Centre Number	Examination Number

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

5124-2-048-864

Science 5124/2

Paper 2

2020

Additional Material(s):

Electronic calculator (non programmable) and / or Mathematical tables
Graph paper
Soft clean eraser
Soft pencil (type B or HB is recommended)

Time 2 hours **Marks: 85**

Instructions to Candidates

1 Write the **centre number** and your **examination number** on every page of this question paper and on the separate Answer Booklet/Paper provided.

2 There are **three (3)** sections in this paper.

(i) Section A

There are **twenty (20)** questions in this section. Answer all questions. For each question, there are four possible answers, **A**, **B**, **C** and **D**. Choose the one you consider correct and record your choice by marking it with a cross (X) on the **answer grid provided** on the question paper.

(ii) Section B

Answer all questions. Write your answers in the **spaces provided** on the question paper. Read very carefully the instructions on the answer sheet.

(iii) Section C

Answer any **two** questions. Write your answer on a separate **answer booklet provided**.

Candidate's Use		Examiner's Use
Section A		
Section B		
Section C	1	
	2	
	3	
Total		

Information for candidates

1 Any rough working should be done in this question paper.

2 **At the end of the examination:**

(i) Fasten the separate answer booklet/papers used securely to the question paper.

(ii) Circle the numbers of the section C questions you have answered in the grid below.

3 The Periodic Table is printed on **page 16.**

4 **Cell phones are not allowed in the examination room.**

5 **Do not open this booklet until you are told to do so.**

This question paper consists of 16 printed pages

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		.											

ANSWER GRID FOR SECTION A

Put a cross (X) on the letter indicating your choice of answer.

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D

11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D

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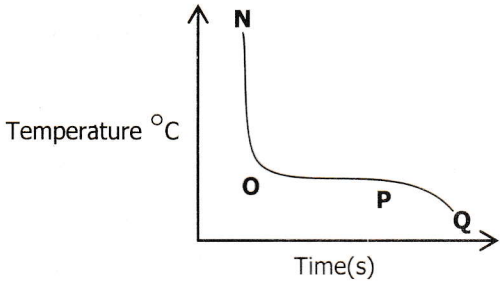
SECTION A [20 marks]

Answer **all** the questions on the answer grid provided.

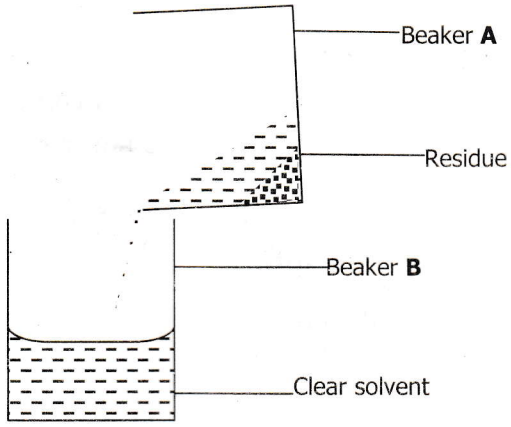
A1 A sample of a pure compound is heated until it is completely molten and the compound is then allowed to cool until it is completely solid again.
The graph shows how the temperature of the compound changes with time.



Which of the following shows points when the compound exists in both liquid and solid states?

A N to O
B O to P
C N to P
D P to Q

A2 The diagram below shows one of the methods used to separate mixtures.



The above method is...

A chromatography.
B crystallisation.
C decantation.
D filtration.

A3 Which gas is **not** obtained on a large scale by fractional distillation?

A Ammonia
B Argon
C Nitrogen
D Oxygen

[Turn over

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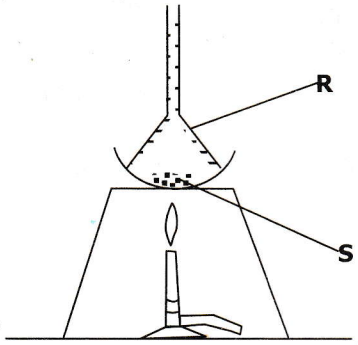
A4 A mixture of salt and iodine crystals was heated for 20 minutes as shown in the diagram below.



What is **R** and **S**?

	R	S
A	Residue	Sublimate
B	Sublimate	Residue
C	Fraction	Distillate
D	Distillate	Fraction

A5 Graphite and diamond are allotropes of Carbon. Which of the statements below gives the correct meaning of the term allotropy?

A The existence of two or more atoms having the same number of protons but different number of neutrons.

B The existence of different forms of an element but in the same physical state.

C They are giant structures formed from a network of carbon atoms.

D Compounds having the same molecular formula but different structural formula.

A6 The table below gives data about four substances. Which substance has particles in a disorderly arrangement at room temperature?

	Melting Point °C	Boiling Point °C
A	–114	–80
B	120	445
C	750	1 407
D	1 610	2 230

A7 At which temperature does a concentrated aqueous solution of sodium chloride begin to boil?

A 98°C

B 99°C

C 100°C

D 104°C

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A8 To determine the concentration of an acid, a learner titrated hydrochloric acid against potassium hydroxide solution. She used 25.0cm^3 of 0.2mol/dm^3 potassium hydroxide. If she started titrating from 0.7cm^3 and reached her end point at 36.2cm^3, what is the concentration of the acid?

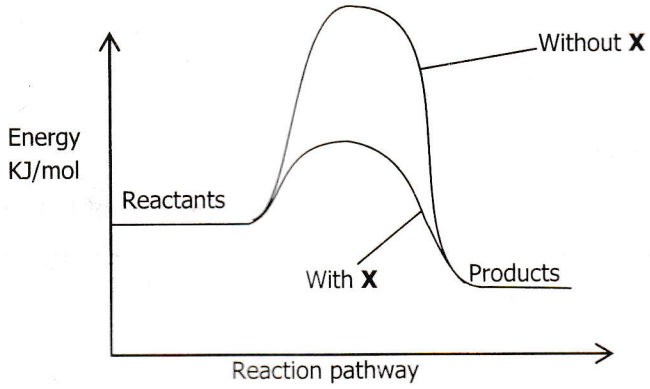
A 0.138 mol/dm^3

B 0.141 mol/dm^3

C 0.750 mol/dm^3

D 1.141 mol/dm^3

A9 The energy level profile shows how adding substance **X** to a reaction mixture changes the reaction pathway.



Which change occurs when **X** is added to the reaction mixture?

A The rate of reaction decreases.

B The rate of reaction increases.

C The reaction becomes less exothermic.

D The reaction becomes more exothermic.

A10 When solid potassium chloride is added to water, the temperature of the liquid goes down. Which conclusion can be made from this observation?

A The potassium chloride molecules split into ions in water.

B The process is exothermic.

C The process is endothermic.

D Very little potassium chloride dissolves in water.

A11 Which ionic equation represents the neutralisation of sodium hydroxide solution with dilute sulphuric acid?

A $2H^+_{(aq)} + 2OH^-_{(aq)} \longrightarrow 2H_2O_{(l)}$

B $2Na^+_{(aq)} + SO_4^{2-}{}_{(aq)} \longrightarrow Na_2SO_{4(aq)}$

C $2Na^+_{(aq)} + H_2SO_{4(aq)} \longrightarrow Na_2SO_{4(aq)} + 2H^+_{(g)}$

D $2Na_{(s)} + H_2SO_{4(aq)} \longrightarrow Na_2SO_{4(aq)} + H_{2(g)}$

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A12 Which of the following reagents could be used to distinguish between dilute nitric acid and dilute hydrochloric acid?

A Aqueous barium chloride

B Aqueous silver nitrate

C Aqueous sodium hydroxide

D Copper (II) carbonate

A13 An aqueous solution of compound **X** reacts with sodium hydroxide solution to form a green precipitate. When aluminium foil is added to the mixture and then warmed, a gas that turns damp red litmus paper blue is given off. What is **X**?

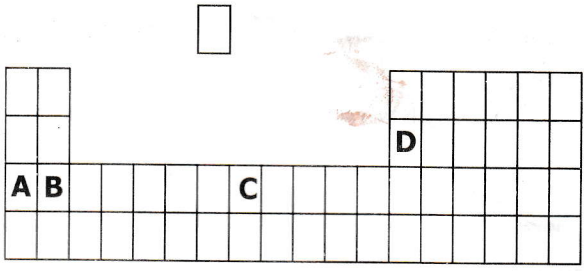
A Ammonium nitrate

B Copper (II) chloride

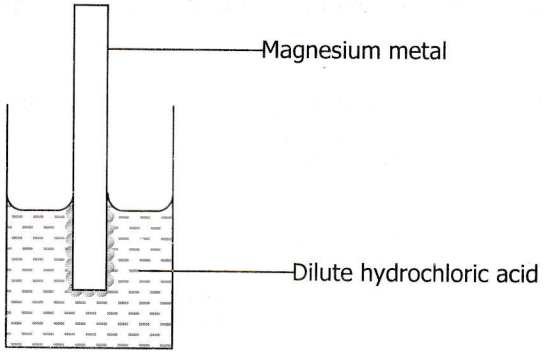
C Iron (II) nitrate

D Iron (III) nitrate

A14 The positions of four elements are shown on the outline of part of the Periodic Table. Element **X** has a high melting point and is a good conductor of electricity. It forms sulphates XSO_4 and $X_2(SO_4)_3$. Which element is **X**?



A15 In the laboratory, an experiment was set up as shown in the diagram below.



Which of the following is the correct equation for the reaction in the above experiment?

A $Mg_{(s)} + HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$

B $Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + 2H_{(g)}$

C $Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$

D $Mg_{(s)} + HCl_{(aq)} \rightarrow MgCl_{(g)} + H_{(g)}$

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A16 The position of metal **M** in the reactivity series is shown below.

K, Na, M, Al, Zn, Fe, Pb, Cu, Ag

Which method will be used to extract **M** from its ore?

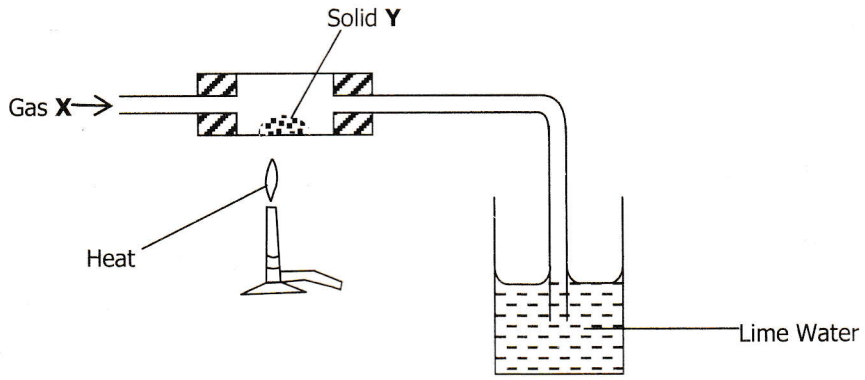
A Electrolysis of its molten oxide.

B Electrolysis of its aqueous sulphate.

C Reduction of its oxide by heating with coke.

D Reduction of its oxide by heating with hydrogen.

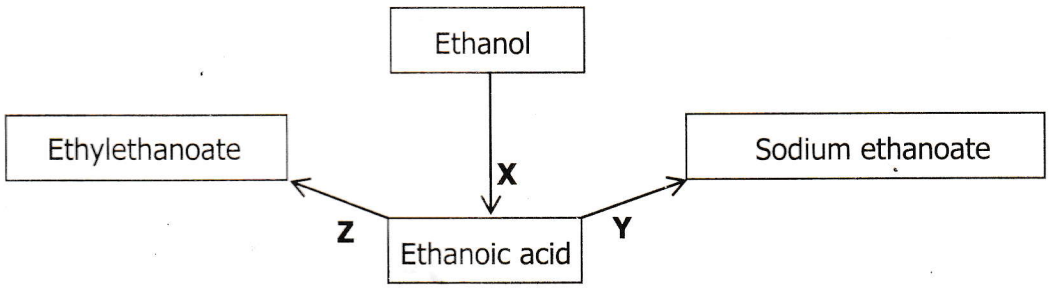
A17 A gas **X** was passed over a hot solid **Y** using the apparatus shown in the diagram below?



At the end of the experiment, the colour of **Y** had changed from black to pink and a white precipitate formed in the limewater. What could be **X** and **Y**?

	X	**Y**
A	Carbon dioxide	Carbon
B	Carbon dioxide	Copper
C	Carbon monoxide	Copper
D	Carbon monoxide	Copper(II)oxide

A18 Three reactions involving ethanoic acid are represented by the letters **X**, **Y** and **Z** as shown in the figure below.



Which of the reactions **X**, **Y** and **Z** involves oxidation?

A **X** only

B **X** and **Y**

C **Y** only

D **Y** and **Z**

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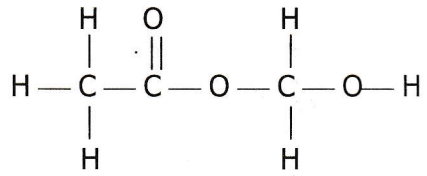
A19 The table shows the result of tests carried out on compound **X.**

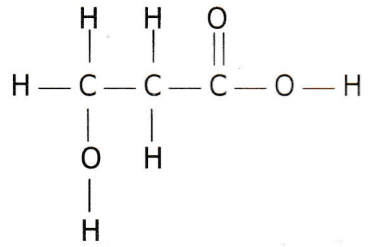
Test	Results
Bromine water added	Decolourised
Sodium carbonate added	Colourless gas evolved

Which formula represents compound **X**?

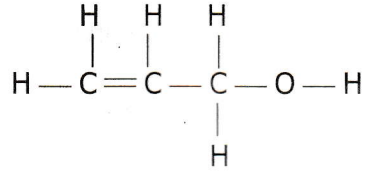
A



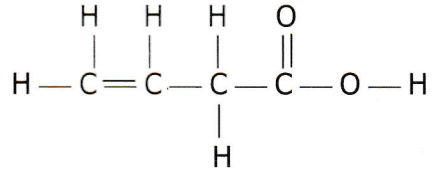
B



C



D



A20 Butane and methylpropane are isomers. Which formula is different for the two isomers?

A Empirical formula

B General formula

C Molecular formula

D Structural formula

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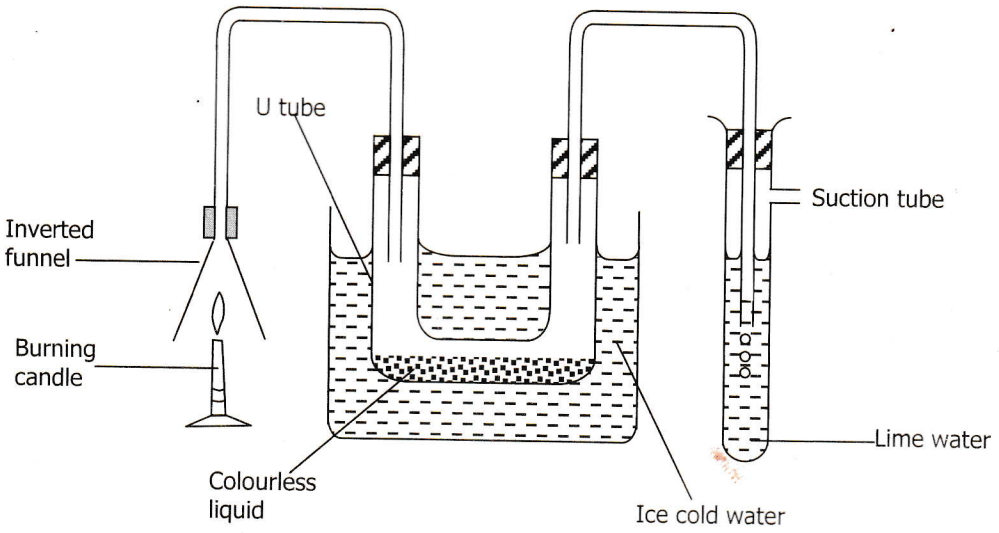
Section B [45 marks]

Answer **all** questions in this section.

Write your answers in the spaces provided in the question paper.

B1 The diagram below shows the set up of apparatus used to investigate the products of a burning candle.



(a) Why is the U-tube surrounded by ice cold water?

..... [1]

(b) Name the colourless liquid.

..... [1]

(c) State what happens to the lime water in the test tube.

..... [1]

(d) Name the elements found in candle wax.

(i) .....

(ii) ..... [2]

(e) Explain how you can confirm the identity of the colourless liquid.

.....

.....

..... [2]

[Total: 7 marks]

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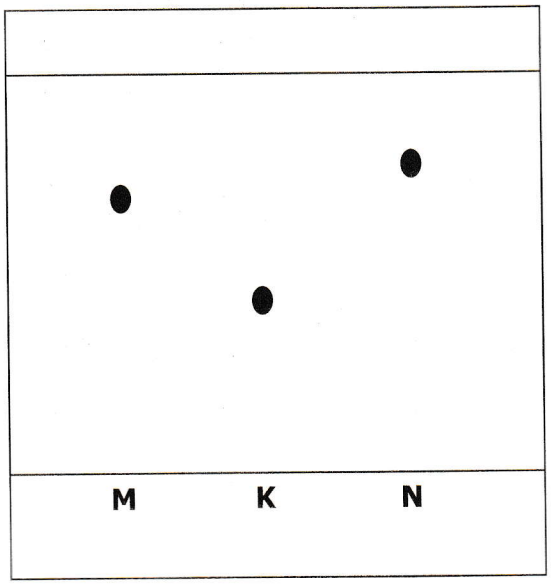
B2 The diagram below represents a paper chromatogram of three sugars **K, M** and **N**.



(a) State the most soluble sugar.

..... [1]

(b) On the Chromatogram above, indicate the solvent front.

..... [1]

(c) The three sugars **K**, **M** and **N** are colourless; what should be done to the chromatogram to make them visible.

.....

.....

..... [2]

(d) Explain how chromatography can be used to identify false bank notes or forged paper money.

.....

.....

.....

..... [2]

[Total: 6 marks]

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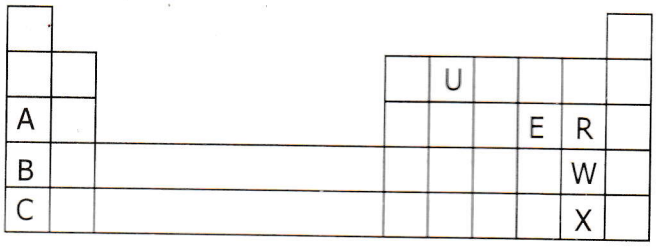
B3 The grid below represents part of the Periodic Table. Study it and answer the questions using the letters. The letters are not the actual symbols of the elements.



(a) An element **V** has atomic number 7. Indicate the position of **V** on the grid. [1]

(b) Explain why the atomic radius of **E** is bigger than that of **R**.

.....

..... [1]

(c) Which element has the highest tendency to gain electrons?

..... [1]

(d) Select the most reactive metal.

..... [1]

(e) Write the formula of a compound formed when **B** reacts with **E**.

..... [1]

[Total: 5 marks]

B4 **(a)** **(i)** Define concentration.

..... [1]

.....

(ii) State the SI unit for concentration.

..... [1]

(iii) Calculate the mass of potassium hydroxide, KOH, that needs to be used to prepare $500cm^3$ of 0.25M solution in water.

.....

.....

..... [2]

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(b) Construct a balanced chemical and net ionic equation, for the reaction between potassium hydroxide and sulphuric acid. Include state symbols.

(i) Chemical equation:

.....

.....

(ii) Net ionic equation:

.....

..... [3]

[Total: 7 marks]

B5 When excess magnesium powder was added to $100cm^3$ of 0.5M copper (II) sulphate solution in a plastic cup wrapped in cotton wool, the temperature of the solution rose by 5°C.

(a) What type of reaction is this?

..... [1]

(b) Suggest what was used to determine the rise in the temperature.

..... [1]

(c) Describe what was observed when magnesium was added to the solution.

(i) .....

.....

(ii) .....

..... [2]

(d) Why is the plastic beaker wrapped in cotton wool during the experiment?

..... [1]

(e) How many moles of copper (II) sulphate are present in the $100cm^3$ solution?

.....

..... [2]

[Total: 7 marks]

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B6 Greenhouse gases pollute the air. Chlorofluorocarbons (CFCs) are greenhouse gases.

(a) **(i)** Name **two** other greenhouse gases found in the atmosphere.

..... and ..... [2]

(ii) State the respective origins of each of the gases named in part **(i)**.

.....

..... [4]

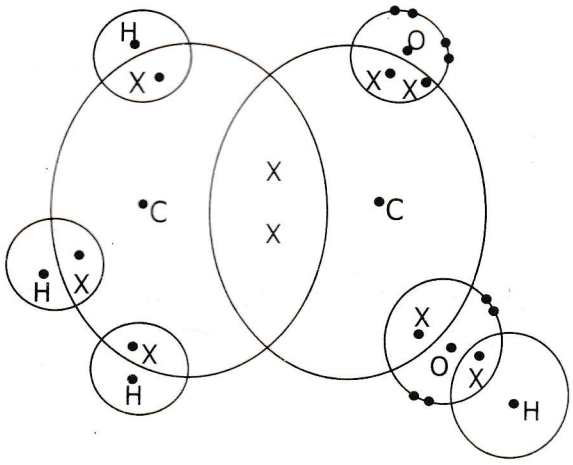
(b) Describe how the presence of CFCs in the upper atmosphere increases the amount of ultra violet light reaching the Earth's surface.

.....

..... [2]

[Total: 8 marks]

B7 The diagram below shows an arrangement of outermost electrons in a molecule of a compound.



(a) **(i)** On the diagram indicate a double covalent bond by putting a circle round it. [1]

(ii) Construct the chemical formula of the molecule above.

..... [1]

(iii) Calculate the molecular mass of the molecule.

..... [1]

(b) **(i)** To which homologous series of compounds does the molecule belong to?

..... [1]

(ii) State **one** chemical property of the molecule.

..... [1]

[Total: 5 marks]

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Section C [20 marks]

Answer any **two (2)** questions from this section. Write your answers in the **separate answer booklet provided**.

C1 Clean dry air contains about 79% by volume of nitrogen.

(a) Name the gases which make up the remaining 21% by volume of clean air [2]

(b) A sample of polluted air was found to contain both nitrogen dioxide and sulphur dioxide.

(i) State a major source of each of the pollutants. [2]

(ii) Describe a test which could be carried out to confirm the presence of sulphur dioxide in the polluted air. [2]

(c) Respiration and rusting are chemical processes which involve one of the gases in air.

(i) Show clearly, by chemical equations, how this gas takes part in each of these reactions.

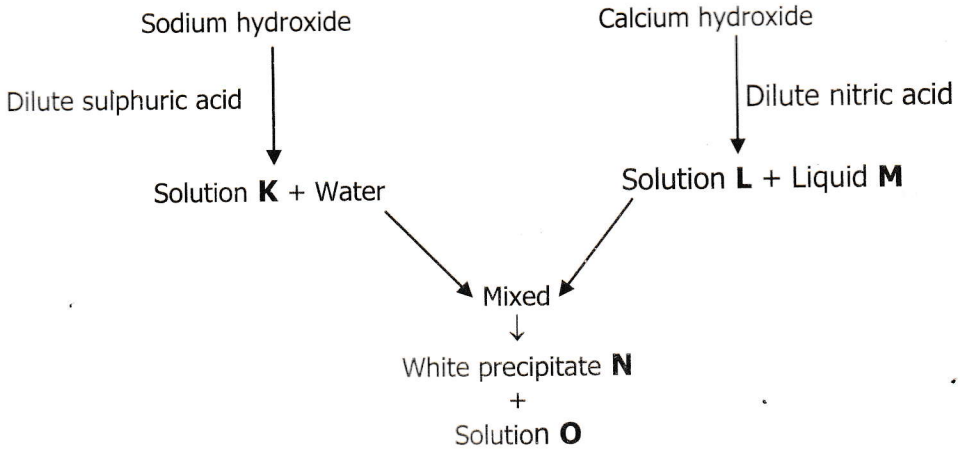
(ii) One method of preventing rusting is sacrificial protection.

Describe how this method of rust prevention could be used on an oil pipeline and explain how it works. [4]

[Total: 10 marks]

C2 **(a)** Define an acid. [1]

(b) Study the following reaction scheme.



(i) Give the names and formula of substances **K** to **O**. [5]

(ii) Write the balanced chemical equation for the formation of solution **L** and liquid **M**. [2]

(iii) Write an ionic equation for the formation of the white precipitate **N**. Include state symbols. [2]

[Total: 10 marks]

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C3 The table below shows information on some substances.

Substance	**Conducts electricity when in solid state**	**Melting point °C**	**Dissolves in water**
Aluminium	Yes	660	No
Sodium chloride	No	808	Yes
Sulphur	No	113	No
Tungsten	Yes	3 377	No
Wax	No	35 to 50	No

Use the information in the table to answer the following questions.

(a) **(i)** Name **two** metals and give a reason for your answer.

(ii) Identify a mixture and justify your answer. [5]

(b) Write a chemical formula of the substance that is a compound. [1]

(c) Describe how the movement and arrangement of particles in aluminium change as the temperature rises from 659°C to 661°C. [2]

(d) Identify the substance with the strongest bonds and give a reason for your answer. [2]

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[Total: 10 marks]

DATA SHEET

The Periodic Table of the Elements

oup																	
I	II										III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 2
7 Li ium	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na dium	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K ssium	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb idium	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Tchnetium 43	104 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs esium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mecury 80	204 Tl Thallium 81	207 Pb lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr ncium	226 Ra Radium 88	227 Ac Actinium 89 +															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

-71 Lanthanoid series
0-103 Actinoid series

ey

a
X
b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

$N_A = 6.0 \times 10^{23}$/mol; 1F = 96500C.