FOR OFFICIAL USE

C

	KU	PS
Total Marks		

0500/402

NATIONAL QUALIFICATIONS 2011

THURSDAY, 26 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

Scottish candidate number

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 10 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_4	B H_2	C CO_2
D CO	E C_2H_5OH	F C

(*a*) Identify the hydrocarbon.

(A)	B	C
D	E	F

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

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

A	(B)	C
D	E	(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:

~~(A)~~	B	C
(D)	E	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:

✓~~(A)~~	B	C
~~(D)~~	E	F

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

1. Limewater can be made by dissolving calcium hydroxide in water.

Identify the term used to describe the water.

A	solute
B	solvent
C	solution
D	insoluble

A
B
C
D

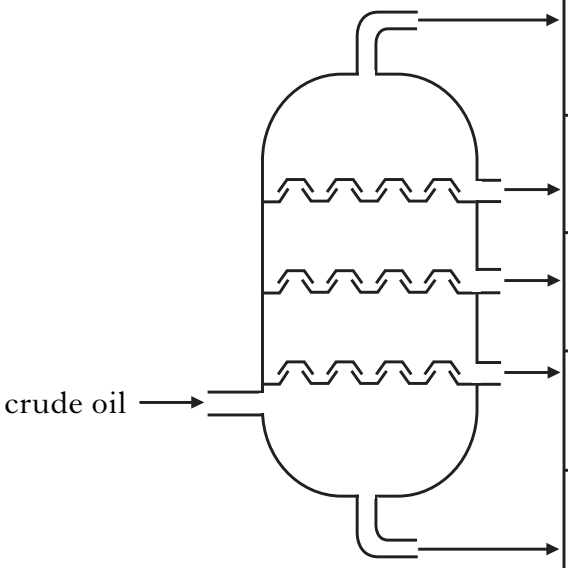
(1)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

2. Distillation of crude oil produces several fractions.



Fraction	Number of carbon atoms per molecule
A	1–4
B	4–10
C	10–16
D	16–20
E	20+

(*a*) Identify the fraction which is used to tar roads.

A
B
C
D
E

1

(*b*) Identify the fraction which is most flammable.

A
B
C
D
E

1

(2)

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

3. The grid shows the symbols of some elements.

A O	B K	C P
D F	E Li	F Al

(*a*) Identify the element with the lowest density.

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

A	B	C
D	E	F

1

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

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

A	B	C
D	E	F

1

(*c*) Identify the **two** elements which would react together to form a molecule with the same shape as an ammonia molecule.

A	B	C
D	E	F

1

(3)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

4. The table contains information about some substances.

Substance	Melting point/°C	Boiling point/°C	Conducts as a solid	Conducts as a liquid
A	–7	59	no	no
B	1492	2897	yes	yes
C	1407	2357	no	no
D	606	1305	no	yes
E	–39	357	yes	yes
F	–78	–33	no	no

(*a*) Identify the substance which is a gas at 0 °C.

A
B
C
D
E
F

1

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

A
B
C
D
E
F

1

(2)

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

5. The grid shows the formulae of some oxides.

A ZnO	B NO_2	C K_2O
D CuO	E Fe_2O_3	F CO

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

A	B	C
D	E	F

1

(*b*) Identify the oxide which dissolves in water to give an alkaline solution.
You may wish to use the data booklet to help you.

A	B	C
D	E	F

1

(*c*) Identify the oxide which is reduced in a blast furnace.

A	B	C
D	E	F

1

(3)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

6. Equations are used to represent chemical reactions.

A	$2H_2(g) + O_2(g) \longrightarrow 2H_2O(\ell)$
B	$2H_2O(\ell) + O_2(g) + 4e^- \longrightarrow 4OH^-(aq)$
C	$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(\ell)$
D	$H^+(aq) + OH^-(aq) \longrightarrow H_2O(\ell)$
E	$Zn(s) + FeSO_4(aq) \longrightarrow Fe(s) + ZnSO_4(aq)$

(*a*) Identify the equation which represents neutralisation.

A
B
C
D
E

1

(*b*) Identify the equation involved in the rusting of iron.

A
B
C
D
E

1

(2)

DO NOT WRITE IN THIS MARGIN

Marks

KU	PS

7. A student made the following statements about the particles found in an atom.

A	Relative mass = 1
B	Charge = zero
C	Found outside the nucleus
D	Charge = 1+
E	Charge = 1–

Identify the **two** statements which apply to an electron.

A
B
C
D
E

(1)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

8. Identify the **two** statements which apply to zinc.

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

A	It displaces calcium from a solution of calcium nitrate.
B	It reacts with cold water.
C	It can be obtained by heating its oxide.
D	It reacts with dilute hydrochloric acid.
E	It is displaced from a solution of its chloride by magnesium.

A
B
C
D
E

(2)

DO NOT WRITE IN THIS MARGIN

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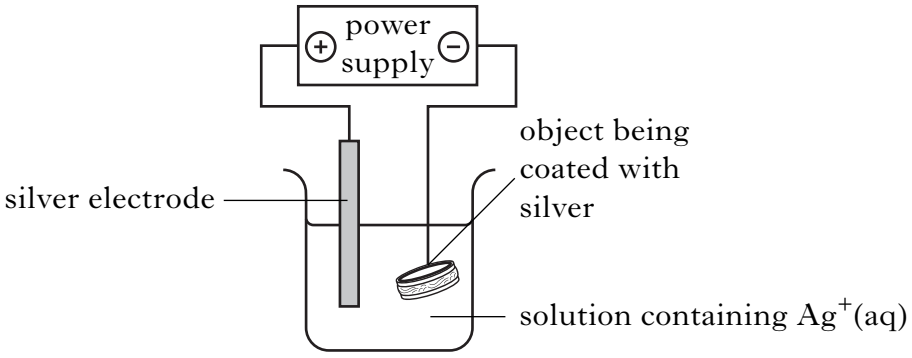
9. The diagram shows how an object can be coated with silver.



The following reactions take place at the electrodes.

Negative electrode: $Ag^+(aq) + e^- \longrightarrow Ag(s)$

Positive electrode: $Ag(s) \longrightarrow Ag^+(aq) + e^-$

Identify the **two** correct statements.

A	Ions flow through the solution.
B	Silver ions move towards the silver electrode.
C	The process is an example of galvanising.
D	The mass of the silver electrode decreases.
E	Reduction occurs at the silver electrode.

A
B
C
D
E

(2)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

10. A student made the following statements about the rusting of iron.

A	During rusting Fe^{3+} ions are changed to Fe^{2+} ions.
B	Rusting is an example of oxidation.
C	Iron rusts when connected to the negative terminal of a battery.
D	Tin gives sacrificial protection to iron.
E	Electroplating provides a surface barrier to air and water.

Identify the **two** correct statements.

A
B
C
D
E

(2)

[Turn over for Part 2 on *Page fourteen*

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

PART 2

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

11. (*a*) The table shows information about two of the gases found in air.

Gas	Boiling point/°C
oxygen	–183
nitrogen	–196

At very low temperatures air is a mixture of liquids.

Name the process which can be used to separate this mixture.

_____ **1**

(*b*) In a sample of oxygen there are two different types of oxygen atom:

$^{18}_{8}O$ and $^{16}_{8}O$

(i) What **term** is used to describe these different types of oxygen atom?

_____ **1**

(ii) Complete the table for each type of oxygen atom.

Type of atom	Number of protons	Number of neutrons
$^{18}_{8}O$		
$^{16}_{8}O$		

1

(3)

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

12. (*a*) Ethanol, for alcoholic drinks, can be made from glucose.

Name this process.

_____ **1**

(*b*) The table below shows the relationship between the percentage of ethanol and the density of alcoholic drinks.

Percentage of ethanol (%)	40	50	60	70	80
Density of alcoholic drink (g/cm^3)	0·928	0·907	0·886	0·865	0·844

(i) Write a general statement describing how the percentage of ethanol affects the density of the alcoholic drink.

_____

_____

_____ **1**

(ii) The density of a particular brand of alcoholic drink is 0·970 g/cm^3.

Predict the percentage of ethanol in this alcoholic drink.

_____ % **1**

(3)

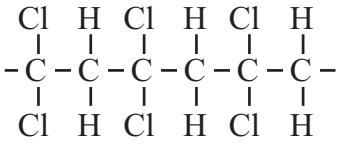
[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

13. Polyvinyldichloride (PVDC) is a plastic used in food packaging.

The structure of part of a PVDC molecule is shown.



(*a*) Draw the **full** structural formula for the monomer used to make PVDC.

1

(*b*) Name a toxic gas produced when PVDC burns.

_____

1

(2)

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

14. (*a*) When sulphur dioxide dissolves in water in the atmosphere "acid rain" is produced.

(Circle) the correct phrase to complete the sentence.

Compared with pure water, acid rain contains { a higher / a lower / the same } concentration of hydrogen ions. **1**

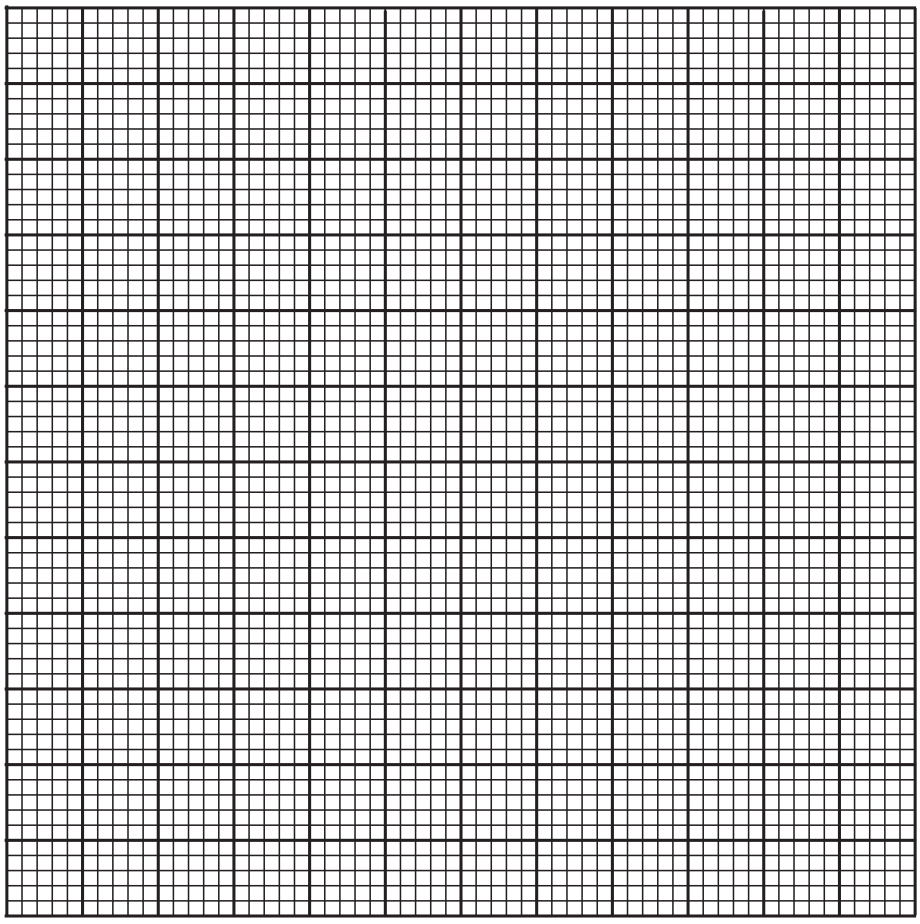
(*b*) The table shows information about the solubility of sulphur dioxide.

Temperature /°C	0	20	30	40	50	60
Solubility in g/100 cm^3	22·0	10·0	6·0	3·0	2·0	1·5

Draw a line graph of solubility against temperature.

Use appropriate scales to fill most of the graph paper.

(Additional graph paper, if required, will be found on page 28.)



2

(3)

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

15. Scientists have developed a "bio-battery" which produces electricity from sucrose.

(*a*) Write the molecular formula for sucrose.

1

(*b*) Name an isomer of sucrose.

_____

1

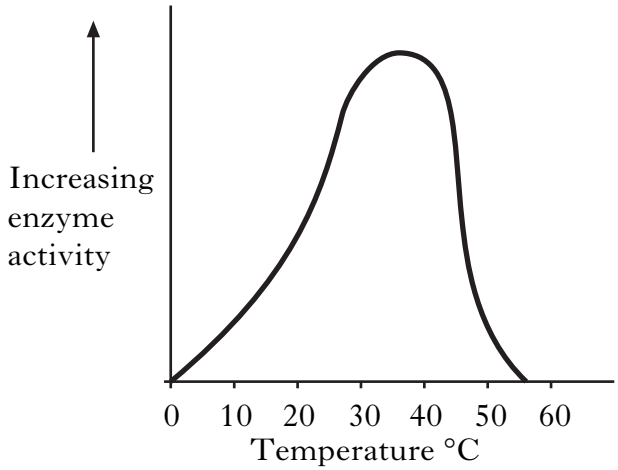
(*c*) The sucrose is broken down using an enzyme.

(i) What is meant by the term "enzyme"?

_____

1

(ii) The graph shows how temperature affects the activity of an enzyme.



State **one** other factor which has a similar effect on enzyme activity.

_____

1

(4)

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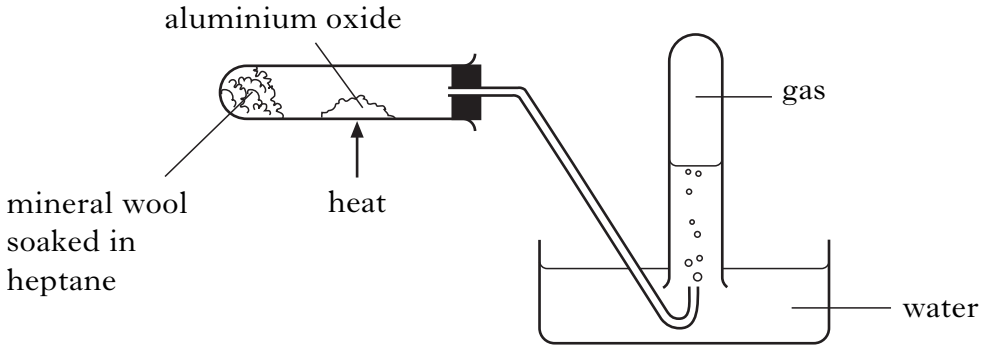
Marks | KU | PS

16. Heptane can be cracked as shown.



One of the reactions which takes place is:

$$C_7H_{16} \longrightarrow C_4H_{10} + C_3H_6$$

(*a*) The product C_3H_6 decolourises bromine solution quickly.

Draw a structural formula for an isomer of C_3H_6, which would **not** decolourise bromine solution quickly.

1

(*b*) Aluminium oxide is used as a catalyst to speed up the reaction.

(i) Suggest another reason for using a catalyst.

_____

_____ **1**

(ii) Write the formula for aluminium oxide.

1

(3)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

17. Urea reacts with water, breaking down to form carbon dioxide and ammonia.

$$\underset{\text{urea}}{H_2NCONH_2} + H_2O \longrightarrow CO_2 + 2NH_3$$

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

_____ **1**

(*b*) Calculate the mass of ammonia produced, in grams, when 90 g of urea breaks down.

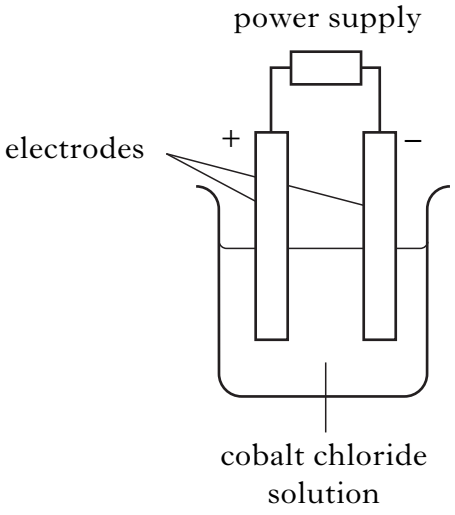
_____ g **2**

(3)

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

18. A student set up the following experiment to electrolyse cobalt chloride solution.



(*a*) What **type** of power supply **must** be used to electrolyse cobalt chloride solution?

_____ **1**

(*b*) Describe what would be **seen** at the positive electrode.

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

_____

_____ **1**

(*c*) The formula for cobalt chloride is $CoCl_2$.

What is the charge on the cobalt ion in $CoCl_2$?

_____ **1**

(3)

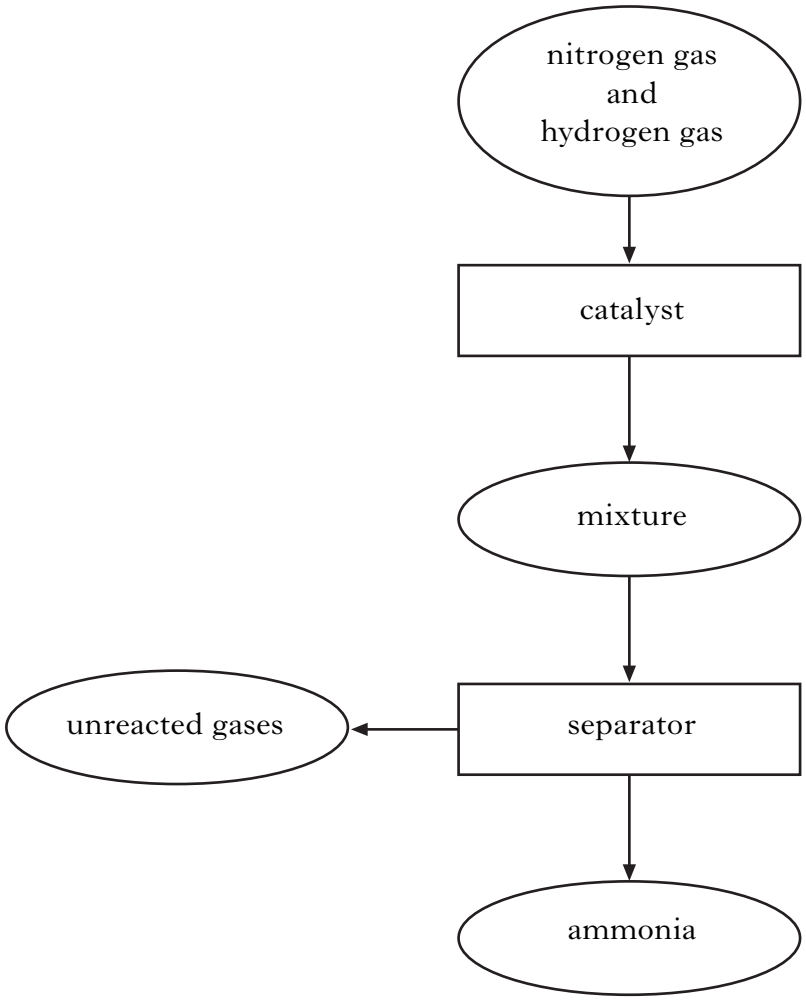
[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

19. Catalysts can be used in different processes.

(*a*) The flow diagram shows the steps involved in the Haber process.

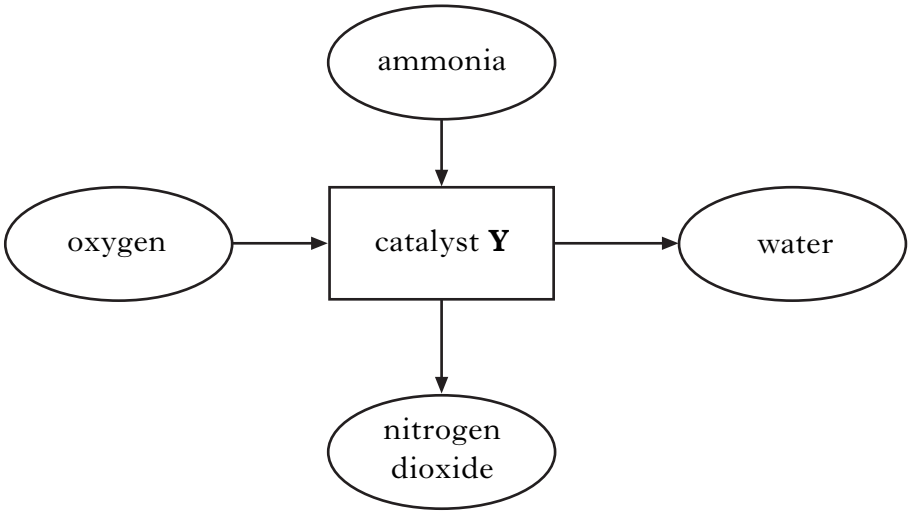


On the flow diagram above draw an arrow to show how the process is made more economical. **1**

Marks | KU | PS

19. (continued)

(*b*) Ammonia can be used to produce nitrogen dioxide as shown.



(i) Name catalyst **Y**.

_____ **1**

(ii) Why is it **not** necessary to continue to supply heat once the reaction has started?

_____

_____ **1**

(*c*) Catalysts are also used in catalytic converters.

What is the purpose of a catalytic converter in a car exhaust system?

_____

_____

_____ **1**

(4)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

20. Metal salts can be produced by different methods.

(*a*) Lead(II) iodide can be produced by reacting lead(II) nitrate solution with sodium iodide solution.

The equation for this reaction is:

$$Pb(NO_3)_2(aq) + NaI(aq) \longrightarrow PbI_2(s) + NaNO_3(aq)$$

(i) Balance the above equation. **1**

(ii) What technique could be used to remove lead(II) iodide from the mixture?

_____ **1**

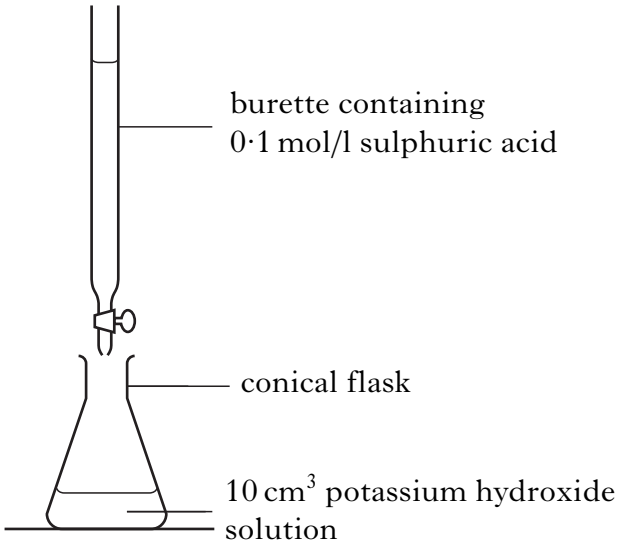
(*b*) The salt copper(II) nitrate can be produced as shown.

$$\mathbf{X} + 2HNO_3 \longrightarrow Cu(NO_3)_2 + CO_2 + H_2O$$

Name substance **X**.

_____ **1**

(*c*) Potassium sulphate can be produced by titrating potassium hydroxide solution with dilute sulphuric acid.



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Marks | KU | PS

20. (*c*) (continued)

(i) What must be added to the conical flask to show the end-point of the titration?

_____ **1**

(ii) The average volume of sulphuric acid used in the titration is $20\,cm^3$.

Calculate the number of moles of sulphuric acid used.

_____ mol **1**

(*d*) The equation for the reaction is:

$$H_2SO_4 + 2KOH \longrightarrow K_2SO_4 + 2H_2O$$

Using your answer from part (*c*)(ii), calculate the number of moles of potassium hydroxide in the $10\,cm^3$ sample of potassium hydroxide solution.

_____ mol **1**

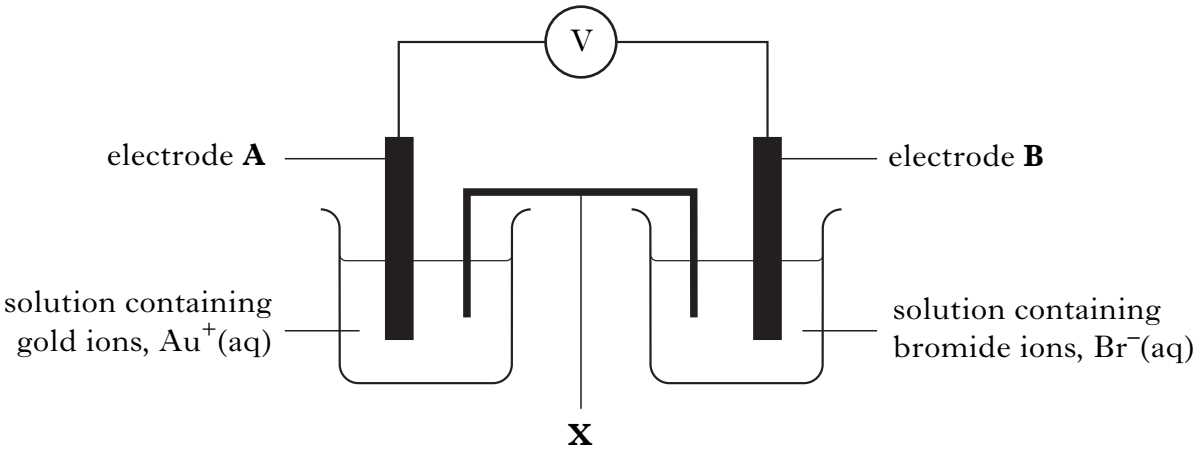
(6)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

21. A technician set up the following cell.



The reaction taking place at electrode **B** is:

$$2Br^-(aq) \longrightarrow Br_2(\ell) + 2e^-$$

(*a*) **On the diagram**, clearly mark the path and direction of electron flow. **1**

(*b*) Write the ion-electron equation for the reaction taking place at electrode **A**.

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

1

(*c*) Name the piece of apparatus labelled **X**.

_____

1

(3)

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

22. Ethylthioethane belongs to a homologous series of compounds called thioethers.

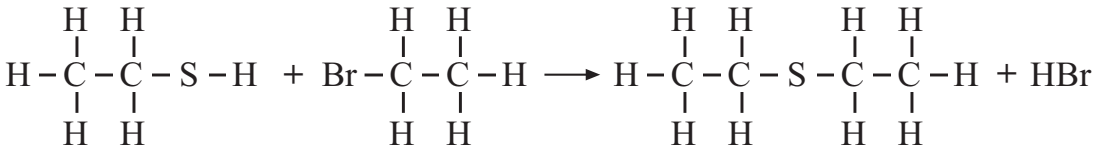
(*a*) What is meant by a homologous series?

_____

_____

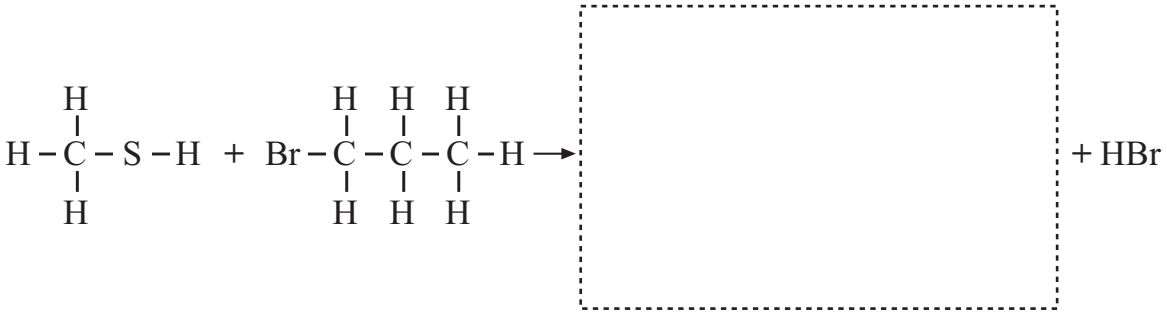
_____ **1**

(*b*) Ethylthioethane is formed when ethylthiol reacts with bromoethane as shown.



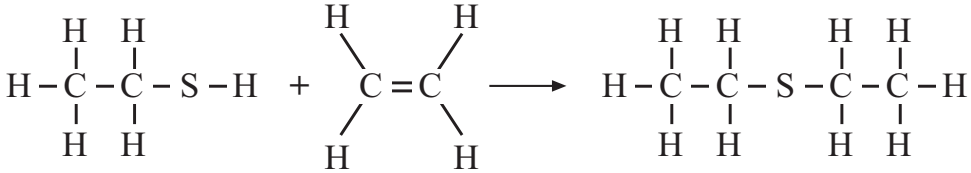
ethylthiol bromoethane ethylthioethane hydrogen bromide

Draw the **full** structural formula for the thioether produced in the following reaction.



1

(*c*) Ethylthioethane can also be formed by the reaction of ethylthiol with ethene.



ethylthiol ethene ethylthioethane

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

_____ **1**

(3)

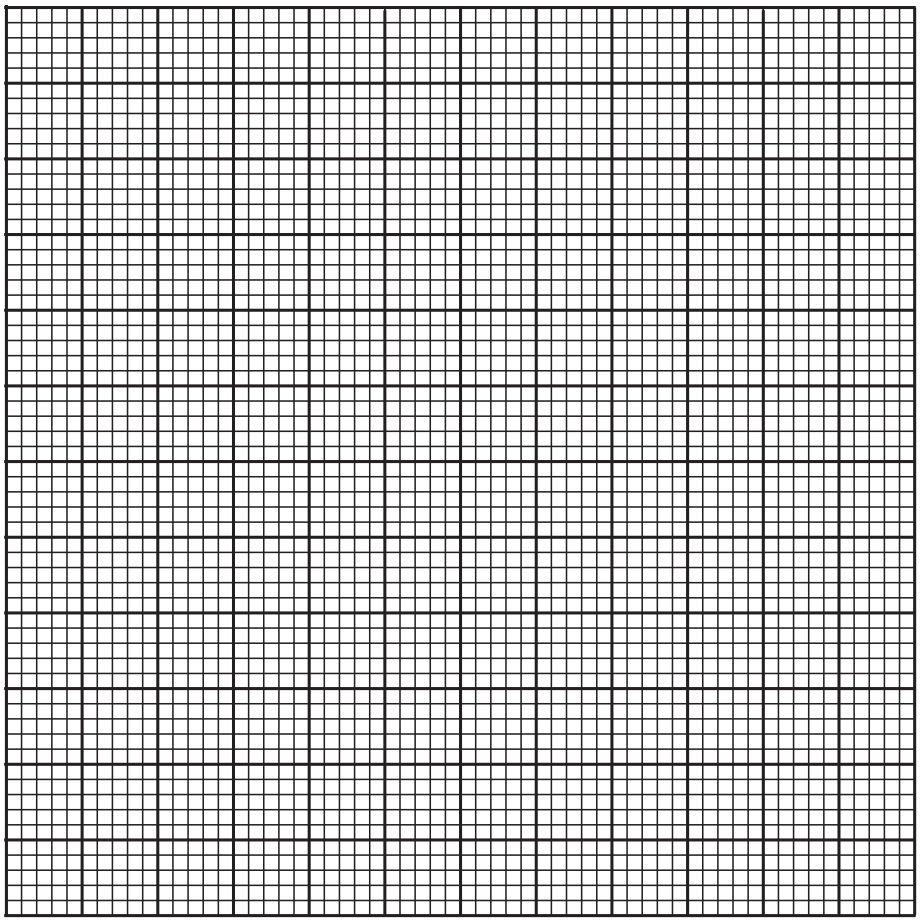
[*END OF QUESTION PAPER*]

DO NOT WRITE IN THIS MARGIN

KU	PS

ADDITIONAL SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 14(*b*)



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ADDITIONAL SPACE FOR ANSWERS

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ADDITIONAL SPACE FOR ANSWERS

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