2025-2026
MOCK EXAM
S.6 CHEM

PAPER 1B

B

Good Hope School
Mock Examination 2025-2026
S.6 Chemistry
Paper 1

Section B: Question-Answer Book B

This paper must be answered in English

請在此貼上電腦條碼
Please stick the barcode label here

Student Number						

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Student Number in the spaces provided on Page 1 and stick your labels in the spaces provided on Pages 1, 3, 5, and 7.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) Answer **ALL** questions.

(4) Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) An asterisk (*) has been put next to the questions where one mark will be awarded for effective communication.

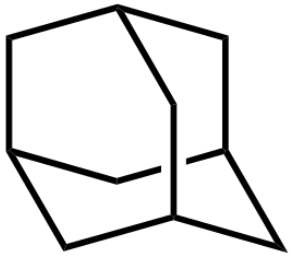
(6) Supplementary answer sheets will be provided on request. Mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this Question-Answer Book.

(7) No extra time will be given to students for filling in the Student Number and the question number boxes after the 'Time is up' announcement.

Part I

Answer **ALL** questions. Write your answers in the spaces provided.

1. The structure of adamantane ($C_{10}H_{16}$) is shown below. It is a white solid with a melting point of 270 °C.



(a) Explain, in terms of structure and bonding, why diamond has a much higher melting point than adamantane. (2 marks)

Diamond has a giant covalent structure. Melting Diamond involves breaking many strong covalent bonds between atoms throughout the giant lattice. [1]

Adamantane has a simple molecular structure. Melting Adamantane involves overcoming weak van der Waals' forces between molecules. [1]

Good Performance

(b) Graphite is another form of carbon. Compare and explain the difference in electrical conductivity between adamantane and graphite. (2 marks)

Graphite conducts electricity while adamantane does not. [1]

In adamantane, there are no delocalized electrons nor mobile ions to conduct electricity. [1]

Satisfactory performance

NOT accept graphite has higher electrical conductivity.

Absolute vs. **Relative**

1. Absolute: Use when the "requirement" for the property is present in one but absent in the other.
2. Comparative: Use when BOTH substances possess the "requirement," but to different degrees.

Total Mark: 4

Answers written in the margins will not be marked.

2. Nitric acid is commonly used acid in the laboratory. When exposed to light, it decomposes slowly to form nitrogen dioxide, water and oxygen.

(a) (i) Write the chemical equation for the decomposition of nitric acid under light. (1 mark)

$4HNO_3(aq) \rightarrow 4NO_2(g) + O_2(g) + 2H_2O(l)$ [1]

Good performance

(ii) Explain whether the decomposition reaction is a redox reaction in terms of oxidation number. (1 mark)

The reaction is a redox reaction because

- the oxidation number of O changes from -2 in HNO_3 to 0 in O_2 /
- the oxidation number of N changes from +5 in HNO_3 to +4 in NO_2 [1]

Satisfactory

(b) Write the balanced chemical equation for the reaction of concentrated nitric acid and copper, and state the expected observation. (2 marks)

$Cu(s) + 4HNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2NO_2(g) + 2H_2O(l)$; OR

$Cu(s) + 4H^+(aq) + 2NO_3^-(aq) \rightarrow Cu^{2+}(aq) + 2NO_2(g) + 2H_2O(l)$

The solution turns from colourless to blue. / Brown fumes evolve. [1]

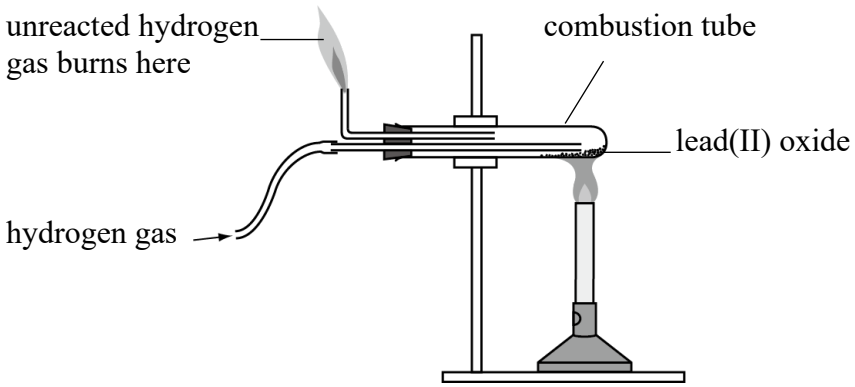
Satisfactory performance

Some students did not recognize that concentrated nitric acid is a strong oxidizing agent. Some misunderstood that the reaction gave hydrogen gas as product.

Total Mark: 4

Answers written in the margins will not be marked.

3. The following diagram shows a set-up for the extraction of lead from lead(II) oxide. Hydrogen gas is passed into the combustion tube while lead(II) oxide is heated strongly.



(a) Lead(II) oxide is a toxic powder. State the colour changes of lead(II) oxide powder before heating, while heating and after heating. (1 mark)

From yellow to orange and then to grey. [1]

Poor performance

(b) Write the chemical equation for the extraction of lead from lead(II) oxide using hydrogen gas. (1 mark)

$PbO(s) + H_2(g) \rightarrow Pb(s) + H_2O(l)$ [1]

Good performance

(c) In a trial, 4.46 g of lead(II) oxide was completely reduced. Calculate the mass of lead metal produced.

(Relative atomic masses: O = 16.0, Pb = 207.2) (2 marks)

Number of moles of PbO = 4.46 / (207.6 + 16) = 0.00200

Mole ratio of PbO : Pb = 1 : 1

Number of moles of Pb = 0.0200 [1]

Mass of Pb = 0.0200 × 207.2 = 4.14 g [1]

Good performance

(d) Explain why it is necessary to pass hydrogen gas into the combustion tube for a few minutes after turning off the heating. (1 mark)

To prevent the hot lead from reacting with oxygen in the air again. [1]

Poorly answered.

(e) Lead can also be extracted from a solution of lead(II) nitrate using zinc metal. Write the ionic equation for the process involved. (1 mark)

$Pb^{2+}(aq) + Zn(s) \rightarrow Pb(s) + Zn^{2+}(aq)$ [1]

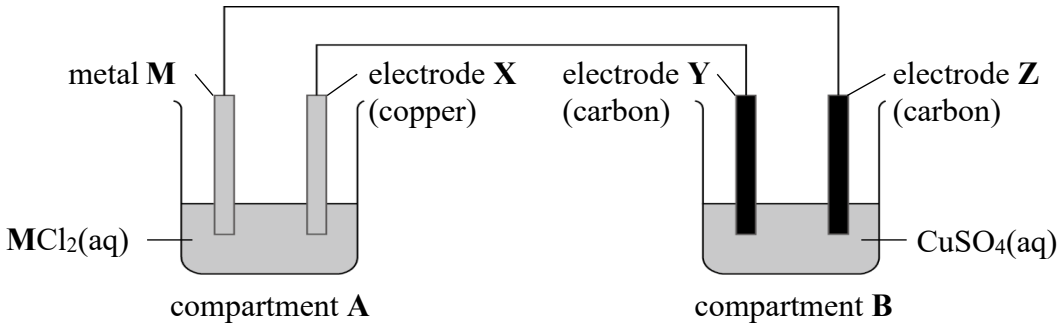
Good performance

Some students save a full chemical equation instead of ionic equation.

Total Mark: 6

Answers written in the margins will not be marked.

4. The following diagram shows a set-up in which an electric current is passing through the electric wires. When the circuit is closed for some time, reddish brown solid is deposited on electrode **Z**.



(a) State the direction of electron flow in the external circuit. (1 mark)

From metal **M** to electrode **Z**/ from electrode **Y** to **X** [1]

Good performance
Must specify the direction of electron flow in either of electrical wires.
- NOT accept from Z to Y
- NOT accept from B to A because there are two wires and the direction of electron flow in the two wires is opposite.

(b) Identify the cathode in compartment **A** and **B** respectively by circling the electrode. (1 mark)

Compartment	Cathode
A	Metal **M** / electrode **X**
B	electrode **Y** / electrode **Z**

Good performance
Cathode refers to electrode where reduction takes place, which involves gaining electrons.

(c) With the aid of a half equation, state an expected observation at electrode **X**. (2 marks)

$2H^+(aq) + 2\ e^- \rightarrow H_2\ (g)$ [1]; Colourless gas bubbles evolve. [1]

Electrode X receives e^-. In $MCl_2(aq)$, cations $M^{2+}(aq)$ and $H^+(aq)$ are present. Since electrode M loses e^-, metal M loses e^- more readily than Cu, hence

Ease of losing e^-: M > H_2 > Cu

$H^+(aq)$ is thus a stronger oxidizing agent/ gains electrons more readily than $M^{2+}(aq)$, $H^+(aq)$ gains electrons and is reduced to H_2.

(d) What is the function of compartment **A** in the set-up? (1 mark)

It acts as a chemical cell to provide electrical energy for the electrolysis in compartment **B**. [1]

Well-answered

Answers written in the margins will not be marked.

(e) Explain whether **M** could be lead. (1 mark)

No. Lead(II) chloride is insoluble in water, so it cannot form the aqueous solution required for the setup. [1]

Poor performance

(f) State what would be observed at electrode **Y** if the carbon rod is replaced by a copper sheet. (1 mark)

The copper sheet dissolves/ becomes thinner. [1]

Well-answered

NOT accept change in colour intensity of the surrounding electrolyte.

Total Mark: 7

Answers written in the margins will not be marked.

5. A student performed an experiment to determine the percentage purity by mass of a sample of impure magnesium oxide (MgO). It is assumed that the impurities are insoluble in water and do not react with acid. The procedure of the experiment was as follows:

Step 1. 1.50 g of the impure sample was weighed.
Step 2. 50.0 cm^3 of 2.00 mol dm^{-3} hydrochloric acid was added to the sample in a beaker. The reaction mixture was stirred until the reaction was complete.
Step 3. The resulting mixture was transferred into a 250.0 cm^3 volumetric flask and made up to the graduation mark with deionised water.
Step 4. 25.0 cm^3 of the diluted solution was withdrawn and titrated with 0.150 mol dm^{-3} sodium hydroxide solution using a methyl orange as the indicator.
Step 5. The average titre of sodium hydroxide required to reach the end point was 22.40 cm^3.

(a) State the colour change at the end point. (1 mark)

From red to orange. [1]

Well-answered

(b) Explain why a direct titration of the magnesium oxide solid with standard hydrochloric acid is not suitable for this analysis. (1 mark)

The reaction between solid MgO and acid is slow. /

MgO is insoluble in water, making it difficult to determine the end point directly. [1]

Poorly answered

(c) Calculate the percentage purity of the magnesium oxide sample.

(Relative atomic masses: O = 16.0, Mg = 24.3) (3 marks)

$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

Number of moles of NaOH = $0.150 \times \frac{22.40}{1000} = 0.00336$

$\therefore$ number of moles of unreacted HCl in 250.0 cm^3 of resultant solution prepared in Step 3

$= 0.00336 \times \frac{250.0}{25.0} = 0.0336$

Number of moles of HCl reacted with MgO = $2.00 \times \frac{50.0}{1000} - 0.0336$ mol = 0.0664 [1]

$MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$

$\therefore$ number of moles of MgO in the sample = $\frac{0.0664 \text{ mol}}{2} = 0.0332$

Mass of MgO in the sample = $0.0332 \times (24.3 + 16.0) = 1.338$ g [1]

Percentage purity of MgO = $\frac{1.338 \text{ g}}{1.50 \text{ g}} \times 100\% = 89.2\%$ [1]

Good performance

(d) Before the titration, the student rinsed the conical flask with the solution withdrawn from the volumetric flask. Explain how this practice would affect the titre volume of sodium hydroxide. (1 mark)

The titre volume would be higher / larger. Rinsing with the analyte increases the number of moles of acid in the flask, requiring more NaOH to neutralise it. [1]

Poorly answered

Total Mark: 6

Answers written in the margins will not be marked.

*6. You are provided with the following three solutions, all at a concentration of 0.1 M:

hydrochloric acid sulphuric acid ethanoic acid

Describe an experiment, by selecting TWO suitable acids from the above list and using common laboratory apparatus or reagents, to demonstrate the difference in acid strength. State the expected observations and explain the results in terms of the properties of the acids. (6 marks)

- Use fixed volume of 0.1 M hydrochloric acid and 0.1 M ethanoic acid. [1]

- **Method A:**

  Add a piece of magnesium ribbon (Mg) / calcium carbonate chips ($CaCO_3$) of the same mass to each acid in separate apparatus. [1]

  Hydrochloric acid reacts more vigorously / produces gas bubbles faster than ethanoic acid. [1]

  OR **Method B:**

  Measure the pH of each solution using a pH meter / data-logger with pH sensor / universal indicator paper. [1]

  Hydrochloric acid has a lower pH than ethanoic acid. [1]

  OR **Method C:**

  Measure the electrical conductivity of each solution using a conductivity meter / circuit with a light bulb. [1]

  Hydrochloric acid shows higher electrical conductivity / the bulb shines brighter than ethanoic acid. [1]

- Hydrochloric acid is a strong acid which undergoes complete ionisation in water, whereas ethanoic acid is a weak acid which undergoes partial ionisation. Therefore, "concentration of $H^+(aq)$" in $HCl(aq)$ is higher than that in $CH_3COOH(aq)$, leading to a faster reaction rate / lower pH / higher conductivity. [1]

Fair comparison [1]

Fair performance

- Should relate answer to extent of ionization.
- Must explain rate, pH and conductivity in terms of **"concentration"** of H^+ (or mobile ions).
- NOT accept measuring time taken for the solid (e.g. Mg, $CaCO_3$) to dissolve fully in the acid solution) as this observation may not very obvious to human eye.
- Preferably suggest method involving simple procedure.

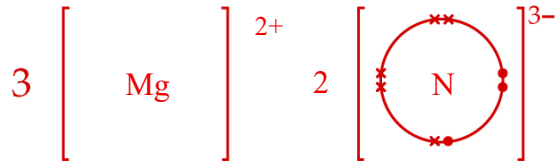
Total Mark: 6

Answers written in the margins will not be marked.

7. Magnesium nitride (Mg_3N_2) is a greenish-yellow powder. It reacts violently with water to produce magnesium hydroxide and ammonia gas.

$$Mg_3N_2(s) + 6H_2O(l) \rightarrow 3Mg(OH)_2(s) + 2NH_3(g) \qquad \Delta H_r^{\ominus}$$

(a) Draw the electron diagram of Mg_3N_2, showing the outermost shell electrons only. (1 mark)



Good Performance

(b) Define the term 'standard enthalpy change of formation'. (1 mark)

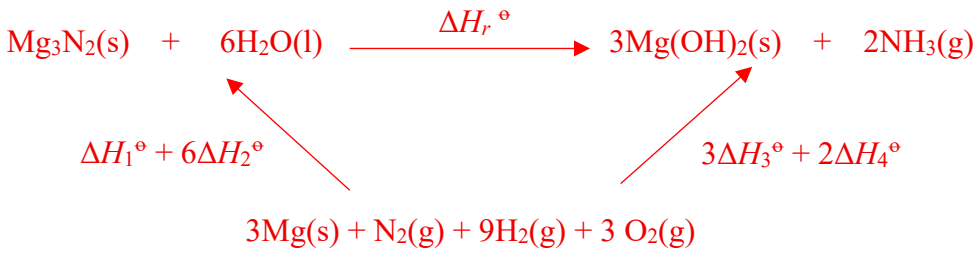
It is the enthalpy change when one mole of the substance forms from its constituent elements in their standard states under standard conditions. [1]

- Fair performance
- Common mistake: omitting "in standard states".
- Standard states refer to the substances in its most stable physical form at 1 atm at 25°C. (e.g. graphite is the most stable form of carbon at 1 atm at 25°C)

(c) Given the following thermochemical equations:

$3Mg(s) + N_2(g) \rightarrow Mg_3N_2(s)$	$\Delta H_1^{\ominus} = -461.0$ kJ mol^{-1}
$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(l)$	$\Delta H_2^{\ominus} = -285.8$ kJ mol^{-1}
$Mg(s) + H_2(g) + O_2(g) \rightarrow Mg(OH)_2(s)$	$\Delta H_3^{\ominus} = -924.7$ kJ mol^{-1}
$\frac{1}{2} N_2(g) + \frac{3}{2} H_2(g) \rightarrow NH_3(g)$	$\Delta H_4^{\ominus} = -46.1$ kJ mol^{-1}

(i) Using the above standard enthalpy change, construct a labelled enthalpy change cycle to determine standard enthalpy change of reaction $\Delta H_r^{\ominus}$. (2 marks)



Correct cycle [1], correct labels [1]
Fair performance

(ii) Calculate the standard enthalpy change of reaction $\Delta H_r^{\ominus}$. (2 marks)

$\Delta H^{\ominus} = [\ 3 \times (-924.7) + 2 \times (-46.1) - (-461.0) - 6 \times (-285.8)]$ [1]

$= -690.5$ kJ mol^{-1} [1]

Good performance

Answers written in the margins will not be marked.

7. (d) In an experiment, 1.01 g of Mg_3N_2 is added to a certain volume of water. The powder dissolves completely and the temperature of the mixture rises by 18.0 °C.

(i) The mass of the reaction mixture is 100.0 g. Calculate the enthalpy change of the reaction under these experimental conditions.

(Assume that the specific heat capacity and the density of the reaction mixture are the same as those of water, i.e. 4.2 J g^{-1} $°C^{-1}$ and 1.0 g cm^{-3} respectively.)

(Relative atomic masses: N = 14.0, Mg = 24.3) (2 marks)

Heat released = 100.0 × 4.2 × 18.0 = 7560 J = 7.560 kJ [1]

ΔH = – 7.560 / (1.01/100.9) = – 756 kJ mol^{-1} [1]

Good performance

(ii) By considering the physical states of the products formed, account for the difference in values calculated in (c)(ii) and (d)(i). (1 mark)

The dissolution of NH_3 gas in water is exothermic. [1]

Poorly answered

Most students were not aware of the side reaction

Total Mark: 9

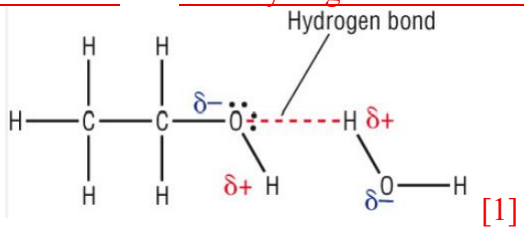
8. (a) With reference to the molecular shape, explain why water is polar. (2 marks)

Water molecule has a V-shaped [1]. The 2 O-H bonds are not symmetrically arranged such that their bond polarities/ dipole moments of the O-H bonds cannot cancel out each other [1]. Hence, water is polar.

Good performance.
Must specify clearly bond polarities/ dipole moments of "the O-H bonds".

(b) Explain, with the aid of labelled diagram, why ethanol can mix well with water. (2 marks)

The -OH group of ethanol molecule can form hydrogen bond with water. [1]



[1]

Satisfactory performance. Many students did not label "hydrogen bond"

(c) Ethanol is commonly separated from its aqueous fermentation solution by fractional distillation. Account for the fact that the boiling point of ethanol (78.3°C) is lower than that of water (100°C). (1 mark)

Hydrogen bonds in water are more extensive than those in ethanol/ more hydrogen bonds are formed per molecule in water/ there are 2 hydrogen bonds per water molecule while only 1 hydrogen bond per ethanol molecule [1]

Fair performance. NOT accept there are 2 hydrogen bonds in water while there is 1 in ethanol.

Total Mark: 5

Answers written in the margins will not be marked.
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9. Consider the following oxides:
$Na_2O(s)$ $MgO(s)$ $Al_2O_3(s)$ $SiO_2(s)$ $P_4O_{10}(s)$

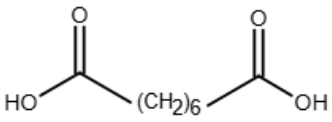
(a) State the general relationship between bonding and acid-base properties of the oxides. (1 mark)
Ionic oxides are basic oxide while acidic oxides are covalent oxides. [1]
Poorly answered
Must relate the trend to "bonding", NOT structure NOR van der Waals forces which is NOT a type of chemical bond.

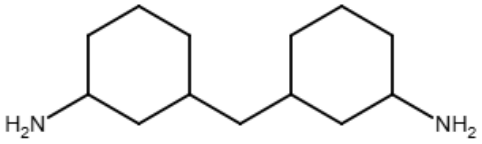
(b) In an experiment, some $SiO_2(s)$ is added to water. Explain the effect on the pH of the mixture. (1 mark)
No effect/ pH remains as 7 because SiO_2 is insoluble in water. [1]
Satisfactory performance

(c) Write the chemical equation for the reaction between $Al_2O_3(s)$ and NaOH(aq). (1 mark)
$2NaOH(aq) + Al_2O_3(s) + 3H_2O(l) \rightarrow 2NaAl(OH)_4(aq)$ [1]
Poorly answered

Total Mark: 3

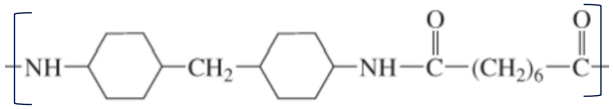
10. Quiana is a synthetic polymer that can be spun into a soft, silky fabric. The monomers used to make Quiana are shown below:





(a) Using Quiana as an example to illustrate what condensation polymerization means. (1 mark)
Monomers join repeatedly/ join to form a long polymer chain with the loss of small molecules H_2O. [1]
Poorly answered
NOT accept "polymerization with loss of small molecules" as this does not "illustrate" what it actually means using formation of Quiana as example.

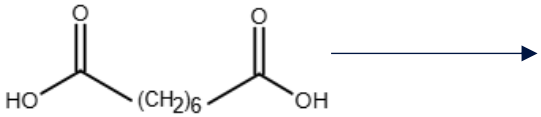
(b) Draw the repeating unit of Quiana. (1 mark)



[1]

Poorly answered
Circle the groups of atoms which will be lost from the functional groups (-COOH group and $-NH_2$ group) when monomer molecules join together.

(c) Outline a synthetic route, *with no more than three steps*, to accomplish the following conversion. For each step, give the reagent(s), reaction conditions (as appropriate) and structure of the organic product.



$\rightarrow$ $CH_2=CH(CH_2)_4CH=CH_2$

(3 marks)

Step 1: $LiAlH_4$ in dry ether 2. $H^+(aq)$ [1] Product: $HO(CH_2)_8OH$ [1]

Step 2: Conc. H_2SO_4 or Al_2O_3, heat [1]

Well-answered

Answers written in the margins will not be marked.

Total Mark: 5

PART II

11. Dinitrogen tetroxide, $N_2O_4(g)$, dissociates to form nitrogen dioxide, $NO_2(g)$, according to the equation:

$$\underset{\text{colourless}}{N_2O_4(g)} \rightleftharpoons \underset{\text{brown}}{2NO_2(g)} \qquad \Delta H = +57.2 \text{kJ mol}^{-1}$$

(a) In an experiment, 0.90 mol of $N_2O_4(g)$ was placed in an empty 2.0 dm^3 sealed vessel at 100°C. When the system reached equilibrium, there was 0.72 mol of $NO_2(g)$ present in the vessel.

Calculate the numerical value of the equilibrium constant, Kc for this reaction at 100°C. (3 marks)

	$N_2O_4(g)$	$\rightleftharpoons$	$2NO_2(g)$
Initial	0.9/2 =0.45		0
Change	-0.18		+ 0.36
At eqm	0.27		0.72 /2 = 0.36 [1]

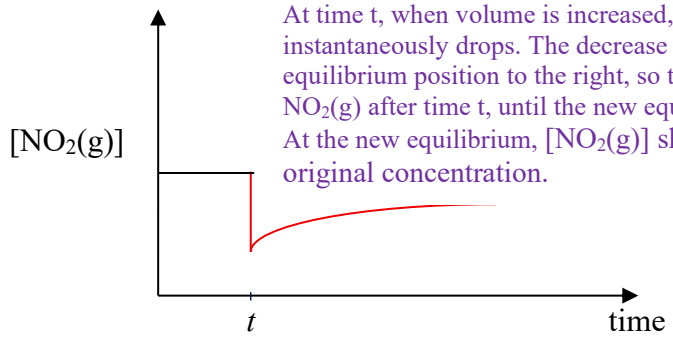
$K_c = \frac{[NO_2(g)]2}{[N_2O_4(g)]}$ or $(0.36)^2/(0.27)$

$= 0.48$ mol dm^{-3} [1]

Satisfactory performance

Common mistakes: did not convert no. of moles of gases into mol dm^{-3}

(b) The graph below shows the concentration of $NO_2(g)$ against time for the reaction system at 100°C.



At time t, when volume is increased, concentration of NO_2 instantaneously drops. The decrease in gas pressure causes the equilibrium position to the right, so there is a net production of $NO_2(g)$ after time t, until the new equilibrium is attained. Note: At the new equilibrium, $[NO_2(g)]$ should NOT exceed the original concentration.

At time *t*, the volume of the vessel was instantly increased while the temperature was kept constant.

(i) Sketch on the given graph to show the expected variation in the concentration of $NO_2(g)$ in the mixture from time *t* (when the change was imposed) until the attainment of a new equilibrium. (1 mark)

[1: remove answer from the above graph]

Poorly answered

(ii) State and explain the effect of increasing volume of the vessel on equilibrium constant, Kc. (1 mark)

No effect as Kc only depends on temperature. [1]

Well-answered

(c) Explain the observable changes if the equilibrium mixture of N_2O_4 and NO_2 is heated while the volume of the vessel is kept constant. (2 marks)

An increase in temperature favours endothermic process, shifting the equilibrium position to the right. [1] Due to the increase in concentration of NO_2, the mixture turns darker brown. [1]

Poorly answered

NOT accept "darker because there is more NO_2". Must explain in terms of "concentration" of NO_2.

Total Mark: 7

Answers written in the margins will not be marked.

12. Dodecane ($C_{12}H_{26}$) is a hydrocarbon found in the naphtha fraction of crude oil. Dodecane can be used as a starting material to produce a wide variety of useful products. The scheme below shows how one such product, polymer **Y**, can be produced from dodecane.

Reaction 1: $C_{12}H_{26} \rightarrow$ **X** + 2 $CH_3CH{=}CHCH_3$

Reaction 2: n $CH_3CH{=}CHCH_3 \rightarrow$ Polymer **Y**

(a) (i) Name the industrial process shown in Reaction 1. (1 mark)

Cracking [1] Good Performance

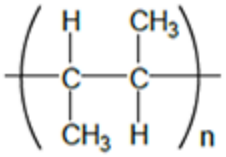
(ii) Deduce the molecular formula of **X**. (1 mark)

C_4H_{10} [1] Good Performance

(iii) State ONE difference in the burning characteristic of **X** and $CH_3CH{=}CHCH_3$. (1 mark)

X burns more completely to give less sooty flame.[1]
Good Performance

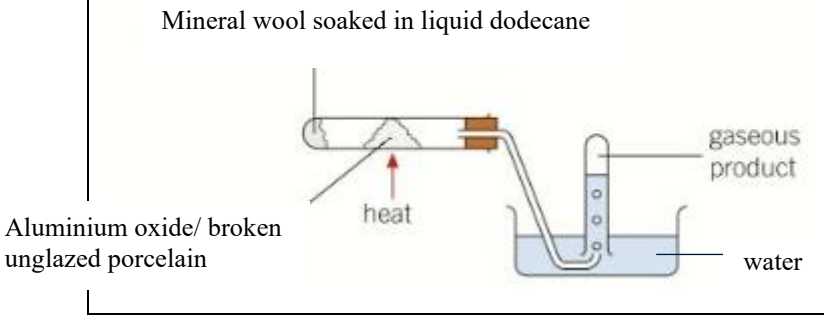
(b) Draw the structure of polymer **Y**. (1 mark)



[1] Good Performance

(c) A student attempts to perform Reaction 1 in the laboratory using liquid dodecane.

(i) Draw a labelled diagram of the experimental set-up that can be used to perform the reaction and collect the gaseous products. (2 marks)



Poorly answered
Remarks:

- The opening of delivery tube should be at the bottom of the inverted test tube.
- Mineral wool ≠ cotton wool
- Working principle of water displacement method: As the gases formed (small hydrocarbons) are insoluble in water and they have lower density than water, they pass through the water in the filled test tube and rise to the top.

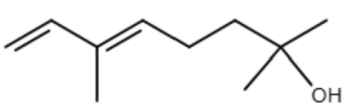
(ii) State one essential safety precaution that must be taken when stopping the experiment (i.e. before removing the heat source). Explain the reason for this precaution. (2 marks)

Remove the delivery tube from the water trough *before* stopping heating. [1]
To prevent 'suck-back of water'/ to prevent cold water from being drawn into the hot boiling tube and cracking it. [1]
Satisfactory performance

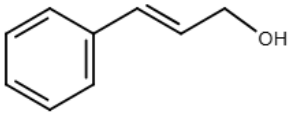
Total Mark: 8

Answers written in the margins will not be marked.

13. Ocimenol and cinnamyl alcohol are organic compounds used primarily as fragrance and flavoring agents in cosmetics, personal care products and food.



ocimenol



cinnamyl alcohol

(a) Give a systematic name for ocimenol. (1 mark)

2,6-dimethylocta-5,7-dien-2-ol [1]

Poorly answered

Remarks: "a" to be added after stem name if there are more than 1 multiple bond

(b) Ocimenol and cinnamyl alcohol are both unsaturated compounds. Describe how you would use a solution of bromine to distinguish the compounds. (3 marks)

Use equal volume/same amount/ same number of moles of ocimenol and cinnamyl alcohol [1]

Add bromine dropwise/from a burette and determine the number of drops/ volume of bromine which the liquid can decolurise [1]

More drops/volume of bromine decolorised for ocimenol [1]

Poorly answered

- Bromination of a alkene is considered a **fast, almost instantaneous reaction** at room temperature.
- Many students suggested ocimenol would react with bromine in a faster rate than cinnamyl alcohol, hence take less time to decolourise bromine. However, in practice, both decolourise bromine so quickly that our eyes will not be able to see this difference.

(c) Name the type of stereoisomerism shown by both ocimenol and cinnamyl alcohol. (1 mark)

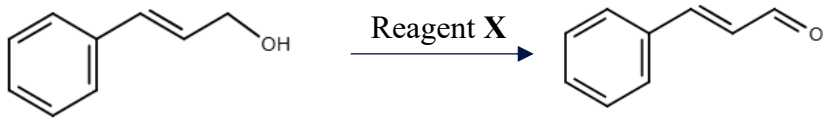
Cis-trans isomerism/ geometrical isomerism [1]

Fair performance

Some students suggested position isomerism. This implies a lack of understanding of what stereoisomers are. Stereoisomers refer to isomers with atoms linked in the same sequence but with differential spatial arrangement. Stereoisomerism thus refers to cis-trans isomerism or enantiomerism. Position isomerism is a kind of structural isomerism.

Answers written in the margins will not be marked.

13. (d) Cinnamaldehyde can be prepared from cinnamyl alcohol by heating with reagent **X** under suitable conditions.



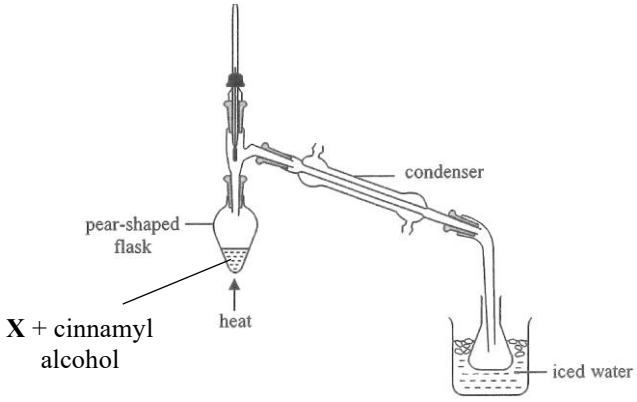
cinnamyl alcohol cinnamaldehyde

(i) Suggest what **X** is. (1 mark)

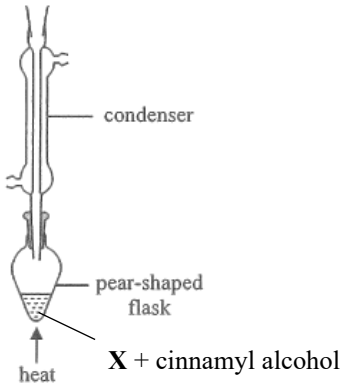
Acidified potassium dichromate [1]

Well-answered

(ii) Explain why set-up 1, instead of set-up 2, should be used to prepare cinnamaldehyde from cinnamyl alcohol.



Set-up 1



Set-up 2

(2 marks)

In set-up 1, cinnamaldehyde is volatile/ lower boiling point and can be distilled off immediately once it is formed. [1] Since it is separated from the reaction mixture, further oxidation to acid can be prevented/ in set-up 2, the volatile components vapourise, condense and drip back into the mixture and reheated with acidified $K_2Cr_2O_7$ continuously, cinnamaldehyde formed will be fully oxidized to form acid instead. [1]

Poorly answered

Many students did not relate their answer to the properties of the chemicals and the functions of the set-ups.

Total Mark: 8

Answers written in the margins will not be marked.

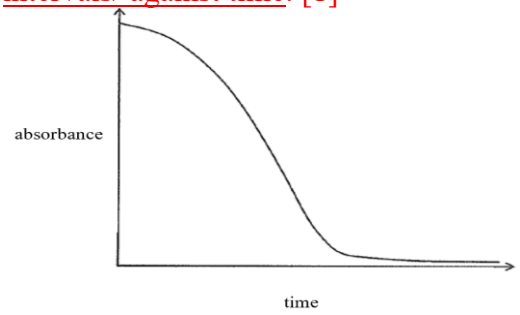
14. The reaction between acidified potassium permanganate(VII) and ethanedioic acid is investigated. It is known that the reaction is auto-catalytic, with the product Mn^{2+} acting as a catalyst.

MnO_4^- (aq) + 5 $C_2O_4^{2-}$ (aq) + 16H^+ (aq) ⟶ 2 Mn^{2+} (aq) + 5CO_2 (g) + 8H_2O(l)

Describe how you would follow the progress of the reaction by colorimetry. Experimental details are NOT expected. Sketch a labelled graph to show the expected results and explain the shape of the graph.

(6 marks)

Measure the colour intensity/ absorbance of the reaction mixture using colorimeter at regular time intervals/ against time. [1]



[1]

As the reaction proceeds, **purple MnO_4^- is consumed**, forming colourless products/ **concentration of purpose MnO_4^- decreases**, thus **colour intensity decreases**. [1]

At the reaction starts, the slope of the curve is small. The rate is slow as Mn^{2+} is yet to be formed/ concentration of Mn^{2+} is low.

As the reaction proceeds, the **slope** of the curve becomes **increases/ steeper**, the **rate increases** because **Mn^{2+} is formed** and speeds up the reaction/ **the "concentration" of Mn^{2+} increases**. [1]

At the later stage of reaction, the **slope** becomes **less steep/ decreases** because the **"concentration" of reactants decreases**.[1]

[1 mark for effective communication]

Poorly answered

- Though it is given that the reaction **involves auto-catalysis**, many students did not take the formation of catalyst (Mn^{2+}) as a factor which affects the reaction rate as the reaction proceeds.
- In this question, students are expected to **explain the shape** of the graph. The graph shows a **decreases in absorbance** and **a curve of varied slope** during reaction. Students are expected to account for these features.
  1. For change in colour intensity: must relate the colour of the chemical species used up/ formed.
  2. For shape of the curve: must **describe the shape using the slope** as the evidence and **interpret the variation in rate** and **then explain the factors involved**.

Slope ⇔ rate ⇔ factors affecting rate (catalyst/ "conc")

Many students have the concepts but not aware that they need to describe the shape in terms of slope and thus lose marks.

- Some students were not aware that colorimetry **involves continuous measurement**, so **no quenching is needed**.
- Many students explained why the reaction rate gets faster in the presence of catalyst using concepts covered in industrial chemistry, which is NOT the focus of this question.

Total Mark: 6

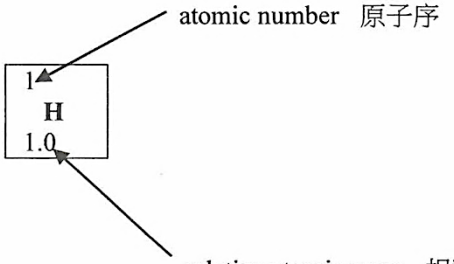
END OF SECTION B

END OF PAPER

Answers written in the margin will not be marked.

PERIODIC TABLE 周期表

GROUP 族



I	II											III	IV	V	VI	VII	0
																	2 **He** 4.0
3 **Li** 6.9	4 **Be** 9.0											5 **B** 10.8	6 **C** 12.0	7 **N** 14.0	8 **O** 16.0	9 **F** 19.0	10 **Ne** 20.2
11 **Na** 23.0	12 **Mg** 24.3											13 **Al** 27.0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 40.0
19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.9	24 **Cr** 52.0	25 **Mn** 54.9	26 **Fe** 55.8	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.5	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.6	33 **As** 74.9	34 **Se** 79.0	35 **Br** 79.9	36 **Kr** 83.8
37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 * **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 ** **Ac** (227)	104 **Rf** (261)	105 **Db** (262)													

*	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
**	90 **Th** 232.0	91 **Pa** (231)	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)