

Name	Form Class	Index Number
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**ANG MO KIO SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR NORMAL ACADEMIC**

SCIENCE
Paper 4 Chemistry

5105/04
5 August 2025

Setter: Ms Audrey Ferng

Paper 3 and 4: 1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this paper.

Write in dark blue or black pen.

You may use a HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Section A

Answer **all** questions.

Write your answers in the spaces provided.

Section B

Answer **one** question.

Write your answers in the spaces provided.

The use of an approved scientific calculator is expected, where appropriate.

In calculations, you should show all the steps in your working, giving your answer at each stage.

You are advised to spend no longer than 30 minutes on Paper 3.

You may proceed to answer Paper 4 as soon as you have completed Paper 3.

A copy of the Periodic Table is printed on page **11**.

At the end of the examination hand in your answer to Paper 3 and Paper 4 separately.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of 11 printed pages and 1 blank page.

[Turn Over

Section A

Answer **all** the questions in the spaces provided.

- 1 (a) Complete the table on the oxygen-17 and oxygen-18 atoms.

atom	nucleon number	number of protons	number of neutrons	number of electrons
oxygen-17		8		
oxygen-18				8

[2]

- (b) Oxygen reacts with non-metals such as carbon and sulfur to form non-metal oxides. Coal contains carbon and traces of sulfur. When coal undergoes combustion, carbon dioxide and sulfur dioxide are formed.

- (i) Sulfur dioxide is an air pollutant which is harmful to the environment
State one source of sulfur dioxide and describe one of its effects on the environment.

source:

.....

effect:

.....

[2]

- (ii) Describe a test to identify carbon dioxide gas.

test:

observation:

[2]

- (iii) Draw a 'dot and cross' diagram of a carbon dioxide molecule, showing only the outer shell electrons.

[2]

[Total: 8]

2 Chlorine, bromine and iodine are elements found in Group 17 of the Periodic Table and they exist as diatomic molecules.

(a) Explain why these elements have similar chemical properties.

.....
..... [1]

(b) Describe a change in physical property down Group 17.

..... [1]

(c) A secret letter was written with ink made from potassium iodide solution.
When the secret letter was placed in a bottle containing chlorine gas, some brown writing appeared.
Explain why the brown writing appeared.

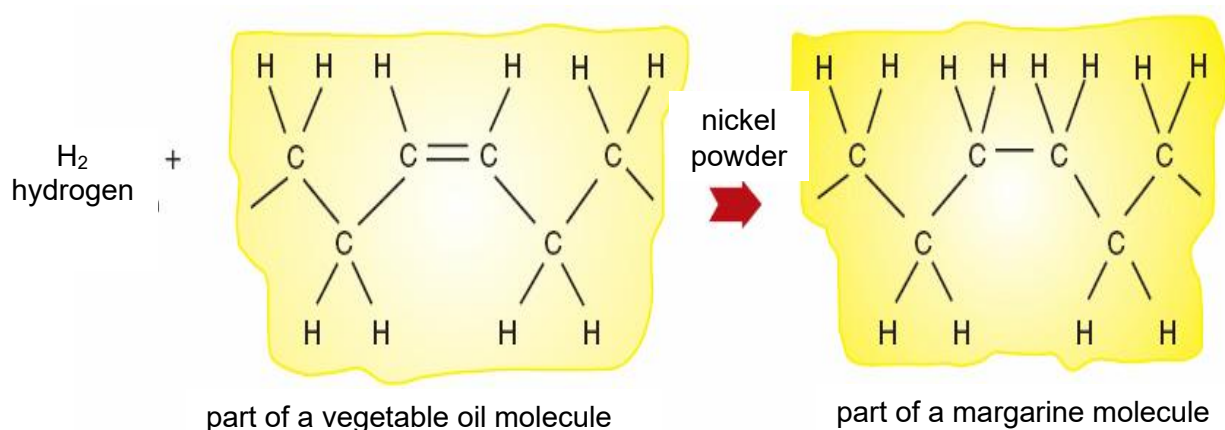
.....
.....
..... [2]

(d) Bromine has a melting point of -7.2°C and a boiling point of 58.8°C . Describe the arrangement and movement of the molecules in bromine at 35°C .

arrangement:
movement: [2]

[Total:6]

- 3 (a) Hydrogen gas is used to produce margarine from vegetable oil as shown in the diagram.



- (i) Vegetable oil is unsaturated.

With reference to the diagram, which part of the structure of vegetable oil shows that it is unsaturated?

..... [1]

- (ii) State the observation when margarine and vegetable oil are respectively added to aqueous bromine.

observation with margarine:

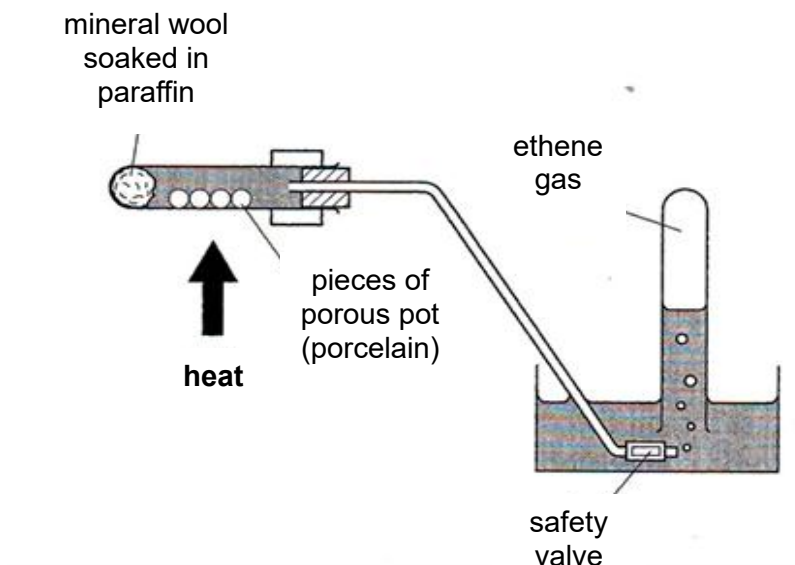
.....

observation with vegetable oil:

.....

[2]

(b) Ethene gas can be prepared in the laboratory as shown in the diagram.



- (i) Ethene reacts with chlorine to form a gaseous product.
Complete the chemical equation and draw the full structural formula of the product.



full structural formula of product:

[2]

- (ii) Hexene, C_6H_{12} , is another hydrocarbon in the same homologous series as ethene.
Calculate the mass of 15 mol of C_6H_{12} .
[Relative atomic masses: A_r : H, 1; C, 12]

mass = [2]

- (iii) Name the polymer formed when hexene undergoes addition polymerisation.

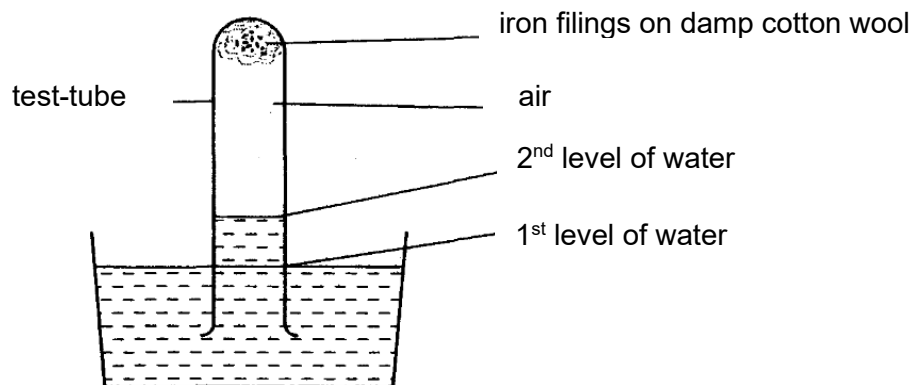
..... [1]

[Total: 8]

Section B

Answer any **one** question from this section.

- 4 (a) The diagram shows the apparatus set-up to study the rusting of iron.



The apparatus was left for one week.

- (i) Explain why the water level in the test-tube had risen after one week.

..... [1]

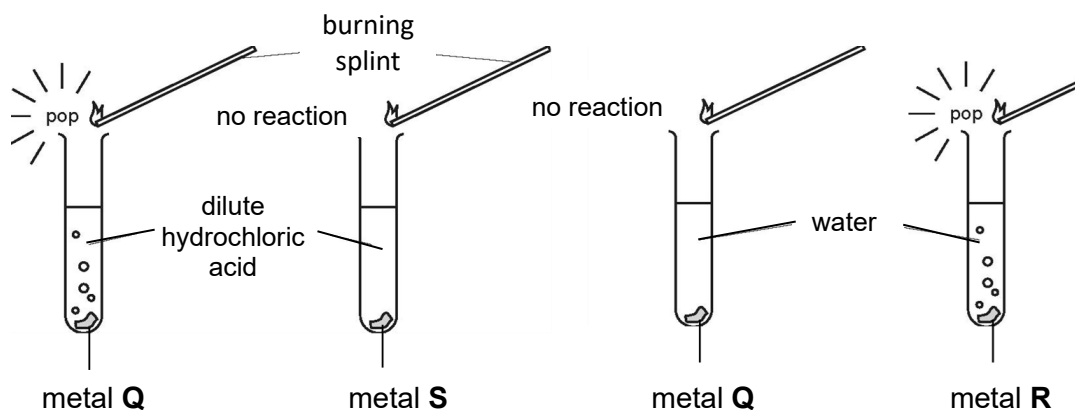
- (ii) State one method of rust prevention.

..... [1]

- (iii) Iron reacts with sulfuric acid to form a gas and iron(II) sulfate. Write a balanced chemical equation for the reaction.

..... [1]

- (b) The diagram shows some experiments carried out by a student investigating the reactions of three metals, **Q**, **R** and **S** with dilute hydrochloric acid and water.



With reference to the diagram, rank metals **Q**, **R** and **S** in order of reactivity.

most reactive

.....

least reactive

[1]

- (c) (i) A metal oxide is formed when a metal reacts with oxygen. Draw the 'dot and cross' diagram of magnesium oxide. Show only outer shell electrons.

[2]

- (ii) Explain in terms of structure and bonding why magnesium oxide has a high melting point.

.....

[2]

[Total: 8]

- 5 A student conducted a set of experiment to investigate the temperature change when different masses of zinc metal are added separately to 50.0 cm³ samples of copper(II) sulfate solution.

The student followed the following steps:

1. Measure 50 cm³ copper(II) sulfate solution into a glass beaker.
2. Measure the initial temperature of the copper(II) sulfate solution. The initial temperature of the copper(II) sulfate solution was recorded as 25.0 °C.
3. Add 0.2 g of zinc.
4. Measure the highest temperature reached and record the results in Table 5.1.
5. Repeat the experiment using different masses of zinc from 0.4 g to 1.2 g.

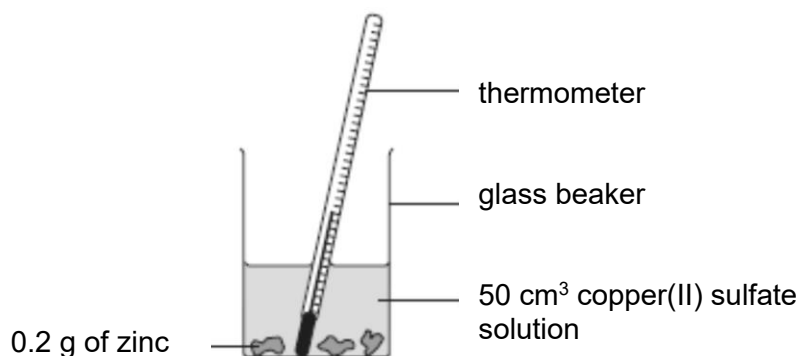


Table 5.1

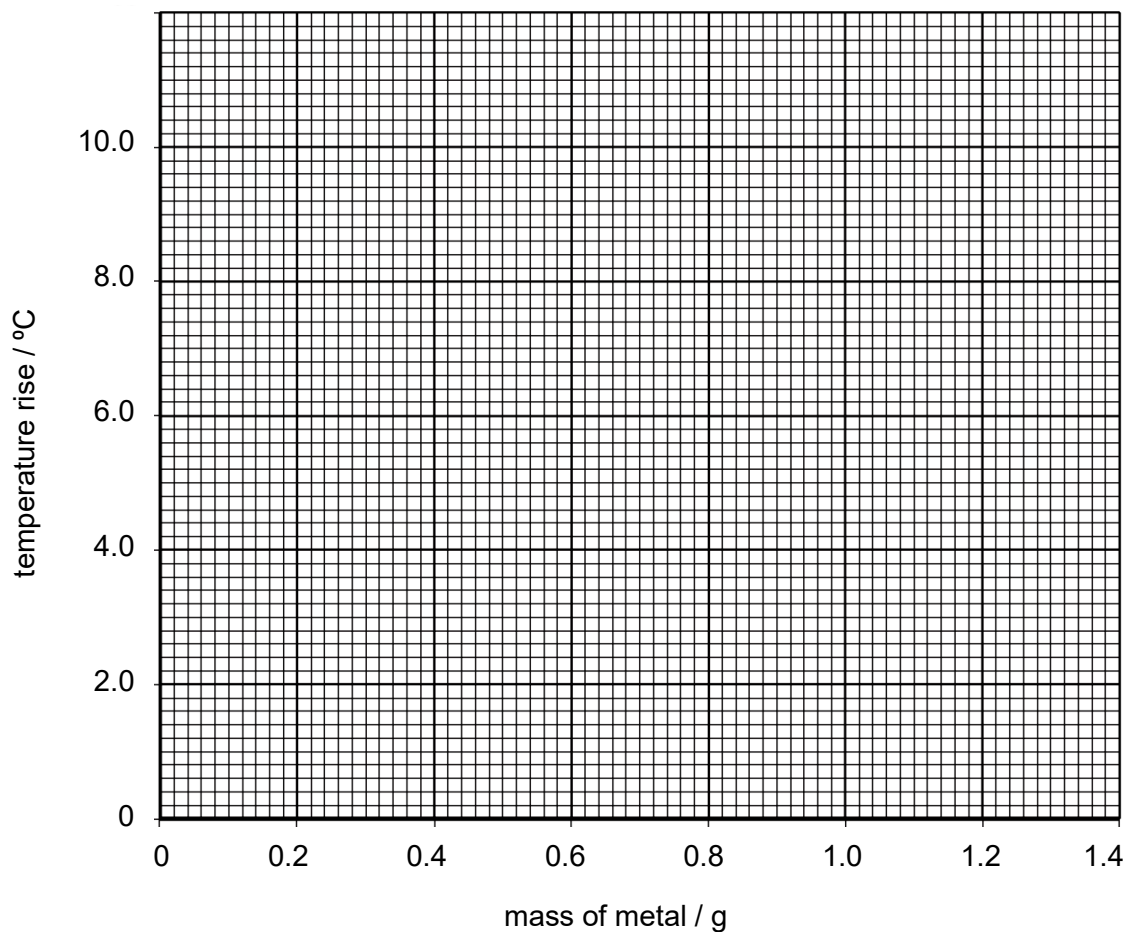
experiment with zinc		
mass of zinc/ g	highest temperature recorded/ °C	temperature rise/ °C
0.0	25.0	0.0
0.2	27.5	
0.4	29.9	
0.6	32.4	
0.8	33.0	8.0
1.0	33.0	8.0
1.2	33.0	8.0

- (a) Calculate the temperature rise and complete Table 5.1 on the experiment with zinc.

[1]

- (b) (i) Plot a graph on temperature rise against mass of zinc metal for the experiments. Mark each point with a cross ($\times$).
- (ii) Join the points with two intersecting straight lines.

[2]



- (c) Use your graphs to answer the following questions.

- (i) What mass of zinc is required to produce a rise in temperature of $4.0\text{ }^{\circ}\text{C}$?

.....

[1]

- (ii) What is the minimum mass of zinc required to produce the maximum temperature rise?

.....

[1]

- (d) Write a balanced chemical equation for the reaction between zinc metal and copper(II) sulfate solution.

..... [1]

- (e) The experiment was repeated using silver metal. Suggest, giving a reason, how the results of this experiment would compare with those using zinc metal.

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

[Total:8]

END OF PAPER

The Periodic Table of Elements

Group																			
1	2	Key												13	14	15	16	17	18
		proton (atomic) number atomic symbol name relative atomic mass																	
1 H hydrogen 1																			
3 Li lithium 7	4 Be beryllium 9																		
11 Na sodium 23	12 Mg magnesium 24																		
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84		
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131		
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —		
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganesson —		
lanthanoids																			
57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175					
actinoids																			
89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —					

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.

