FOR OFFICIAL USE

C

	KU	PS
Total Marks		

0500/402

NATIONAL QUALIFICATIONS 2007

THURSDAY, 10 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

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.

SA 0500/402 6/26770

PART 1

In Questions 1 to 9 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:

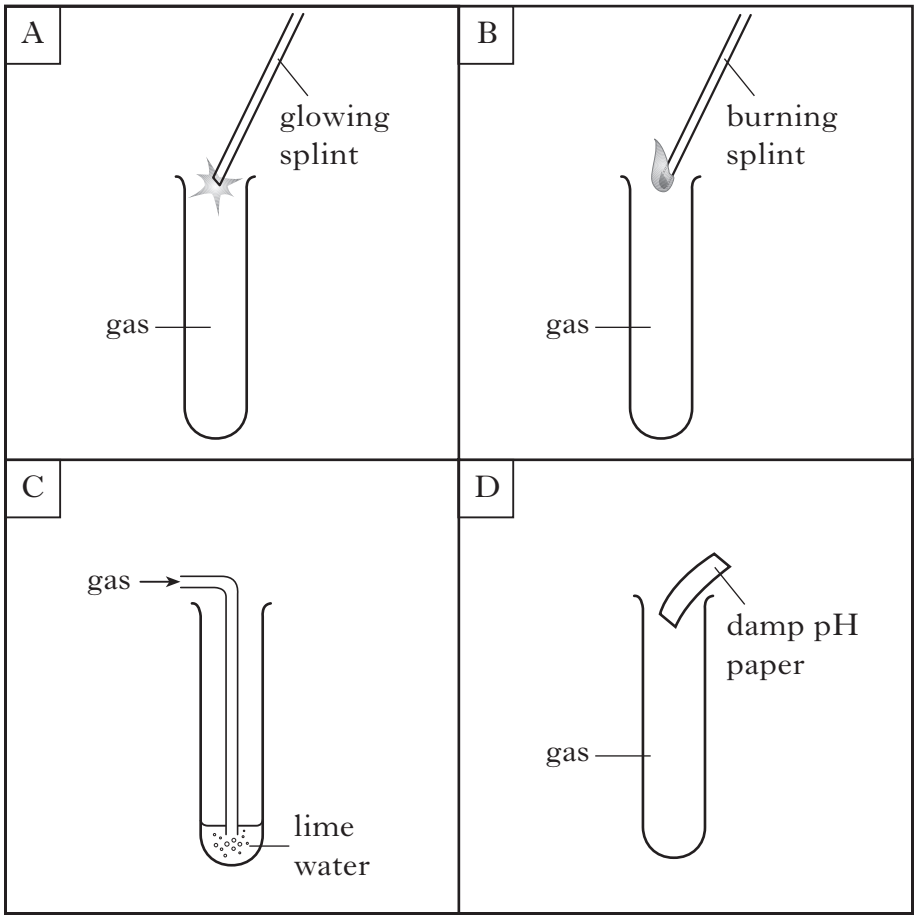
✓~~(A)~~	B	C
~~(D)~~	E	F

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

1.

Testing gases



(*a*) Identify the test for oxygen gas.

A	B
C	D

1

(*b*) Identify a test for ammonia gas.

A	B
C	D

1

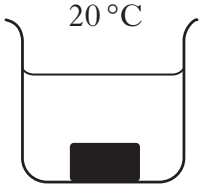
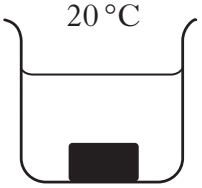
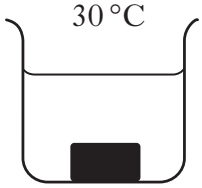
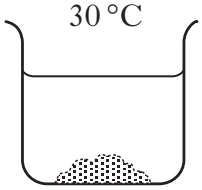
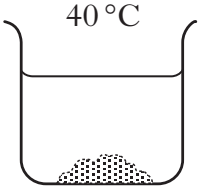
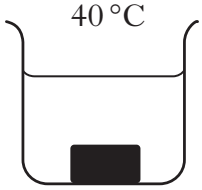
(2)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

2. Zinc and magnesium both react with dilute hydrochloric acid.

A 20 °C  zinc lump 1 mol/l hydrochloric acid	B 20 °C  magnesium lump 1 mol/l hydrochloric acid	C 30 °C  magnesium lump 1 mol/l hydrochloric acid
D 30 °C  zinc powder 2 mol/l hydrochloric acid	E 40 °C  magnesium powder 2 mol/l hydrochloric acid	F 40 °C  zinc lump 2 mol/l hydrochloric acid

(*a*) Identify the experiment with the **slowest** rate of reaction.

A	B	C
D	E	F

1

(*b*) Identify the **two** experiments which could be used to investigate the effect of temperature on the rate of reaction.

A	B	C
D	E	F

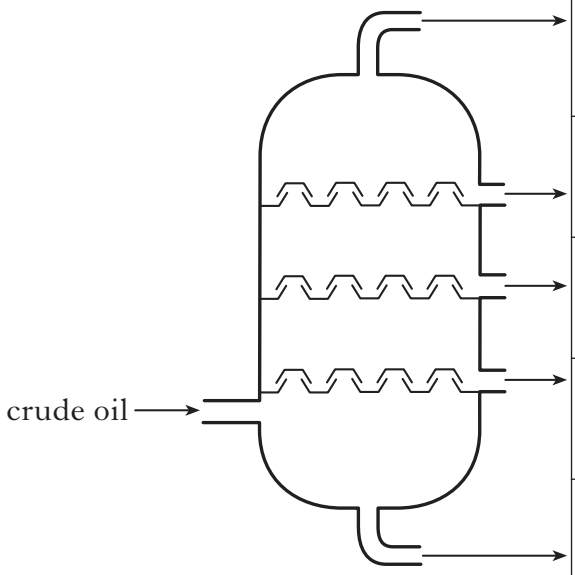
1

(2)

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

3. 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 with the lowest boiling point.

A
B
C
D
E

1

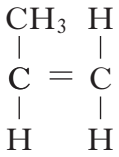
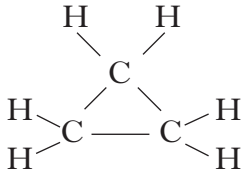
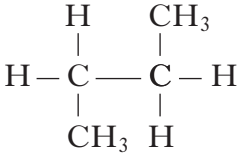
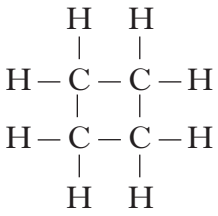
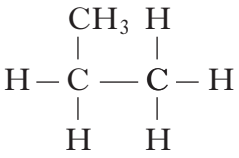
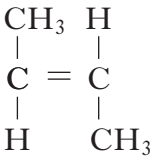
(2)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

4. The structural formulae for some hydrocarbons are shown below.

A 	B 	C 
D 	E 	F 

(*a*) Identify the hydrocarbon which could be used to make poly(butene).

A	B	C
D	E	F

1

(*b*) Identify the **two** hydrocarbons with the general formula C_nH_{2n} which do **not** react quickly with hydrogen.

A	B	C
D	E	F

1

(2)

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

5. The table contains information about some substances.

Substance	*Melting point/ °C*	*Boiling point/ °C*	*Conducts as a solid*	*Conducts as a liquid*
A	1700	2230	no	no
B	605	1305	no	yes
C	–13	77	no	no
D	801	1413	no	yes
E	181	1347	yes	yes
F	–39	357	yes	yes

(*a*) Identify the substance which exists as covalent molecules.

A
B
C
D
E
F

1

(*b*) Identify the metal which is liquid at 25 °C.

A
B
C
D
E
F

1

(2)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

6. Equations are used to represent chemical reactions.

A	$Sn(s) \longrightarrow Sn^{2+}(aq) + 2e^-$
B	$Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$
C	$H^+(aq) + OH^-(aq) \longrightarrow H_2O(\ell)$
D	$2Mg(s) + O_2(g) \longrightarrow 2MgO(s)$
E	$SO_2(g) + H_2O(\ell) \longrightarrow 2H^+(aq) + SO_3^{2-}(aq)$

(*a*) Identify the equation which represents the formation of acid rain.

A
B
C
D
E

1

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

A
B
C
D
E

1

(*c*) Identify the **two** equations in which a substance is oxidised.

A
B
C
D
E

2

(4)

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

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

A	It has a positive charge.
B	It has a negative charge.
C	It has a relative mass of almost zero.
D	It has a relative mass of 1.
E	It is found inside the nucleus.
F	It is found outside the nucleus.

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

A
B
C
D
E
F

(2)

8. A student made some statements about the reaction of silver(I) oxide with excess dilute hydrochloric acid.

A	The concentration of hydrogen ions increases.
B	Carbon dioxide gas is produced.
C	An insoluble salt is produced.
D	Hydrogen gas is produced.
E	Water is produced.

Identify the **two** correct statements.

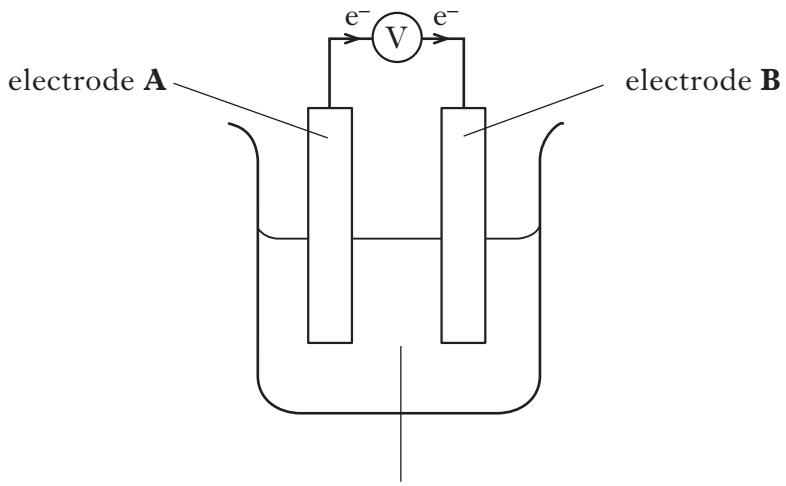
A
B
C
D
E

(2)

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

9. When two different electrodes are joined in a cell, a chemical reaction takes place and a voltage is produced.



	Electrode A	***Electrode B***
A	magnesium	iron
B	iron	carbon
C	iron	aluminium
D	iron	copper
E	lead	iron

Which **two** pairs of electrodes will produce a flow of electrons in the same direction as shown in the diagram and would produce a blue colour around electrode **A**?

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

A
B
C
D
E

(2)

[Turn over for Part 2 on *Page twelve*

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

PART 2

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

10. A sample of silver was found to contain two isotopes, $^{107}_{47}Ag$ and $^{109}_{47}Ag$.

(*a*) This sample of silver has an average atomic mass of 108.

What does this indicate about the amount of each isotope in this sample?

_____

_____ **1**

(*b*) Complete the table to show the number of each type of particle in a $^{107}_{47}Ag^{+}$ ion.

Particle	***Number***
proton	
neutron	
electron	

2

(*c*) Silver can be displaced from a solution of silver(I) nitrate.

$$AgNO_3(aq) + Cu(s) \longrightarrow Ag(s) + Cu(NO_3)_2(aq)$$

(i) Balance this equation. **1**

(ii) Name a metal which would **not** displace silver from silver(I) nitrate.

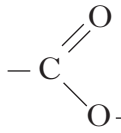
You may wish to use the data booklet to help you.

_____ **1**

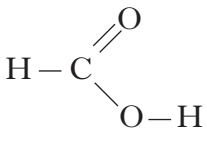
(5)

DO NOT WRITE IN THIS MARGIN

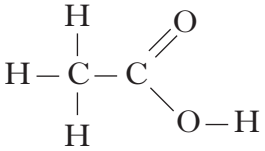
Marks	KU	PS

11. Alkanoic acids are a family of compounds which contain the  group.

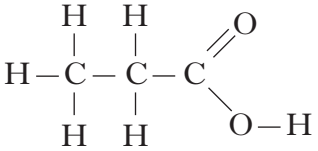
The **full** structural formulae for the first three members are shown.



methanoic acid



ethanoic acid



propanoic acid

(*a*) Draw the **full** structural formula for the alkanoic acid containing 4 carbon atoms.

1

(*b*) The table gives information on some alkanoic acids.

Acid	***Boiling point/ °C***
methanoic acid	101
ethanoic acid	118
propanoic acid	141
butanoic acid	164

(i) Using this information, make a general statement linking the boiling point to the number of carbon atoms.

_____

_____

_____ **1**

(ii) Predict the boiling point of pentanoic acid.

_____ °C **1**

(3)

[Turn over

DO NOT WRITE IN THIS MARGIN

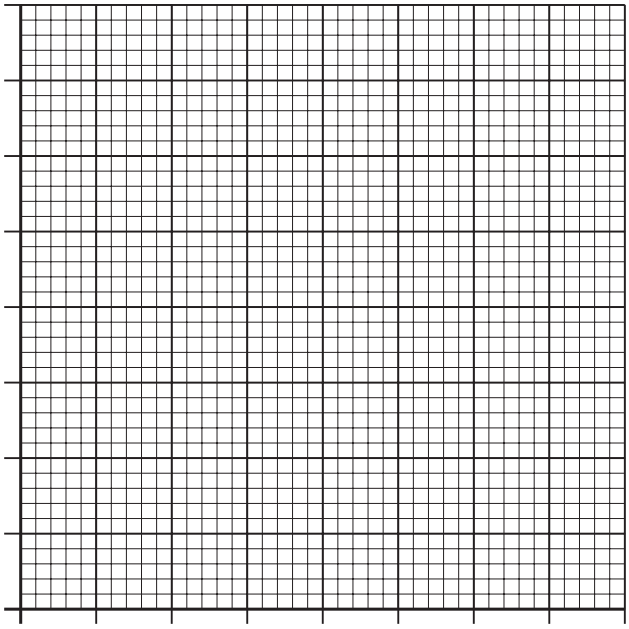
Marks	KU	PS

12. Ammonia is made when nitrogen and hydrogen react together.

The table below shows the percentage yields obtained when nitrogen and hydrogen react at different pressures.

Pressure/atmospheres	***Percentage yield of ammonia***
25	28
50	40
100	53
200	67
400	80

(*a*) Draw a line graph of percentage yield against pressure.
Use appropriate scales to fill most of the graph paper.
(Additional graph paper, if required, will be found on page 27.)



2

(*b*) Use your graph to estimate the percentage yield of ammonia at 150 atmospheres.

_____

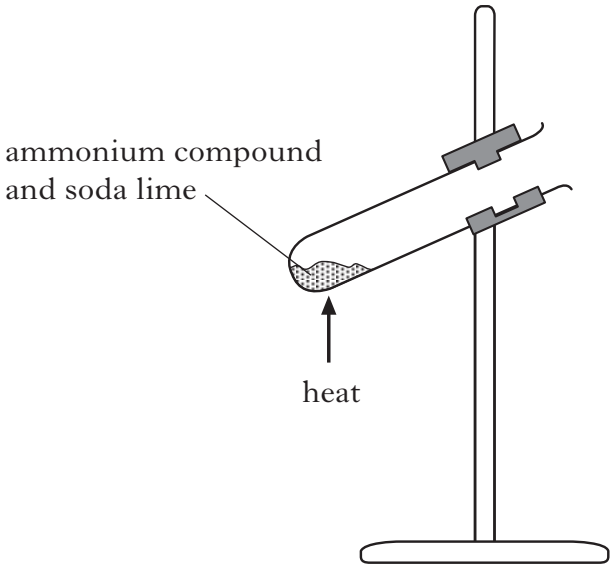
1

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

12. (continued)

(*c*) Ammonia can be produced in the lab by heating an ammonium compound with soda lime.



In order to produce ammonia, what **type** of compound must soda lime be?

_____ **1**

(4)

[Turn over

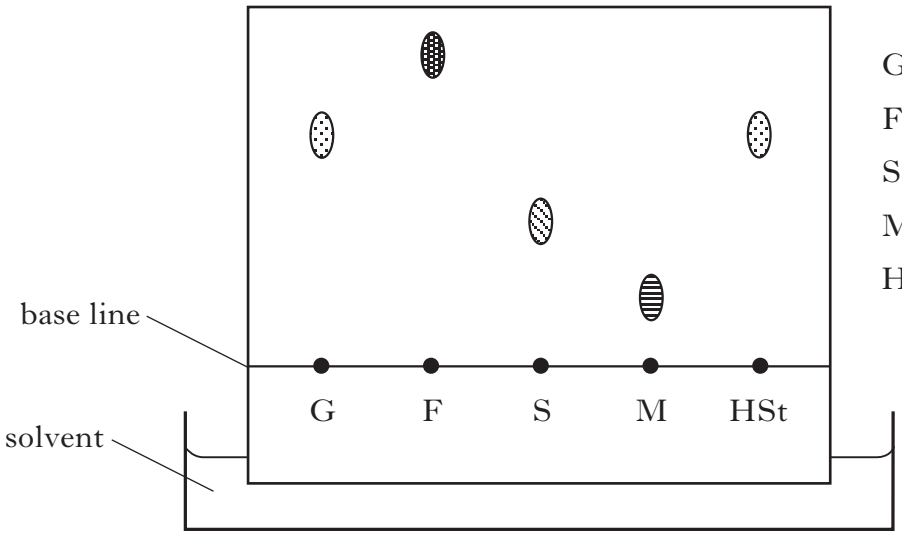
DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

13. Starch and sucrose can be hydrolysed to produce simple sugars.

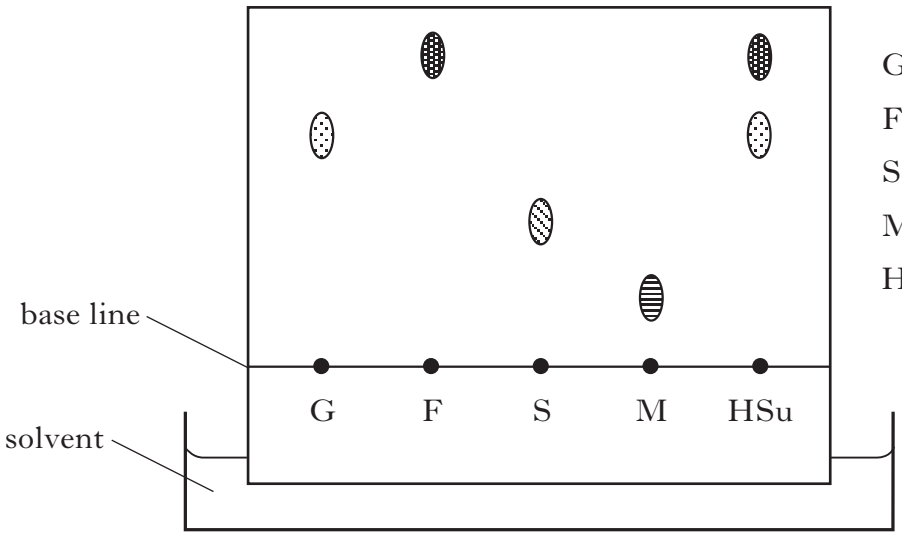
Chromatography is a technique which can be used to identify the sugars produced.

Samples of known sugar solutions are spotted on the base line. The solvent travels up the paper carrying spots of sugars at different rates.



The diagram above shows that **only glucose** is produced when starch is hydrolysed.

(*a*) The chromatogram below can be used to identify the simple sugars produced when sucrose is hydrolysed.



Name the sugars produced when sucrose is hydrolysed.

_____

1

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

13. (continued)

(*b*) What **type** of substance, present in the digestive system, acts as a catalyst in the hydrolysis of sucrose?

_____ **1**

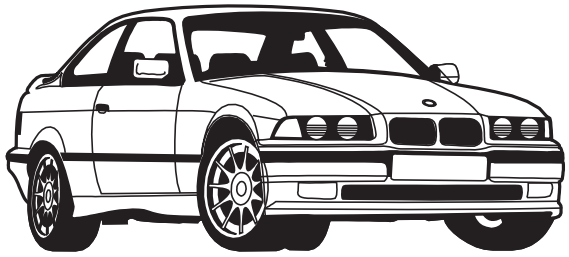
(2)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

14. Cars made from steel can be protected from rusting in a number of ways.



(*a*) Circle the correct word to complete the sentence below.

Steel does not rust when attached to the { negative / positive } terminal of a car battery. **1**

(*b*) The steel body of the car can be coated by dipping it in molten zinc.

(i) What name is given to this process?

_____ **1**

(ii) Explain why the steel does **not** rust even when the zinc coating is scratched.

_____

_____

_____ **1**

(3)

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

15. The atoms in a chlorine molecule are held together by a covalent bond. A covalent bond is a shared pair of electrons.

The chlorine molecule can be represented as

● = electron

(*a*) Showing **all** outer electrons, draw a similar diagram to represent a molecule of hydrogen chloride, HCl.

1

(*b*) In forming covalent bonds, why do atoms share electrons?

_____

_____

_____ **1**

(2)

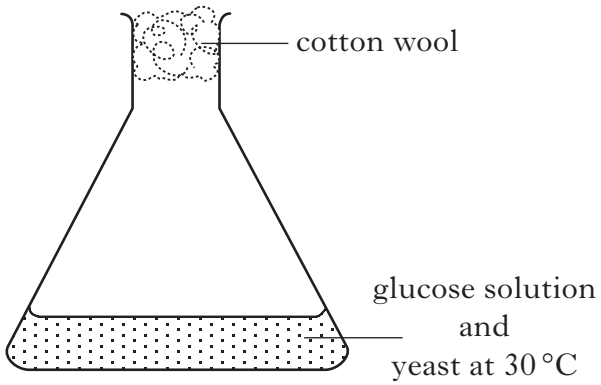
[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

16. Ethanol is the alcohol found in alcoholic drinks.

It can be produced as shown in the diagram.



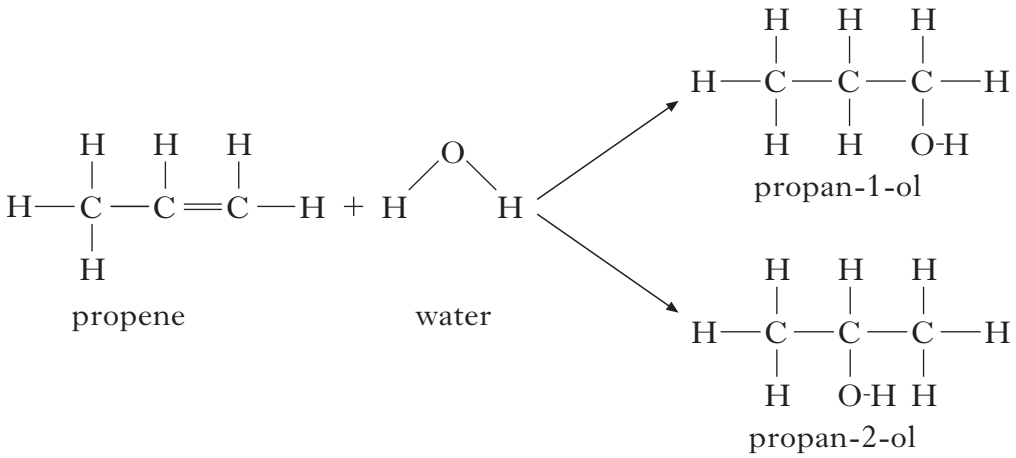
(*a*) (i) Name the type of chemical reaction taking place in the flask.

_____ **1**

(ii) What would happen to the rate of the reaction if the experiment above was repeated at 50 °C?

_____ **1**

(*b*) In industry, alcohols can be produced from alkenes as shown in the example below.



(i) Name the type of chemical reaction taking place.

_____ **1**

DO NOT WRITE IN THIS MARGIN

	Marks	KU	PS

16. (*b*) (continued)

(ii) What **term** is used to describe a pair of alcohols like propan-1-ol and propan-2-ol?

_____ **1**

(iii) Propan-1-ol and propan-2-ol have different boiling points.

Name the process which could be used to separate a mixture of these alcohols.

_____ **1**

(5)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

17. The table contains information on minerals.

Mineral	***Formula***
cinnabar	HgS
fluorite	CaF_2
gibbsite	$Al(OH)_3$
haematite	Fe_2O_3
zinc blende	ZnS

(*a*) State the chemical name for zinc blende.

_____ **1**

(*b*) Name the salt formed when gibbsite reacts with dilute hydrochloric acid.

_____ **1**

(*c*) Calculate the percentage, by mass, of calcium in fluorite (CaF_2).

Show your working clearly.

_____ % **2**

(*d*) Iron metal can be extracted from haematite (Fe_2O_3) by heating with carbon monoxide. Carbon dioxide is also produced.

Write an equation, using **symbols** and **formulae**, for this reaction.

There is no need to balance it.

_____ **1**

(*e*) Name a metal which can be extracted from its ore by heat alone.

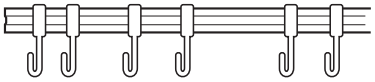
_____ **1**

(6)

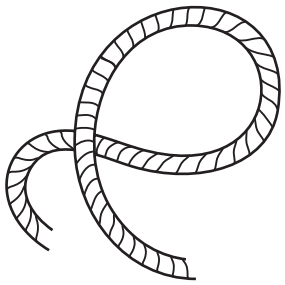
DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

18. Nylon is a polymer with many uses.



curtain rail



rope

jacket

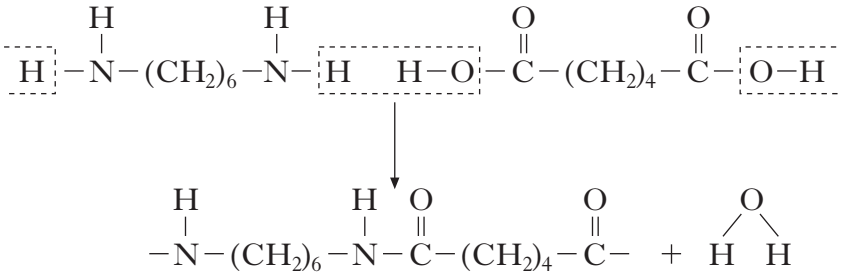
(*a*) Nylon is a thermoplastic polymer.

What does thermoplastic mean?

_____

_____ **1**

(*b*) Nylon is a polymer made from two different monomers as shown.



nylon

During the polymerisation reaction, water is also produced.

Suggest a name for this **type** of polymerisation.

_____ **1**

(2)

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

19. Many ionic compounds are coloured.

Compound	***Colour***
nickel(II) nitrate	green
nickel(II) sulphate	green
potassium permanganate	purple
potassium sulphate	colourless

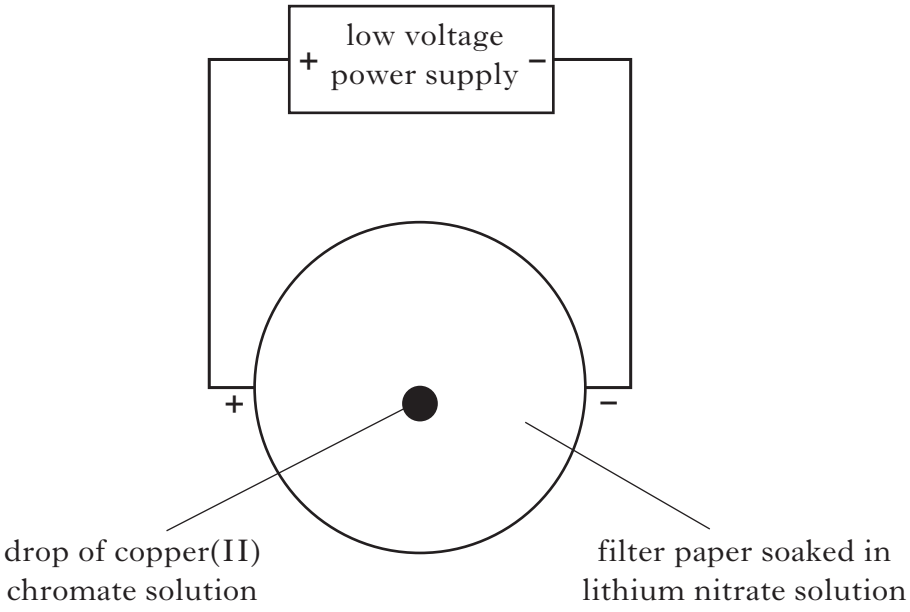
(*a*) Using the information in the table, state the colour of the potassium ion.

_____ **1**

(*b*) Write the **ionic** formula for nickel(II) nitrate.

_____ **1**

(*c*) A student set up the following experiment to investigate the colour of the ions in copper(II) chromate.



The student made the following observation.

Observation
yellow colour moves to the positive electrode
blue colour moves to the negative electrode

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Marks	KU	PS

19. (*c*) (continued)

(i) State the colour of the chromate ion.

_____ **1**

(ii) Lithium nitrate solution is used as the electrolyte.

What is the purpose of an electrolyte?

_____

_____

_____ **1**

(iii) Suggest why lithium phosphate can **not** be used as the electrolyte in this experiment.

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

_____

_____

_____ **1**

(5)

[Turn over

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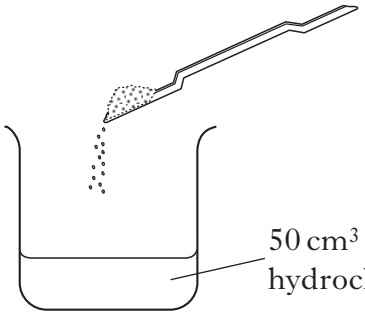
	Marks	KU	PS

20. Indigestion is caused by excess acid in the stomach. Indigestion remedies containing calcium carbonate neutralise some of this acid.

Christine carried out an experiment to find the mass of calcium carbonate required to neutralise a dilute hydrochloric acid solution.

She added calcium carbonate until all the acid had been used up.



(*a*) Calculate the number of moles of dilute hydrochloric acid used in the experiment.

_____ mol **1**

(*b*) The equation for the reaction is

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2O(\ell) + CO_2(g)$$

(i) Using your answer from part (*a*), calculate the number of moles of calcium carbonate required to neutralise the dilute hydrochloric acid.

_____ mol **1**

(ii) Using your answer from part (*b*)(i), calculate the **mass** of calcium carbonate ($CaCO_3$) required to neutralise the acid.

_____ g **1**

(3)

[*END OF QUESTION PAPER*]

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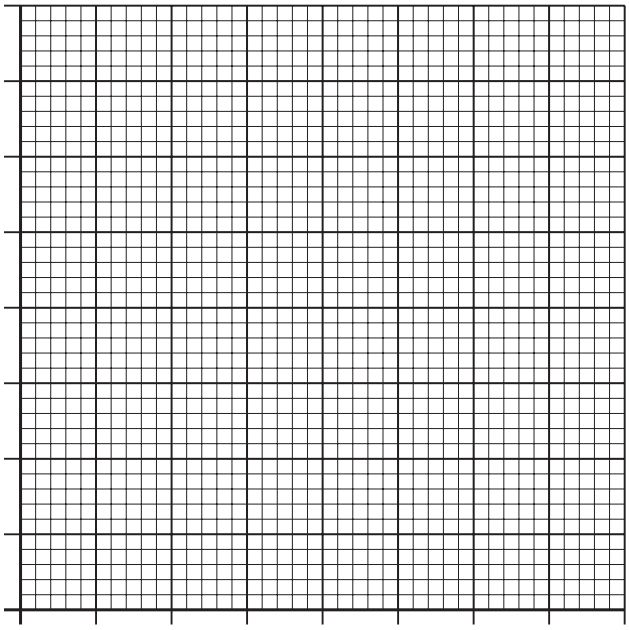
KU	PS

ADDITIONAL SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 12(*a*)



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ADDITIONAL SPACE FOR ANSWERS

ACKNOWLEDGEMENTS

Question 14
Drawing of a BMW car. Reproduced by kind permission of BMW (UK) Limited.