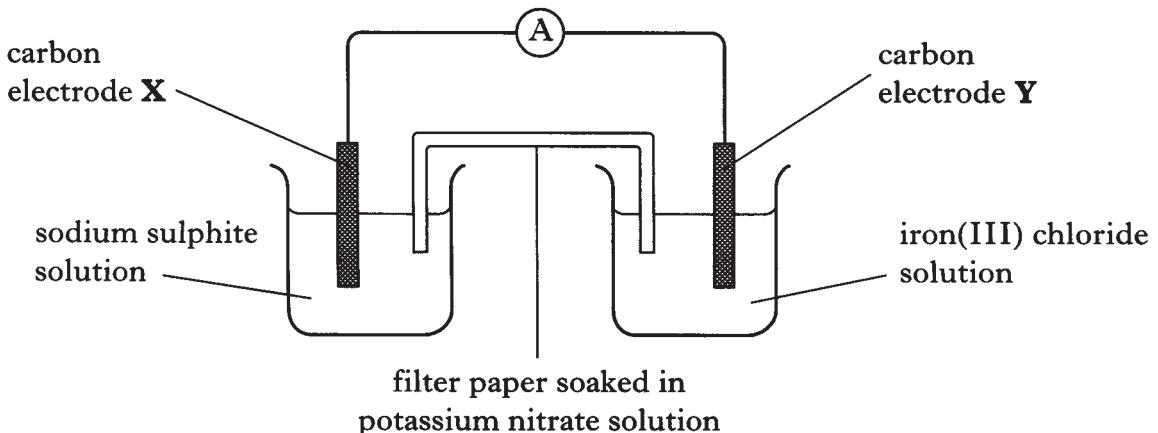
Draw a diagram to show the **shape** of a methane molecule.

Marks

KU

PS

10. A pupil set up the following experiment.



The reaction occurring at electrode Y is



(a) On the diagram, clearly mark the path and direction of electron flow.

(b) Name the type of chemical reaction taking place at electrode Y.

(c) After some time, ferroxyll indicator was added to the beaker containing electrode Y.

What colour would the ferroxyll indicator turn?

1

1

1

(3)

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WRITE IN
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MARGIN*Marks*

KU PS

11. Some types of steel can rust.(a) Name the **two** substances which must be present for steel to rust.

1(b) Paint containing "Red Lead" (Pb_3O_4) was used to protect steel from rusting.

Calculate the percentage, by mass, of lead in "Red Lead".

 %**2**

(c) Stainless steel is a type of steel which does not need protection. It contains chromium which forms a layer of chromium(III) oxide on the steel.

Write the formula for chromium(III) oxide.

1**(4)****[Turn over**

Marks

KU PS

12. Laura added the catalyst manganese dioxide to hydrogen peroxide solution and measured the volume of oxygen produced.



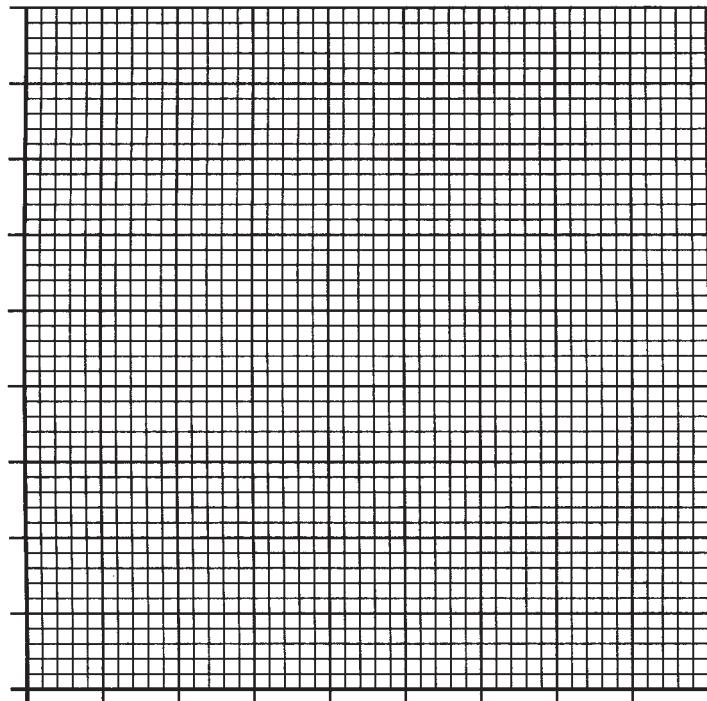
Her results are shown in the table.

| Time/s | 0 | 10 | 30 | 40 | 50 | 60 |
|----------------------------------|---|----|----|----|----|----|
| Volume of oxygen/cm ³ | 0 | 25 | 35 | 38 | 40 | 40 |

(a) 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 25.)



2

12. (continued)

(b) Using your graph, predict the volume of oxygen produced during the first 20 seconds.

_____ cm³

1

(c) Laura repeated the experiment at a higher temperature. She used the same volume and concentration of hydrogen peroxide solution.

Suggest a volume of oxygen produced during the first 30 seconds.

_____ cm³

1

(4)

[Turn over]

| Marks | KU | | PS |
|-------|----|--|----|
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13. Glucose is a carbohydrate.

(a) Name an isomer of glucose.

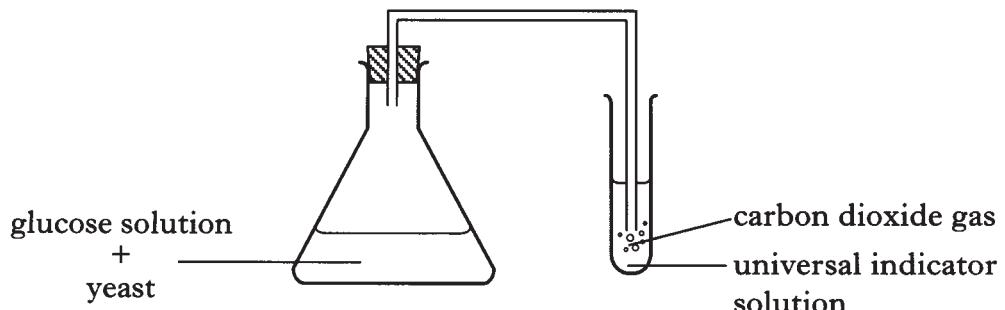
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(b) Glucose molecules join together to form starch in a polymerisation reaction.

Name the **type** of polymerisation reaction which takes place.

1

(c) The diagram shows how glucose can be fermented to produce an alcohol. Carbon dioxide gas is also produced.



(i) What is the chemical name for the alcohol produced?

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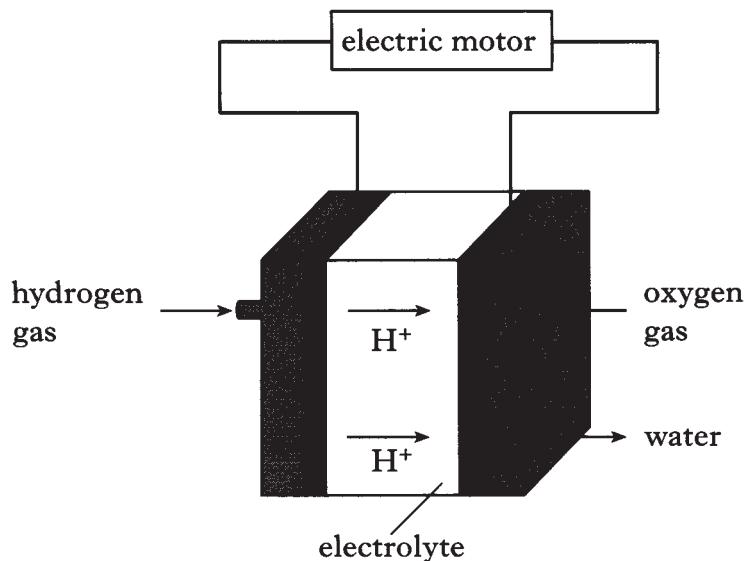
(ii) Suggest the colour of the universal indicator solution after the carbon dioxide gas has been bubbled through it.

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| KU | PS |
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| 1 | |
| 1 | |
| 1 | |
| (3) | |

14. Fuel cells produce electricity to power cars. The electricity is produced when hydrogen and oxygen react to form water.



(a) Suggest a possible source of oxygen for use in the fuel cell.

(b) Suggest an advantage in using fuel cells rather than petrol to power cars.

(c) Write the ion-electron equation for the formation of hydrogen ions.

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

[Turn over

15. Dinitrogen monoxide can be used to increase power in racing cars.

Dinitrogen monoxide decomposes to form nitrogen and oxygen.

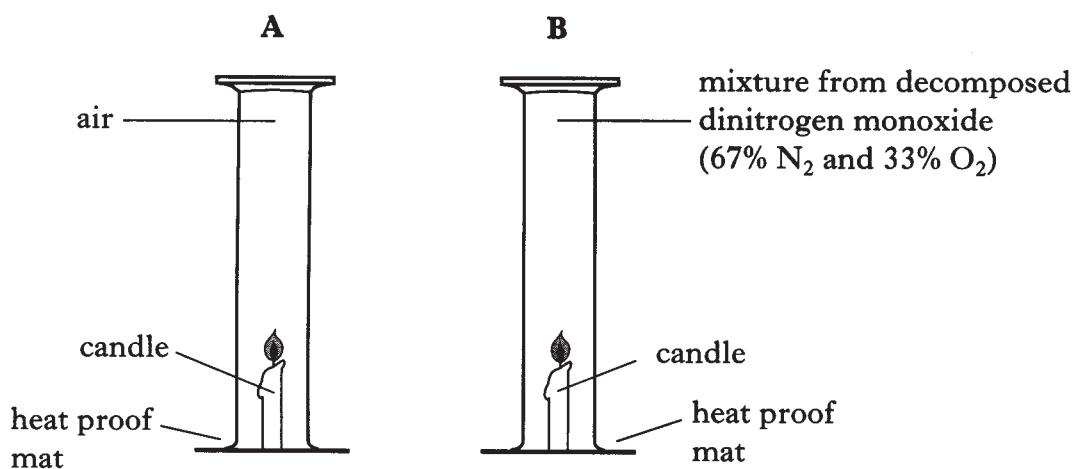


(a) Calculate the mass of oxygen produced, in grams, when 22 grams of dinitrogen monoxide decomposes.

Answer _____ g

2

(b) Tom set up the following experiment to compare the time taken for the burning candles in gas jars **A** and **B** to go out.



Circle the correct word in the table to show how the burning time of the candle in gas jar **B** compared to that in gas jar **A**.

| Candle | Burning time/s |
|----------|---------------------|
| A | 10 |
| B | same/longer/shorter |

1

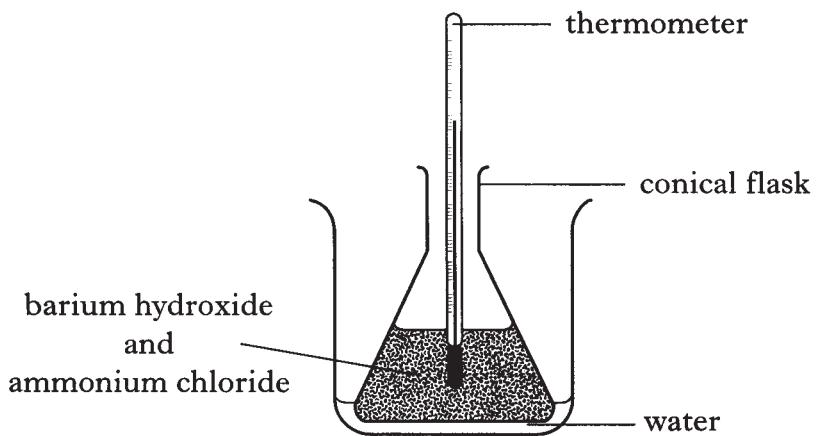
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16. Ammonia gas is produced when barium hydroxide reacts with ammonium chloride.



(a) The equation for the reaction which takes place is:



Balance this equation.

(b) Describe a test which would detect ammonia at the mouth of the flask.

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(c) During the reaction the reading on the thermometer dropped from 25°C to -5°C .

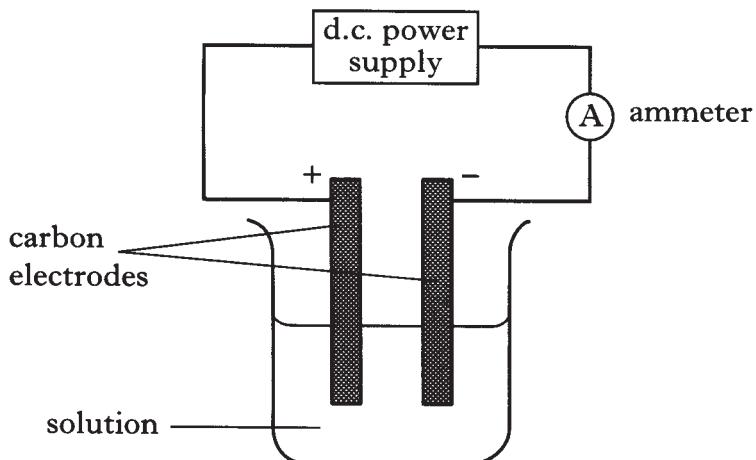
Suggest what would happen to the water in the beaker.

[Turn over

17. A class were given three chemicals labelled **X**, **Y** and **Z**.

The chemicals were glucose solution, copper chloride solution and dilute hydrochloric acid.

The apparatus below was used to help identify each solution.



The class obtained the following results.

| Solution | Ammeter reading | Observations at electrodes |
|----------|-----------------|--|
| X | Yes | bubbles of gas formed at both electrodes |
| Y | Yes | brown solid formed at negative electrode |
| Z | No | no reaction |

(a) When electricity is passed through solutions **X** and **Y** they are broken up.

What term is used to describe this process?

1

17. (continued)

(b) (i) Identify **X**.

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(ii) What type of bonding is present in **Z**?

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(iii) Describe what was **seen** at the positive electrode when electricity was passed through solution **Y**.

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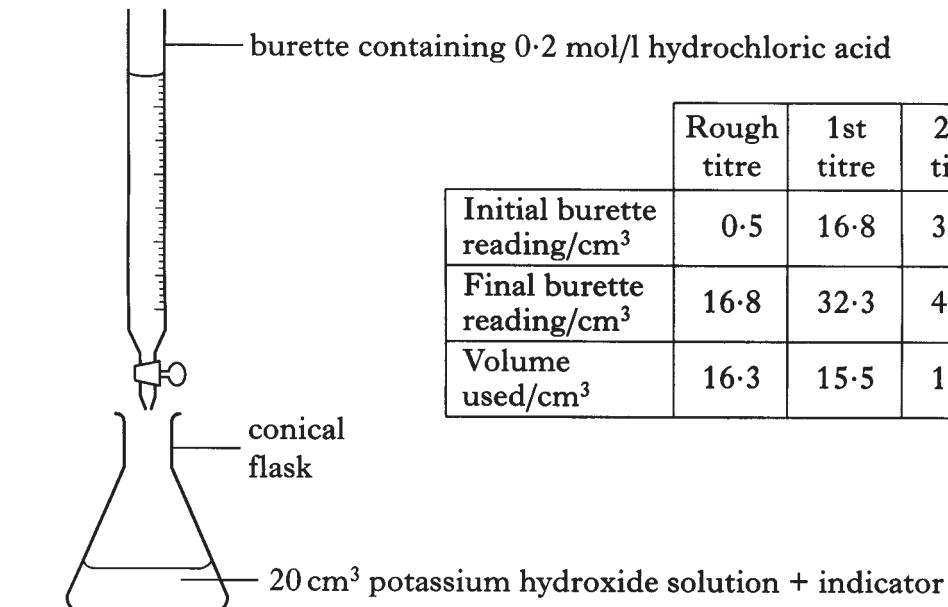
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Marks

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18. A pupil carried out a titration experiment to find the concentration of a potassium hydroxide solution.



| | Rough titre | 1st titre | 2nd titre |
|--|----------------|--------------|--------------|
| Initial burette reading/cm ³ | 0.5 | 16.8 | 32.3 |
| Final burette reading/cm ³ | 16.8 | 32.3 | 48.0 |
| Volume used/cm ³ | 16.3 | 15.5 | 15.7 |

The equation for the reaction is:



(a) Using the results in the table, calculate the **average** volume of hydrochloric acid required to neutralise the potassium hydroxide solution.

_____ cm³

1

Marks

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PS

18. (continued)

(b) Use the pupil's results to calculate the concentration, in mol/l, of the potassium hydroxide solution.

Show your working clearly.

_____ mol/l

2

(c) The indicator was removed from the potassium chloride solution by filtering the solution through charcoal.

How would the pupil then obtain a sample of **solid** potassium chloride from the solution?

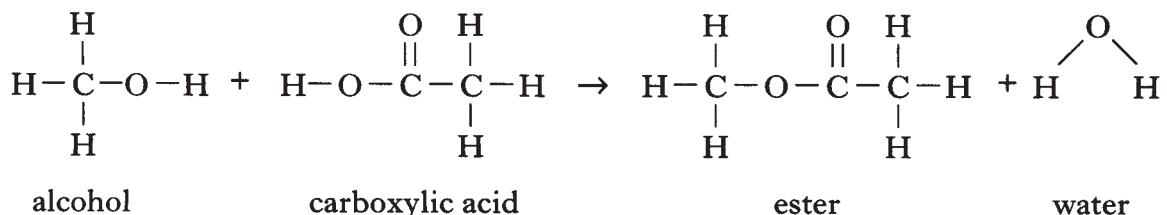
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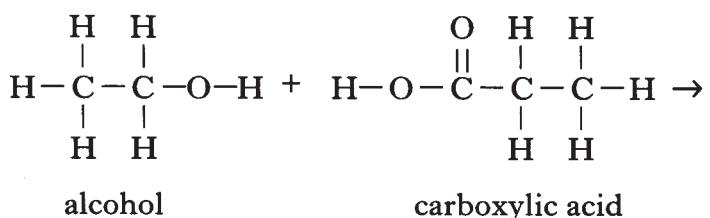
[Turn over

19. Esters are compounds used in perfumes.

Esters can be made when an alcohol reacts with a carboxylic acid.



(a) Draw the **full** structural formula for the **ester** produced in the following reaction.



(b) After some time the esters in perfumes react with water and break down to form the alcohol and carboxylic acid again.

Suggest a name for the type of chemical reaction taking place.

1

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(2)

[END OF QUESTION PAPER]