2023-2024
MOCK EXAM
S.6 CHEM

PAPER 1B

B

Good Hope School
Mock Examination 2023 – 2024
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, 7 and 9.

(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. Lithium occurs naturally in two isotopes, ^{6}Li and ^{7}Li. It can form lithium nitride (Li_3N) when burnt in air.

(a) (i) Calculate the percentage abundance of ^{6}Li in nature.
(Relative atomic mass: Li = 6.9)

$6.0 \times x + 7.0 \times (1-x) = 6.9$ [1]

$x = 0.1$ (or 10%) [1]

(ii) Describe the bonding in lithium.

The metallic bond / electrostatic attraction (NOT accept: giant metallic bond) [1] between delocalised electrons / sea of electrons and metal ions / lithium ions / Li^+ (NOT accept nuclei/ atom). [1]

(Not accept: free electrons / electrons / outermost electrons)

(Or diagram with correct labels)

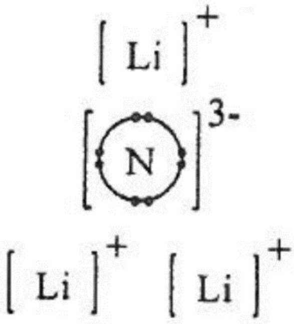
(For diagram:

(1) The Lithium ions should be labelled as "Li^+" or "+"

(2) Clearly indicates sea of electrons, or delocalised electrons between metal ions.

(3) Clearly indicate metallic bond/electrostatic attraction between sea of electrons / delocalised electrons and metal ions.)

(iii) Draw the electron diagram for lithium nitride, *showing electrons in the outermost shells only*.



[accept use of different electrons in N^{3-} ion; not accept electrons in Li^+ ion]

(5 marks)

1. (b) In an experiment, 1.25 g of lithium nitride is put into water, LiOH and NH_3 are formed.

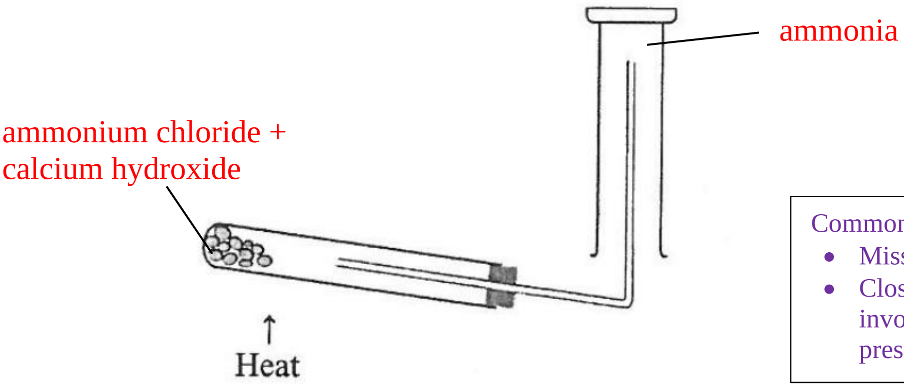
(i) Write a chemical equation for the reaction involved.

$Li_3N(s) + 3H_2O(l) \rightarrow 3LiOH(aq) + NH_3(aq)$ [1]

(ii) Calculate the mass of LiOH formed during the reaction.
(Relative atomic masses: H = 1.0, Li = 6.9, N = 14.0, O = 16.0)

Mass of NH_3 formed from 1.25 g of Li_3N = 3 × [1.25 /(6.9×3+14)] × [6.9+16+1] g [1]
= 2.58 g [accept 2.583 g] [1]

(iii) Ammonia can also be prepared using solid ammonium chloride and solid calcium hydroxide in a laboratory. Draw a labelled diagram to show the set-up involved and how ammonia gas is collected.



Common mistakes:
- Missing heating
- Closed system (Since heating is involved, it will be generous if gas pressure build up in a closed system.)

correct diagram showing upward delivery– 1 mark

correct label with heating – 1 mark

[NOT accept closed system]

Performance: fair

Sub-total: 10

(5 marks)

2. Benzene is a liquid hydrocarbon with molecular formula C_6H_6.

(a) Suggest why the enthalpy change of formation of $C_6H_6(l)$ CANNOT be determined directly by experiment. (1 mark)

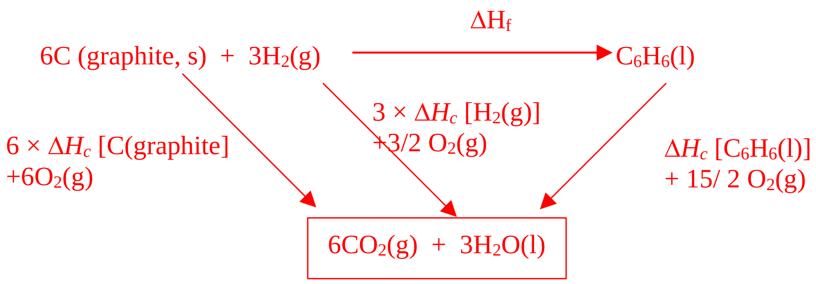
C cannot react with H_2 to give C_6H_6 under room conditions / the reaction between C and H_2 does not give C_6H_6 only / side products will be formed. [1]

(b) Hess's law can be used to find enthalpy changes which CANNOT be determined directly by experiment. State Hess's law. (1 mark)

Hess's law states that the enthalpy change accompanying a reaction is independent of the pathway it takes between the initial and final states. [1]

2. (c) The enthalpy change of formation of $C_6H_6(l)$ can be determined based on the enthalpy changes of combustion ΔH_c of $C_6H_6(l)$, C(graphite) and $H_2(g)$ by the construction of an enthalpy change cycle.

(i) Draw, with labels, this enthalpy change cycle.



Correct cycle – [1];
Correct state symbol and ΔH_f – [1]

Fair performance

Most students come up with a correct cycle but missed some details e.g. labelling of enthalpy change symbols/ stating the physical states/ stating "graphite" next to the symbol of carbon

(ii) The standard enthalpy changes of combustion ΔH_c^θ of $C_6H_6(l)$, C(graphite) and $H_2(g)$ are given below:

	ΔH_c^θ / kJ mol^{-1}
$C_6H_6(l)$	–3267
C(graphite)	–394
$H_2(g)$	–286

(1) State the standard conditions for 'standard enthalpy change'.

<u>1 atmospheric pressure</u> and <u>25°C/ 298K.</u> [1]

Fair performance

(2) Calculate the standard enthalpy change of formation of $C_6H_6(l)$.

ΔH_f^θ = 6(-394) + 3(-286) – (-3267) [1]
= + 45 kJ mol^{-1} [1]

Satisfactory performance

Sub-total: 7

(5 marks)

3. The percentage by mass of calcium carbonate in a limestone sample was determined as follows:

Step (1): 0.801 g of limestone sample was ground into powder.
Step (2): The sample was put into a conical flask. After that, 25.00 cm^3 of 2.00 M HCl(aq) were added.
Step (3): The mixture was warmed for 15 minutes.
Step (4): After cooling down, the mixture was titrated with 1.04 M NaOH(aq) using an indicator **X**.

(a) The mixture turned from colourless to pale pink at the end point of titration in Step (4). Name indicator **X**. (1 mark)

Phenolphthalein* [1]

Common mistakes: spelling mistakes

(b) 34.00 cm^3 of NaOH(aq) was needed to reach the end point of titration in Step (4). Calculate the percentage by mass of calcium carbonate in the limestone sample. (3 marks)
(Relative atomic masses: C = 12.0, O = 16.0, Ca = 40.1)

Number of moles of NaOH used = 1.04 × 0.034 mol =0.03536 mol
Number of moles of HCl reacted with NaOH = 0.03536 mol [0.5]
Number of moles of HCl reacted with $CaCO_3$ = 2.00 × 0.025 – 0.03536= 0.01464 mol [1]
Number of moles of $CaCO_3$ reacted with HCl = 0.01464/2 = 0.007320 mol [0.5]
Mass of $CaCO_3$ in the sample = 100.1 g mol^{-1} × 0.007320 mol = 0.7327 g
Percentage by mass of $CaCO_3$ = (0.7327 g / 0.801 g) × 100 = 91.5% [1] [Accept 91.48%]

Comments:
Some students didn't recognize that this experiment involves back-titration.

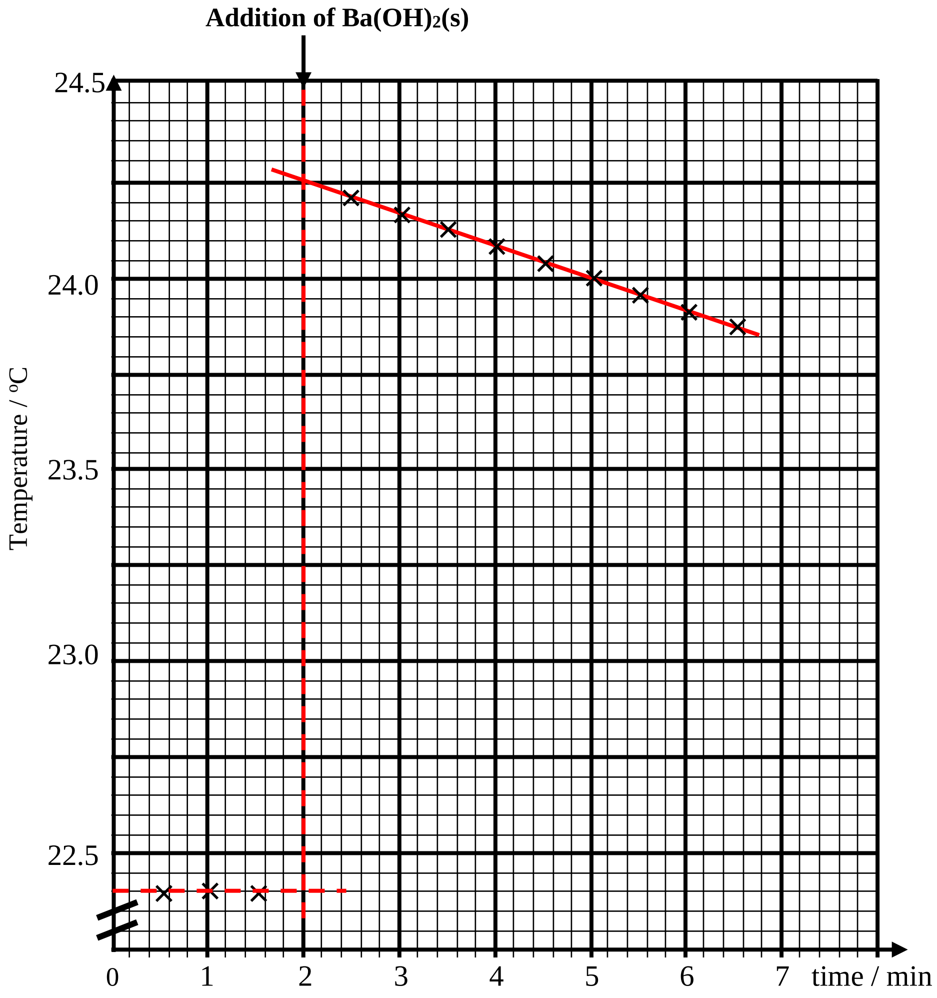
(c) In step (4), the equivalence point can also be determined by measuring the pH values of the mixture when NaOH(aq) was added slowly into the sample solution in step (3). Name the apparatus used to measure the pH of the mixture. (1 mark)

pH meter/ pH sensor connected to data logger [1]

[NOT accept data logger without mentioning pH sensor]

Sub-total: 5

4. An experiment was performed to determine the enthalpy change of neutralization between $Ba(OH)_2(s)$ and HCl(aq). 100.0 cm^3 of 1.0 M HCl(aq) was placed in an expanded polystyrene cup. The temperature of the contents in the cup was measured at half-minute intervals. Right at the second minute, 1.26 g of $Ba(OH)_2(s)$ was added to the cup with thorough stirring. The recordings of temperature are shown in the graph below:



(a) By sketching on the graph above, estimate the greatest temperature rise of the contents in the cup.

24.25 - 22.40 = 1.85

The greatest temperature rise = ____________________°C

(1 mark)

4. (b) In the experiment, HCl(aq) is in excess. Calculate the enthalpy change of neutralisation between $Ba(OH)_2(s)$ and HCl(aq), in kJ mol^{-1}, under the experimental conditions. You may assume that the heat capacity of the expanded polystyrene cup is negligible.

Given: volume of the reaction mixture = 100.0 cm^3;
density of the reaction mixture = 1.00 g cm^{-3};
specific heat capacity of the reaction mixture = 4.2 J g^{-1} K^{-1};
relative atomic masses: H = 1.0, O = 16.0, Cl = 35.5, Ba = 137.3

$Ba(OH)_2(aq) + 2HCl(aq) \rightarrow BaCl_2(s) + 2H_2O(aq)$

Energy released during reaction = (100.0 × 1) × 4.2 × 1.85 J = 777 J; [1]

Enthalpy change of the reaction = - 777 J / (1.26/171.3) mol^{-1} = - 105600 J mol^{-1} (105.6 kJ mol^{-1}) [1]

Enthalpy change of neutralization = -105.6/2 kJ mol^{-1} = -52.8 kJ mol^{-1} [1]

OR

Energy released during reaction = (100.0 × 1) × 4.2 × 1.85 J = 777 J; [1]

No. of moles of water formed = (1.26 / 171.3) 2 =0.0147 [1]

Enthalpy change of neutralization = - 777 / 0.0147 = -52.8 kJ mol^{-1} [1]

- Fair performance
- Common mistakes: Standard enthalpy change of neutralization refers to the enthalpy change when ONE mole of water is formed from the reaction between an acid and alkali under standard condition.

(3 marks)

Sub-total: 4

*5. You are provided with the following items :

Mg strip, Fe strip, Ag strip, zinc sulphate solution, sulphuric acid solution and test tubes

Suggest how you can perform an experiment to determine (with expected observations and explanation) the order of reducing power of Mg, Fe and Ag.

(6 marks)

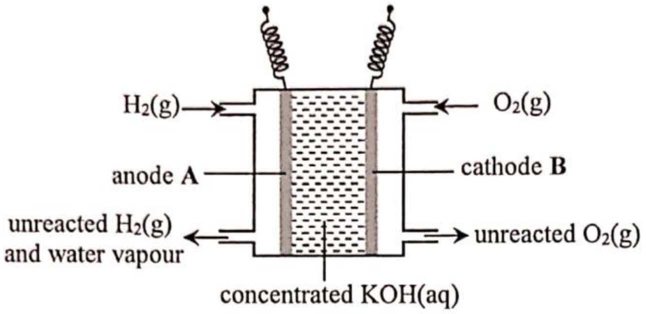
- Put each metal strip into test tubes containing zinc sulphate solution and sulphuric acid respectively. [1]
- In sulphuric acid, Mg and Fe strips will dissolve and give out colorless gas bubbles but there is no observable change for Ag. [1]
- The experiment shows that Mg and Fe give out electrons more readily than H_2, but Ag is less ready to release electrons [0.5]. Thus, Mg and Fe have higher reducing power than Ag [0.5]
- In zinc sulphate solution, Mg strip dissolves /grey solid (Zn) is formed while there is no observable change for Fe and Ag. [1]
- The experiment indicates that Mg is more ready to release electrons than Fe and Ag [0.5]. Mg has the strongest reducing power among the three metals [0.5].

Effective communication – 1 (chemical knowledge 3 marks or above with no wrong concept / irrelevant material [1])

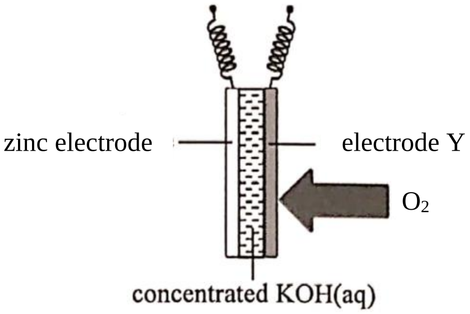
- Must compare observations, hence compare the reducing the power
- Many students did not relate their deduction to the tendency of losing electrons.
- Displacement reaction refers to "an element" being displaced out from its compound. So, it is WRONG to say Mg displaces "Zn^{2+}" from its solution. The process should be described as Mg displace Zn from its solution.

Sub-total: 6

6. The simplified structures of a hydrogen-oxygen fuel cell and a zinc-air cell are shown below:



hydrogen-oxygen fuel cell



zinc-air cell

(a) Explain whether the hydrogen-oxygen fuel cell is a primary cell. (1 mark)

It is a primary cell because it is not rechargeable. [1]

Poor performance

(b) Give ONE advantage of using this hydrogen-oxygen fuel cell. (1 mark)

The cell only gives harmless water as the only product/ does not give any pollutants. [1]

Well-answered

(c) In the above zinc-air cell, oxygen reacts with water to form hydroxide ions at electrode **Y**.

(i) Write the half equation for the change that occurs at electrode **Y**.

$O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$ [1]

Well-answered

(ii) Explain whether **Y** is the anode or cathode in terms of oxidation number.

The oxidation number of O decreases from 0 to -2, indicating that the reaction is a reduction. Electrode **Y** is a cathode. [1]

Remarks:
Most students recognized that Y is the cathode based on the change in O.N., but did not mention that reduction occurs.

(iii) The zinc electrode will slowly change into zinc hydroxide. Write the half-equation that occurs at the zinc electrode.

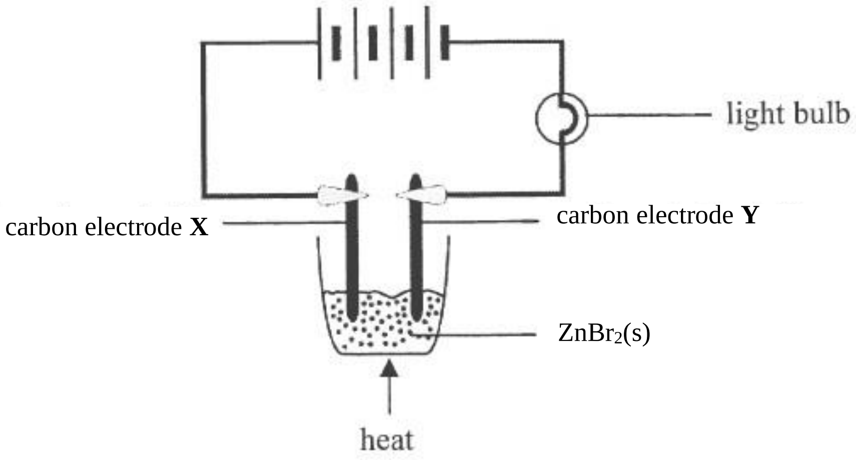
$Zn(s) + 2OH^-(aq) \rightarrow Zn(OH)_2(s) + 2e^-$ [1]

Poor performance

Sub-total: 5

(3 marks)

7. Consider the experimental set-up shown below:



(a) In the above experiment, the bulb only lights up when $ZnBr_2(s)$ becomes molten.

(i) Explain why the bulb only lights up when $ZnBr_2(s)$ becomes molten.

When $ZnBr_2(s)$ is heated to molten state, ions become mobile and $ZnBr_2$ can conduct electricity. [1]

Well-answered

(ii) State the observation at carbon electrode **X**.

Orange / brown fumes (or gas) are formed [1].

- Poorly answer.
- NOT accept the solution turns brown as molten Zn Br2 is NOT a solution.
- NOT accept brown liquid formed as Br2 is bromine and will escape as a gas upon heating.

(iii) Write a half equation for the change that occurs at carbon electrode **Y**.

$Zn^{2+} + 2e^- \rightarrow Zn$ [1]

Some students misunderstood that the electrolyte as an aqueous solution of $ZnBr_2$.

(3 marks)

(b) If water is added to $ZnBr_2$ and copper is used as electrode **X**, the bulb lights up even when $ZnBr_2$ is not heated.

(i) State the observation at copper electrode **X**.

The copper electrode becomes thinner /dissolves / surrounding solution turns blue. [1]

Well-answered

(ii) Write a half equation for the change that occurs at carbon electrode **Y**.

$2H^+ + 2e^- \rightarrow H_2$ [1]

Well-answered

Sub-total: 5

(2 marks)

8. Under certain conditions, a violet compound **Y** reacts with NaOH(aq) to give a colourless product. Three trials of an experiment were conducted to study the kinetics of the reaction. Firstly, three NaOH(aq) solutions were prepared by mixing different volumes of 1.0 M NaOH(aq) and H_2O(l) at 25°C. After that, 1 drop of **Y** was added to each of them and the time needed for the violet colour to disappear was recorded. The relevant data is shown below:

	Volume used (cm^3)		Time taken for the violet colour to disappear (s)
	1.0 M NaOH(aq)	H_2O(l)	
Trial 1	2.5	7.5	240
Trial 2	5.0	5.0	120
Trial 3	10.0	0	60

(a) Why is it necessary to make the total volume of the reaction mixtures the same for the trials?

(1 mark)

To ensure fair comparison between different trials.[1] /
To ensure the concentration of NaOH(aq)/ reactant is the only variable./
The volume of the NaOH(aq) used can represent the concentration of NaOH(aq)/ reactant in the reaction mixtures.
[NOT accept if answer is expressed in terms of "amount of NaOH"]

Satisfactory

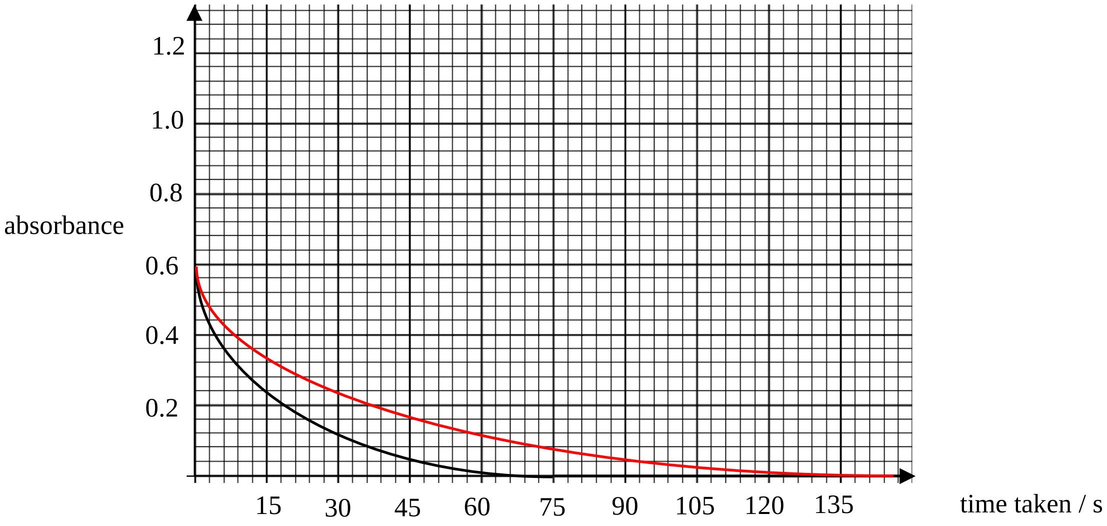
(b) Based on the information provided, deduce one factor which affects the rate of this reaction.

(2 marks)

The concentration of NaOH(aq) [1]
The shorter the time for the violet colour to disappear, the faster the reaction. An increase in concentration of NaOH(aq) will result in an increase in rate of reaction. [1]

- Fair performance
- Many students did not include the trend of data as the evidence to support that the reaction becomes faster as the concentration of NaOH increases.
- Common mistake: stating volume of NaOH(aq) as the factor affecting rate.

8. (c) To detect the colour change more accurately, the progress of the reaction was monitored by colorimetry. The graph below shows how the absorbance of the reaction mixture changes over time for Trial 3.



(i) Describe how the initial rate of reaction can be determined from the graph.

Draw <u>a tangent to the curve at time =0 and determine its slope</u>.

[NOT accept draw a slope]

Well-answered

- Tangent is a <u>straight line</u> just touches the curve at one point.
- Slope is a value, NOT a line. The value of the slope is to be calculated using Δy/Δx.

(ii) Sketch a labelled curve on the graph given to show how the absorbance changes over time if Trial 3 is repeated at a lower temperature.

(2 marks)

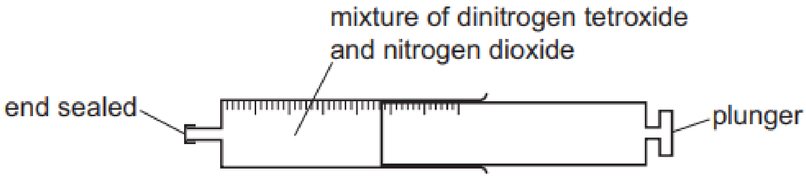
Well-answered

Sub-total: 5

9. (a) Dinitrogen tetroxide, N_2O_4, decomposes into nitrogen dioxide, NO_2.

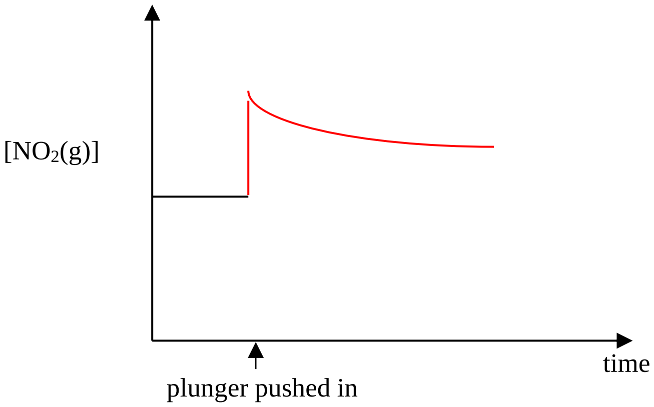
$N_2O_4(g) \rightleftharpoons 2NO_2(g) \quad \Delta H > 0$

The diagram below shows a gas syringe containing a mixture of $N_2O_4(g)$ and $NO_2(g)$ at equilibrium at room temperature.



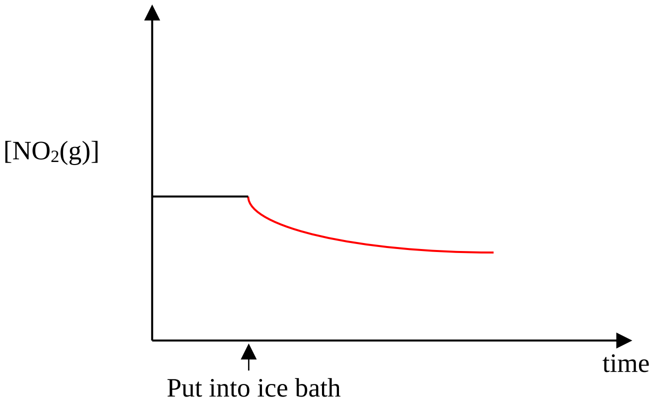
In each of the following cases, sketch on the given graph to show the expected variation in the concentration of $NO_2(g)$ in the mixture until a new equilibrium is attained.

(i) The plunger of the gas syringe is pushed quickly in while the temperature of the mixture is kept unchanged.



Fair performance

(ii) The mixture is put into an ice bath while the volume and the temperature of the mixture are kept unchanged.



(2 marks)

Satisfactory performance

9. (b) In an experiment, 2.0 mol of $N_2O_4(g)$ was allowed to decompose in a closed container of volume 10.0 dm^3 maintained at a certain temperature. When equilibrium was attained, 40% of $N_2O_4(g)$ was found to have decomposed.

Calculate the equilibrium constant Kc of the reaction. (3 marks)

	$N_2O_4(g)$	$\rightleftharpoons$	$2\,NO_2(g)$	
Initial (mol)	2		0	
Change (mol)	-2 (0.4)		+ 2(0.4)(2)	
At eqm (mol)	1.2		1.6	[1]

$$Kc = \frac{[NO_{2(g)}]^2}{[N_2O_{4(g)}]}$$ [1 for correct Kc expression]

$$= \frac{\left(\frac{1.6}{10}\right)^2}{\left(\frac{1.2}{10}\right)}$$

$= 0.213\ mol\ dm^{-3}$ [1]

- Satisfactory performance
- Some student misunderstood that 40% of $N_2O_4(g)$ remained in the equilibrium mixture.

Sub-total: 5

PART II

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

10. Arrange the following organic compounds in order of decreasing boiling point. Explain your answer.

CH_3CH_2OH	$CH_3CH_2CH_3$	CH_3CH_2F
X	**Y**	**Z**

(3 marks)

X and **Z** are polar molecules while **Y** is non-polar molecule. Van der Waals' forces between molecules of **Y** are weaker than those in others [1], hence it has the lowest boiling point.

The hydrogen bond between molecules of **X** is stronger than the van der Waals' forces between **Z**, hence **X** has the highest boiling point. [1]
Boiling point: **X** > **Z** > **Y** [1]

- Satisfactory performance
- Some students misunderstood that Z has a smaller molecular size than Y. In fact, both molecules have similar sizes because theur total no. of electrons of Y and Z are the same.

Sub-total: 3

11. Crude oil is a natural source of hydrocarbons that are used as fuels.

(a) Explain why hydrocarbons with low molecular mass are suitable for use as fuels. (1 mark)

Smaller hydrocarbons burn more completely/ burns to give less pollutants / burn with hotter flame/ is more flammable. [1]

(b) Ethene is an unsaturated hydrocarbon which can be produced by cracking. In a reaction, dodecane, $C_{12}H_{26}$, is cracked to produce an alkane and ethene in 1:3 mole ratio.

(i) Write a chemical equation for the reaction involved.

$C_{12}H_{26} \rightarrow C_6H_{14} + 3\ C_2H_4$ [1]

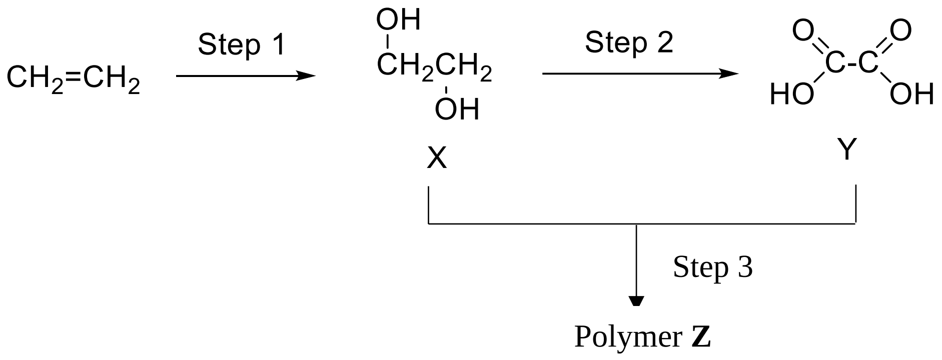
Some students did not read the question carefully enough such that they did not show the correct mole ratio of the alkane and ethene.

(ii) Suggest a chemical test to distinguish the two products.

Mix the two compounds with bromine dissolved in organic solvent (e.g. hexane/ $CHCl_3$). [1]
Ethene turns the solution from brown to colourless more rapidly [1]
Mix the two compounds with bromine dissolved in organic solvent (e.g. hexane/ $CHCl_3$) in dark. [1] Only ethene turns the solution from brown to colourless.[1]

(3 marks)

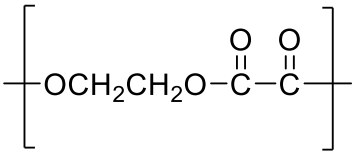
(c) Ethene can be converted into a polymer via the following conversion scheme.



(i) Suggest the reagent(s) and condition(s) required for Step 2.

Acidified potassium dichromate, heat / reflux [1]

(ii) I. Give the repeating unit of polymer **Z**.



$$\left[-OCH_2CH_2O-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}- \right]$$

[1]

Poor performance

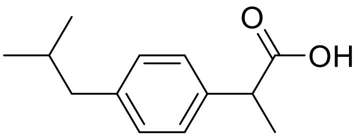
II. Explain why **X** and **Y** can react to form a polymer.

Both of them have 2 functional groups which allow them to join up with one another repeatedly to form long chains. [1]

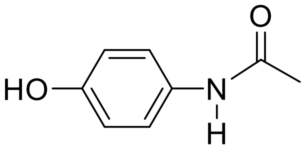
Sub-total: 7

(3 marks)

12. Ibuprofen and paracetamol are pain-relief drugs.



ibuprofen



paracetamol

(a) (i) Explain why ibuprofen does not dissolve well in water.

Due to the presence of large hydrocarbon part, ibuprofen is weakly polar/ essentially non-polar, hence does not dissolve well in water which is polar.[1]

- Poor performance
- Solubility depends on the polarity of BOTH solute and solvent. So, it is necessary to compare the polarity of the solute and solvent.

(ii) Explain why a white suspension of ibuprofen and water turns clear when sodium carbonate powder is added.

-COOH group of ibuprofen reacts with carbonate ions to form a soluble salt/ soluble ions/ soluble -COO-. [1]

(2 marks)

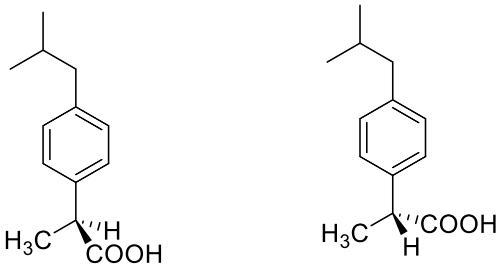
(b) (i) Name a type of isomerism exists in ibuprofen, but not in paracetamol.

Enantiomerism [1]

[NOT accept enantiomer]

{NOT accept stereoisomer as it is not specific enough]

(ii) Draw the three-dimensional diagrams to show the two isomeric forms of ibuprofen.



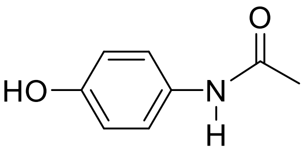
[1+1]

12. (b) (iii) Describe how the two isomeric forms of ibuprofen can be distinguished by physical test.

The rotate the plane of polarized light to the same extent but in different direction, hence can be distinguished by polarimetry.

(4 marks)

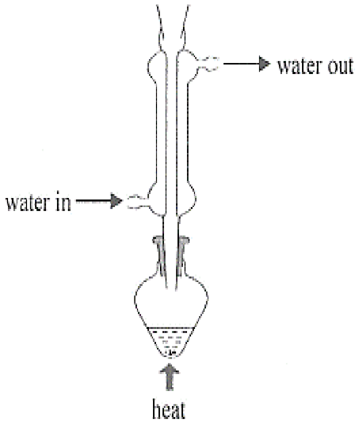
(c) On heating under reflux, paracetamol reacts with HCl(aq) to form CH_3COOH and organic compound **L**.



paracetamol

$\xrightarrow[\text{reflux}]{\text{HCl(aq)}}$ CH_3COOH + compound **L**

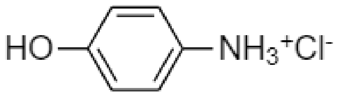
(i) Draw a labelled diagram to show the set-up for this reaction.



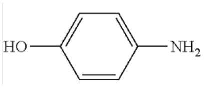
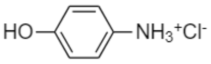
[Set-up: 1 mark; labels (heat, water in and water out: 1mark]

Common mistake: NOT accept a closed system.

(ii) Give the structure of compound **L**.



[1]

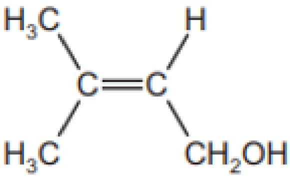
- Poor performance
- Paracetamol is an amide. Upon acid hydrolysis,  formed (which is a base) is neutralized by acid to form alkyl ammonium chloride salt 

The chemistry of amine is similar to that of NH_3. Amine is also a base and can accept a hydrogen ion by donating the lone electrons on the N atom in the amine group.

(3 marks)

Sub-total: 9

13. Prenol is a naturally occurring organic molecule found in many fruits. Its structure is shown below:



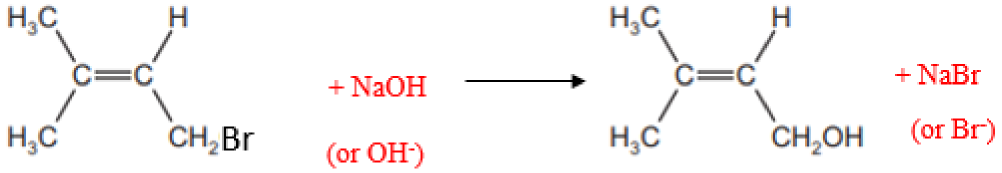
(a) State the systematic name for prenol. (1 mark)

3-methylbut-2-en-1-ol [1]

Poor performance

(b) Prenol can be formed by the reaction between a bromine-containing compound and a suitable reagent.

(i) Write a chemical equation for the reaction involved.



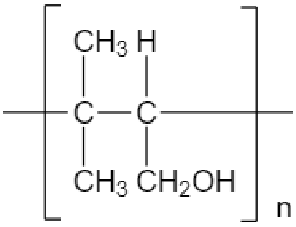
Poor performance. Many student did not state the byproduct/ did not balance the equation.

(ii) Name this type of reaction.

Substitution reaction. [1]

(2 marks)

(c) Under suitable conditions, prenol can form a polymer. Draw the structure of the polymer formed. (1 mark)



[1]

Well-answered

Sub-total: 4

14. An experiment was performed to study the following reaction:

$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

When $H_2O_2(aq)$ was kept under room conditions, there was no observable change. Then a small amount of yellow $FeCl_3(aq)$ solution was added to the mixture. Gas bubbles formed vigorously and the mixture turned to brown. When no more gas evolved, the brown mixture turned back to yellow.

(a) There is a view saying that iron illustrates catalytic property according to the observation of this experiment. Suggest reasons to support this view. (2 marks)

The rate of formation of gas bubbles increases / rate of reaction increases when Fe^{3+} ions are added [1] and the yellow Fe^{3+} ions are regenerated/ remain chemically unchanged / do not consume at the end of reaction. [1]

Fair performance
Many students only suggested one piece of evidence catalytic property.

(b) A student claimed that the decomposition reaction is catalysed by chloride ion. Suggest a simple experiment to show that iron (III) ion is the catalyst for the reaction instead of chloride ion. (1 mark)

Repeat the same experiment but adding small amount of NaCl(aq)/ $MgCl_2$ (aq) instead of $FeCl_3(aq)$. If no gas bubbles are formed, this shows that chloride ion is not the catalyst./

Repeat the same experiment but adding small amount of $Fe_2(SO_4)_3$ instead of $FeCl_3(aq)$. If gas bubbles are still formed in the absence of chloride, this shows that Fe^{3+} serves as the catalyst.

- Fair performance
- Some students should state the expected result to show that iron (III) ion is the catalyst for the reaction.

(c) Other than catalytic property, suggest ONE other characteristic property of transition metals with reference to the observations of this experiment. (1 mark)
Formation of coloured ion/ coloured compound: Fe^{3+}(aq) is yellow. [1]

- Should provide evidence to illustrate the characteristic property of iron (II) ion in this reaction.

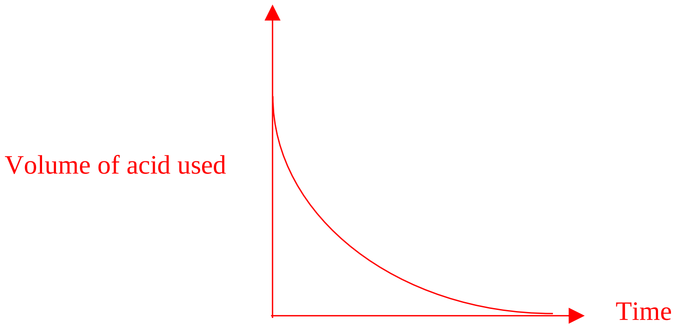
Sub-total: 4

15*. Consider the following reaction:

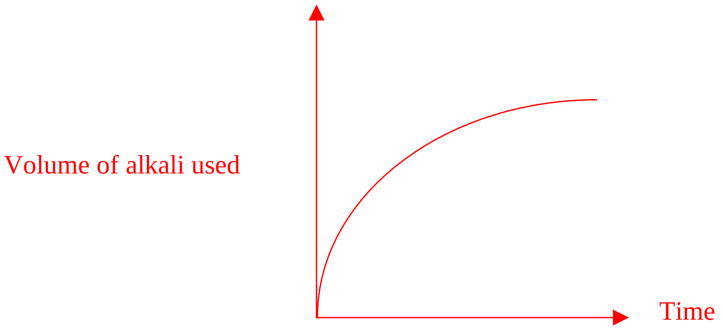
$CH_3COOCH_3 + NaOH \rightarrow CH_3COONa + CH_3OH$

Outline the experimental procedure to follow the progress of the above reaction by titration method. Sketch a graph to show how the volume of titrant used varies with time. (5 marks)

- A fixed volume of sample is withdrawn from the reaction mixture at different time/ at regular time interval. [1]
- Immediately quench the reaction by transferring the sample to ice-water [1].
- Determine the concentration of NaOH remained by titration with acid e.g. HCl(aq), H_2SO_4(aq) (using a suitable indicator) [1]
- A graph showing volume of titrant decreases with time as the reaction proceeds. [1]



- A fixed volume of sample is withdrawn from the reaction mixture at different time/ at regular time interval. [1]
- Immediately quench with known amount of excess acid [1].
- Determine the amount of unreacted acid by titration with NaOH(aq)/ KOH(aq) (using a suitable indicator) [1]
- A graph showing volume of titrant increases with time as the reaction proceeds. [1]

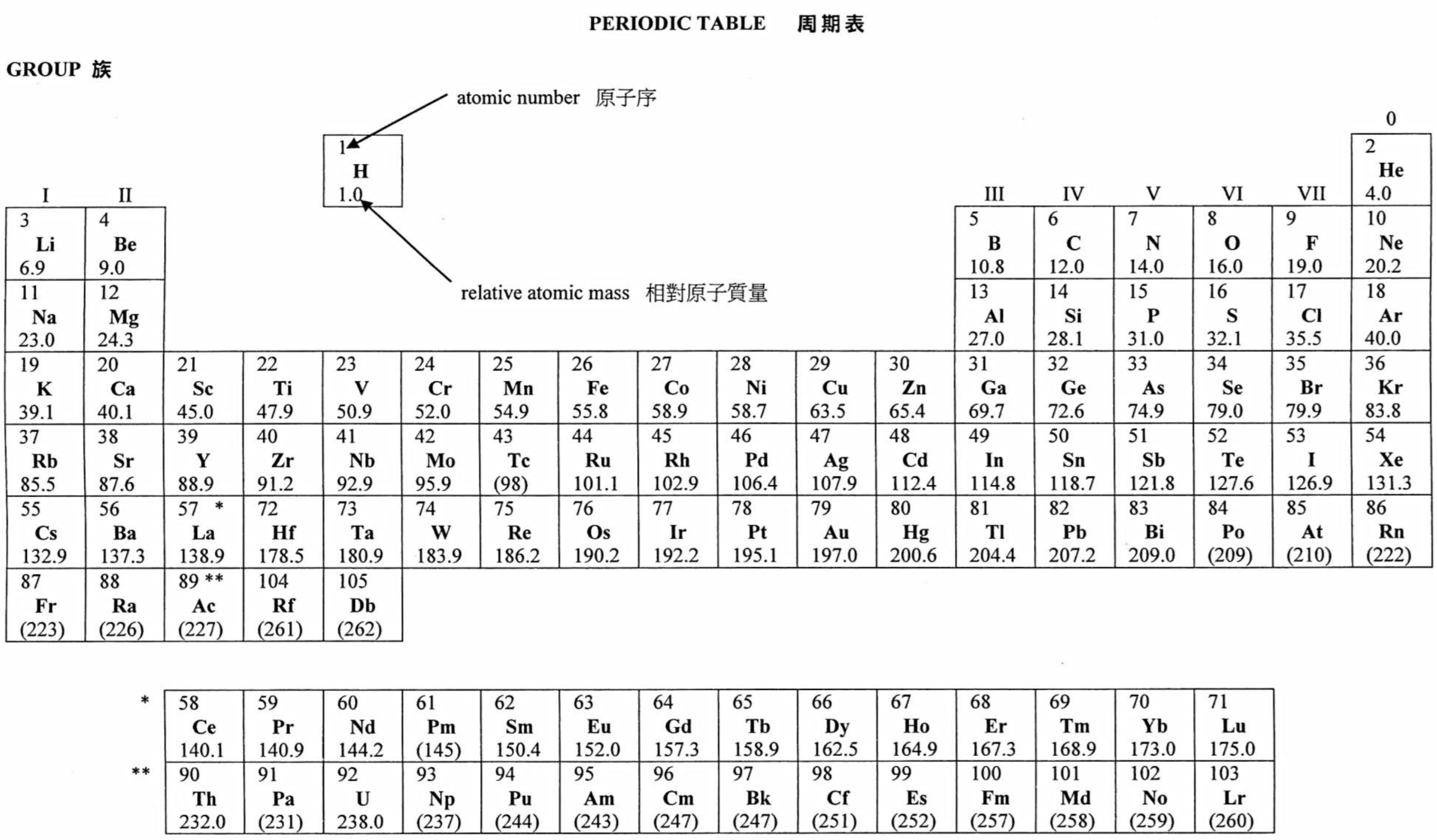


Effective communication – 1 (chemical knowledge 3 marks or above with no wrong concept / irrelevant material [1])

- Poor performance.
- Some students described how to conduct titration instead of describing how the rate of reaction can be traced with the aid of titration as the reaction proceeds.
- Most students also had no idea how the volume of titrant varies.
- Many students got 0 in this question. This shows students had little understanding about the working principle of using titration method to trace the progress of reaction.

Sub-total: 5

END OF SECTION B
END OF PAPER



PERIODIC TABLE 周期表

GROUP 族

atomic number 原子序

relative atomic mass 相對原子質量

I	II											III	IV	V	VI	VII	0
				1 **H** 1.0													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)