

FOR OFFICIAL USE

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KU PS

Total Marks

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0500/402

NATIONAL THURSDAY, 24 MAY
 QUALIFICATIONS 10.50 AM – 12.20 PM
 2001

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

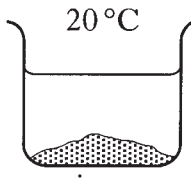
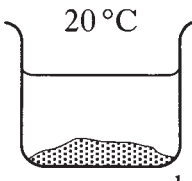
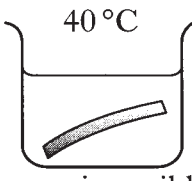
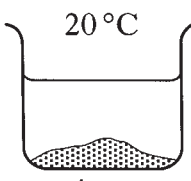
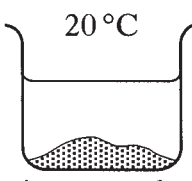
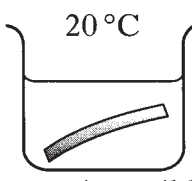
- All questions should be attempted.
- Necessary data will be found in the Data Booklet provided for Chemistry at Standard Grade and Intermediate 2.
- The questions may be answered in any order but all answers are to be written in this answer book, and must be written clearly and legibly in ink.
- Rough 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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2. Frank and Dave carried out several experiments with metals and acids.

A  20°C magnesium powder 1 mol/l hydrochloric acid	B  20°C copper powder 1 mol/l hydrochloric acid	C  40°C magnesium ribbon 1 mol/l hydrochloric acid
D  20°C magnesium powder 1 mol/l sulphuric acid	E  20°C iron powder 2 mol/l hydrochloric acid	F  20°C magnesium ribbon 1 mol/l hydrochloric acid

(a) Identify the **two** experiments which should be compared to show the effect of particle size on reaction rate.

A	B	C
D	E	F

(b) Identify the experiment in which no reaction would take place.

A	B	C
D	E	F

5. The grid shows the names of some chemical compounds.

A	sodium hydroxide	B	potassium nitrate	C	sodium chloride
D	lithium carbonate	E	sodium phosphate	F	barium sulphate

- (a) Identify the **two** bases.

A	B	C
D	E	F

- (b) Identify the compound which could be prepared by precipitation.
You may wish to refer to page 5 of the data booklet.

A	B	C
D	E	F

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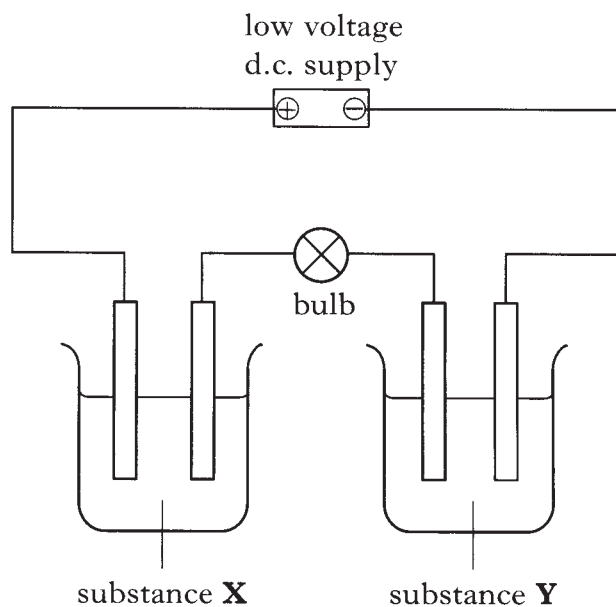
6. The grid contains information about the particles found in atoms.

A	relative mass = 1	B	charge = 1+	C	found inside the nucleus
D	charge = 1-	E	relative mass almost zero	F	charge = zero

Identify the term(s) which can be applied to **both** protons **and** neutrons.

A	B	C
D	E	F

7. Several conductivity experiments were carried out using the apparatus shown below.



Identify the experiment(s) in which the bulb would light.

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

A
B
C
D
E

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8. The table below shows the names and colours of some common ions.

Ion	Formula	Colour
copper	Cu^{2+}	blue
nickel	Ni^{2+}	green
zinc	Zn^{2+}	colourless
lithium	Li^+	colourless
magnesium	Mg^{2+}	colourless
nitrate	NO_3^-	colourless
sulphate	SO_4^{2-}	colourless
permanganate	MnO_4^-	purple
dichromate	$\text{Cr}_2\text{O}_7^{2-}$	orange

Identify the true statement(s) based on the information in the table.

A	Copper nitrate is blue.
B	Coloured ions contain transition metals.
C	Ions containing oxygen are colourless.
D	All transition metal ions are coloured.
E	All lithium compounds are colourless.

A
B
C
D
E

9. To turn a gas into a liquid it must be cooled below a temperature known as its critical temperature.

Gas	Formula	Relative formula mass	Critical temperature/°C
hydrogen	H ₂	2	-240
helium	He	4	-268
ammonia	NH ₃	17	133
oxygen	O ₂	32	-119
carbon dioxide	CO ₂	44	31

Identify the true statement(s) based on the information in the table.

A	Compounds have higher critical temperatures than elements.
B	Critical temperature increases as relative formula mass increases.
C	Diatomic elements have higher critical temperatures than monatomic elements.
D	Carbon dioxide can be a liquid at 40 °C.

A
B
C
D

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PART 2

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

10. Andrew investigated the effect of different hydrocarbons on bromine solution.

Hydrocarbon	Formula	Effect on bromine solution
A	C_5H_{12}	
B	C_6H_{12}	no effect
C	C_5H_{10}	no effect
D	C_5H_{10}	quickly decolourised

- (a) Complete the table to show the effect of hydrocarbon **A** on bromine solution.

1

- (b) Name hydrocarbon **B**.

1

- (c) What term is used to describe a pair of hydrocarbons like **C** and **D**?

1

(3)

11. Siobhan carried out some experiments with four metals (W, X, Y and Z) and some of their compounds. She made the following observations.

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When each metal was placed in cold water, only metal Y reacted.

Only metal W was obtained from its oxide by heating.

When metal X was placed in a solution containing ions of metal Z, metal X dissolved and solid metal Z was formed.

- (a) Name the gas formed when metal Y reacts with water.

1

- (b) Suggest names for metals W and Y.

metal W _____ metal Y _____

1

- (c) Place the four metals (W, X, Y and Z) in order of reactivity (most reactive first).

1

- (d) Name the type of chemical reaction which takes place when a metal is extracted from its oxide.

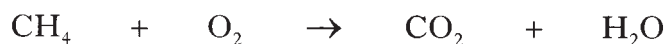
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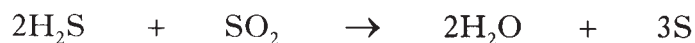
12. Some sources of methane contain hydrogen sulphide (H₂S).
This is removed before the methane is used as a fuel.

(a) Balance the equation for the combustion of methane.



(b) Why is hydrogen sulphide removed before the methane is used as a fuel?

(c) Hydrogen sulphide is removed by reacting it with sulphur dioxide.



Calculate the mass of sulphur produced, in grams, when 34 g of hydrogen sulphide reacts with sulphur dioxide.

Show your working clearly.

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2		

Marks

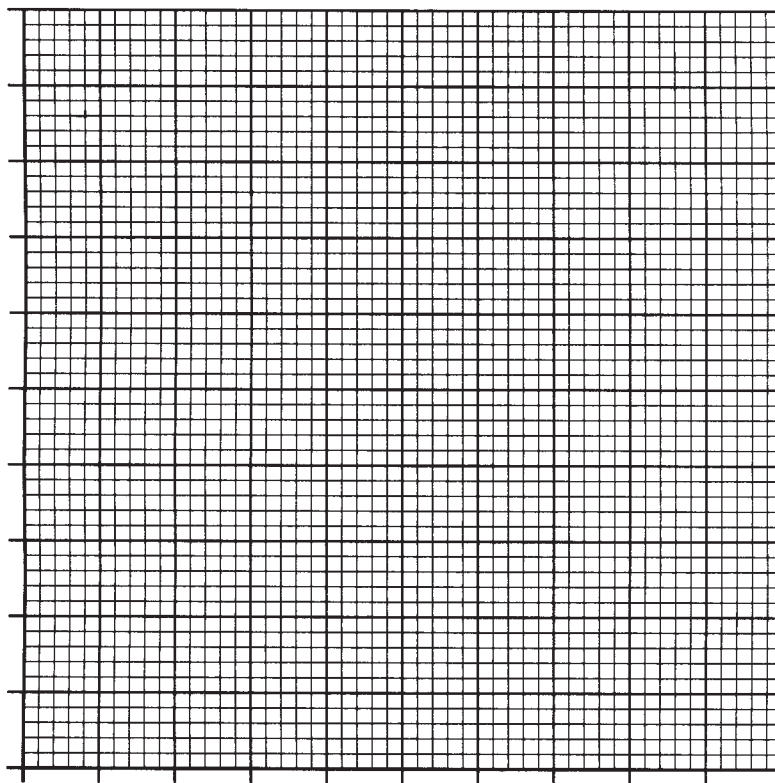
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12. (continued)

- (d) The table shows the relationship between solubility of sulphur dioxide in water and the temperature of the water.

Temperature/°C	0	10	20	30	40	60	80
Solubility/ grams per litre	225	145	95	60	35	15	5

- (i) 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 24.)



- (ii) State the relationship between the solubility of sulphur dioxide in water and the temperature of the water.

2

1

(7)

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Marks

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13. Nitrogen forms many useful compounds.

Compound	Formula
Y	$(\text{NH}_4)_3\text{PO}_4$
potassium nitrate	KNO_3
urea	$\text{CO}(\text{NH}_2)_2$

(a) (i) Name compound Y.

1

(ii) Compound Y can be used as a fertiliser.
Why are fertilisers added to the soil?

1

(b) Which acid is used to make potassium nitrate?

1

(c) Urea can be used to make a thermosetting polymer.

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

1

(ii) Calculate the percentage mass of nitrogen in urea.
Show your working clearly.

14. The table compares the mass of ions found in ocean water with the mass of ions found in water from the Dead Sea.

Ion	Mass in 1 litre of ocean water/g	Mass in 1 litre of Dead Sea water/g
Na ⁺	10.7	31.5
K ⁺	0.4	6.8
Mg ²⁺	1.3	36.2
Ca ²⁺	0.4	13.4
Cl ⁻	19.2	183.0
Br ⁻	0.1	5.2
SO ₄ ²⁻	2.5	0.6

- (a) What general statement can be made about the mass of ions in water from the Dead Sea compared with ocean water?

1

- (b) Suggest a name for a compound which might be obtained if a sample of water from the Dead Sea was evaporated to dryness.

1

- (c) Calculate the concentration of calcium ions, in mol/l, in ocean water.

1

(3)

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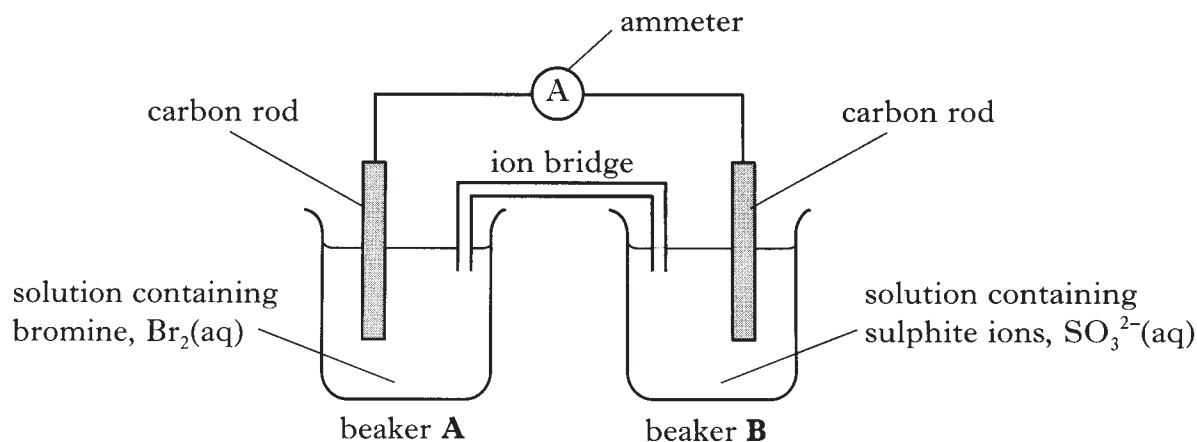
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15. Sarah set up the circuit shown below.



In beaker **B** sulphite ions are converted to sulphate ions:



- (a) On the diagram, clearly mark the path and the direction of the electron flow.
- (b) (i) What term is used to describe the type of chemical reaction taking place in beaker **B**?
- _____
- (ii) Suggest what would happen to the pH in beaker **B**.
- _____
- (c) Write the ion-electron equation for the chemical reaction taking place in beaker **A**.
- You may wish to use the data booklet to help you.
- _____

1

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16. (a) Ammonia is made industrially by the Haber process.
Name the catalyst used to make ammonia.

- (b) Name **two** compounds, which can react together to produce ammonia in the laboratory.

- (c) The atoms in an ammonia molecule are held together by covalent bonds. A covalent bond is a shared pair of electrons.
Explain how this holds the atoms together.

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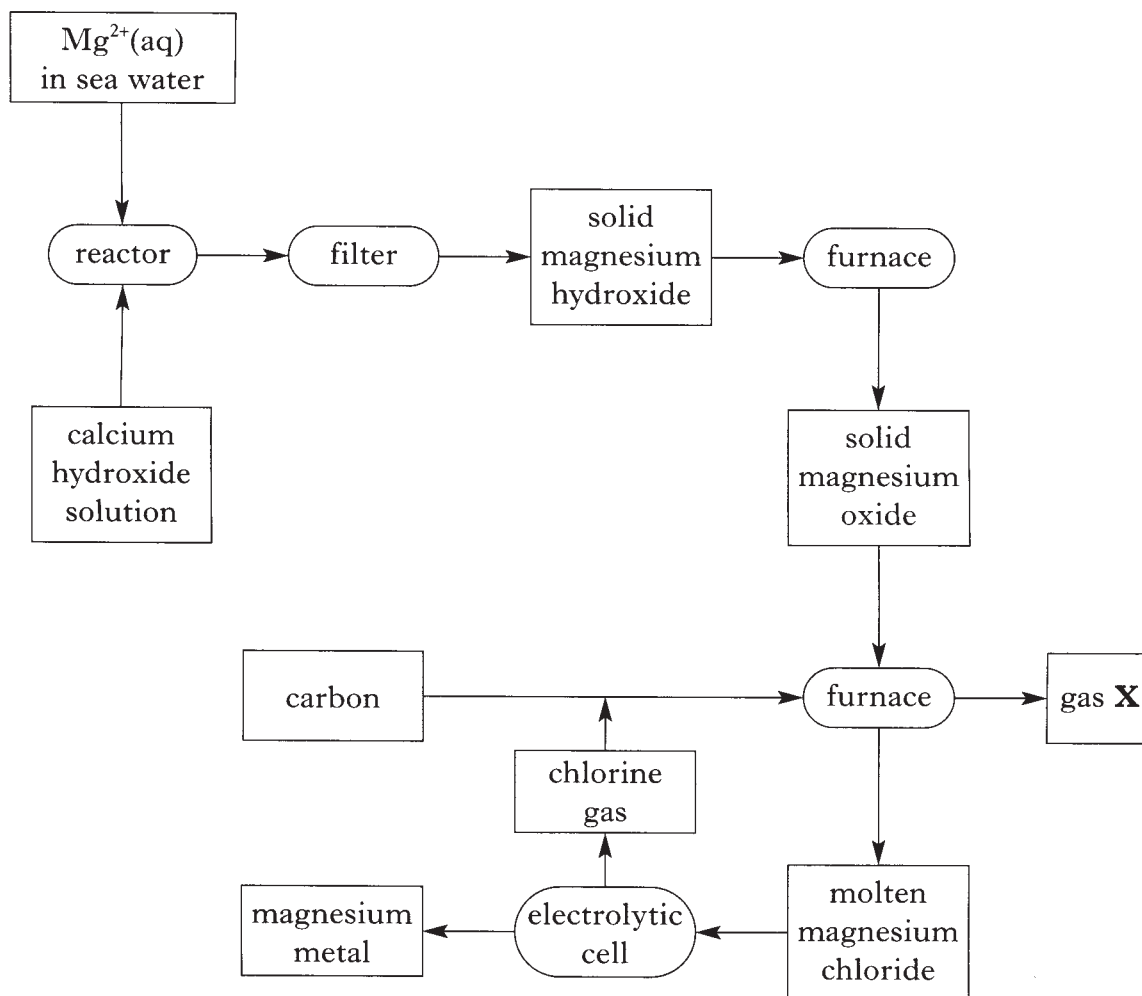
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		KU	PS
17. (a) Methoxyethane belongs to a homologous series of compounds called ethers. What is meant by the term "homologous series"?	_____		

	_____	1	
(b) Methoxyethane is formed when bromomethane, ethanol and sodium react together.			
$2 \text{CH}_3\text{Br} + 2 \text{C}_2\text{H}_5\text{OH} + 2 \text{Na} \rightarrow 2 \text{CH}_3\text{OC}_2\text{H}_5 + 2 \text{NaBr} + \text{X}_2$ <p align="center">bromomethane ethanol methoxyethane</p>			
(i) Name X_2 .	_____		
		1	
(ii) Draw a full structural formula for methoxyethane ($\text{CH}_3\text{OC}_2\text{H}_5$).			
		1	
		(3)	

18. Sea water contains magnesium ions. The diagram below shows how magnesium can be extracted from sea water.

Marks



- (a) Name the type of chemical reaction which takes place in the reactor.

1

- (b) Write the **ionic** formula for calcium hydroxide.

1

- (c) Name gas **X**.

1

- (d) Why do ionic compounds like magnesium chloride conduct electricity when molten?

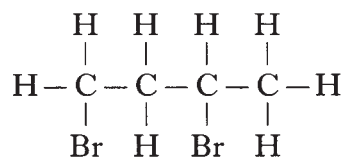
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19. (b) (continued)

- (ii) Suggest why the dibromoalkane shown below does **not** form an alkyne when heated with sodium hydroxide.



1
(3)

[END OF QUESTION PAPER]