

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2020

CHEMISTRY PAPER 1
SECTION B: Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

- (1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode 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) This section consists of TWO parts, Parts I and II.
- (4) Answer ALL questions in both Parts I and II. 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. Write your candidate number, 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 candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.



PART I

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

1. The table below shows some information of elements Y and Z.

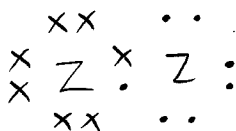
	Y	Z
Atomic number	35	53
Number of occupied electron shells in the atoms	4	5
Number of electrons in the outermost shell in the atoms	7	7

- (a) State the electronic arrangement of an atom of Y.

2, 8, 18, 7

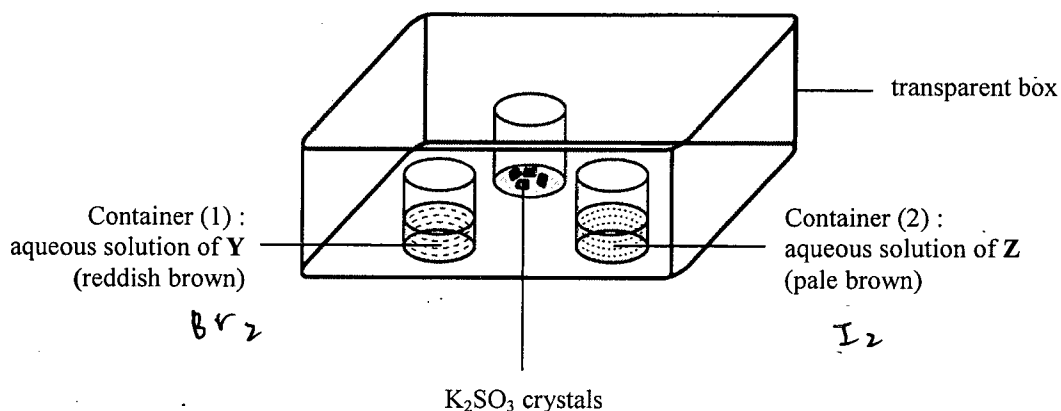
(1 mark)

- (b) Draw the electron diagram for a molecule of Z, showing ELECTRONS IN THE OUTERMOST SHELLS only.

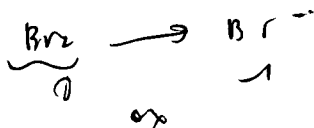
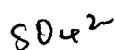


(1 mark)

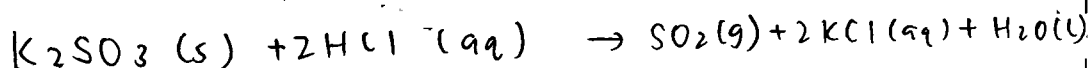
- (c) An experiment for Y and Z is performed as shown in the set-up below. Dilute hydrochloric acid is added to the K_2SO_3 crystals, then the whole set-up is covered with a lid.



Answers written in the margins will not be marked.

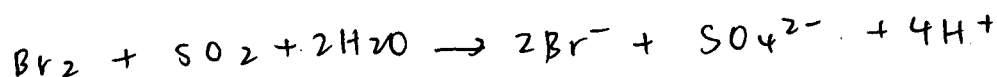


1. (c) (i) K_2SO_3 crystals react with dilute hydrochloric acid to give sulphur dioxide gas. Write a chemical equation for the reaction, showing all state symbols.



- (ii) State the expected observation in Container (1) and write an ionic equation for the reaction involved.

the aqueous solution changes from reddish brown to colourless.



- (iii) It is expected that the observation in Container (2) is similar to that in Container (1). Suggest a reason for this expectation based on electronic arrangement.

As both Y and Z have 7 outermost shell electrons, they have similar chemical properties. Both Y and Z are oxidizing agents and therefore reduces from reddish brown Y_2 to colourless Y^- and pale brown Z_2 to colourless Z^- respectively, showing similar observation as they have similar chemical properties.

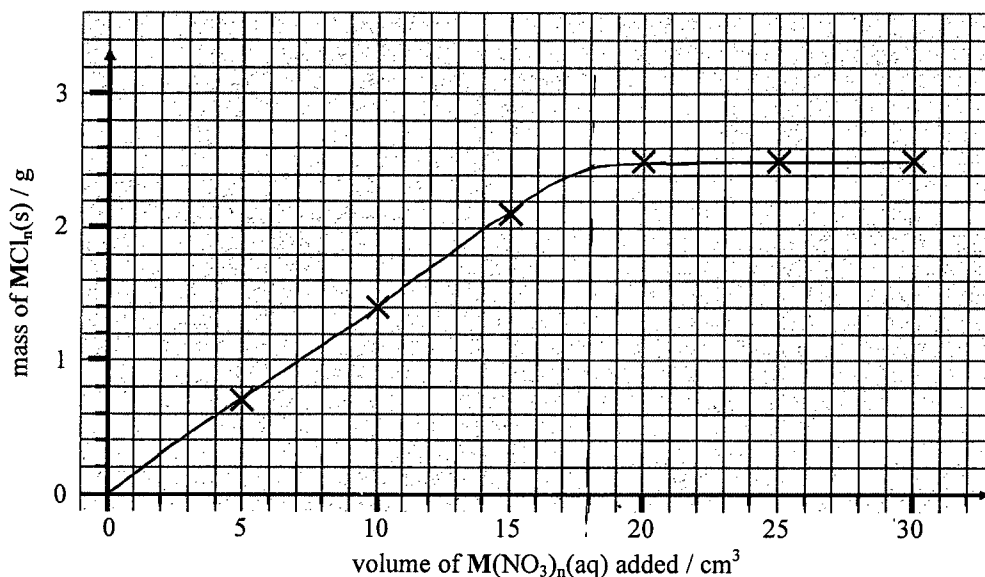
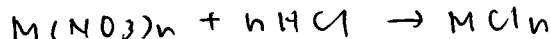
(5 marks)

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2. An experiment was performed to deduce the empirical formula of an insoluble chloride of a metal M . At room temperature, different volumes of a $0.50 \text{ mol dm}^{-3} M(\text{NO}_3)_n(\text{aq})$ were added to six beakers each containing 50 cm^3 of $0.36 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$. The $M\text{Cl}_n(\text{s})$ obtained in each beaker was filtered, washed, dried and weighed. The mass of $M\text{Cl}_n(\text{s})$ obtained and the corresponding volume of $M(\text{NO}_3)_n(\text{aq})$ added were plotted on the graph below.



- (a) Suggest why the masses of $M\text{Cl}_n(\text{s})$ for the last three points in the graph are the same.

It is because when volume of $M(\text{NO}_3)_n$ is at 20 cm^3 , 25 cm^3 , 30 cm^3 respectively, $M(\text{NO}_3)_n$ is in excess and HCl is the limiting reagent, therefore the masses of $M\text{Cl}_n$ is the same even with the increase in volume of $M(\text{NO}_3)_n$. (1 mark)

- (b) (i) By sketching on the graph above, deduce the volume of the $M(\text{NO}_3)_n(\text{aq})$ that can completely react with 50 cm^3 of $0.36 \text{ mol dm}^{-3} \text{HCl}(\text{aq})$.

Volume of $M(\text{NO}_3)_n(\text{aq}) = 18 \text{ cm}^3$

- (ii) Hence, calculate the number of moles of $M(\text{NO}_3)_n(\text{aq})$ that can completely react with the $\text{HCl}(\text{aq})$.

$$\frac{18}{1000} \times 0.5 = 9 \times 10^{-3} \text{ mol}$$

$\therefore 9 \times 10^{-3} \text{ mol}$ of $M(\text{NO}_3)_n$ can completely react with $\text{HCl}(\text{aq})$.

(3 marks)

2. (c) Determine, by calculation, the empirical formula of the chloride of M. Hence, deduce whether M would be silver or lead.

$$\text{mol of HCl} : \\ \frac{50}{1000} \times 0.36 = 0.018 \text{ mol}$$

$$\frac{0.018}{n} = 9 \times 10^{-3}$$

$$n = 2$$

$\therefore$ empirical formula is MCl_2 .

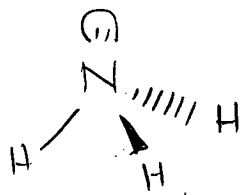
As Pb has two outermost shell electrons while Ag only has one, Pb forms PbCl_2 while Ag forms AgCl , as value of n is 2.

$\therefore$ M would be lead.

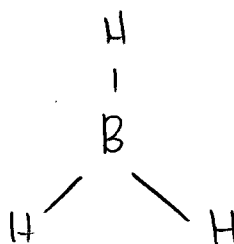
(3 marks)

3. (a) Draw a three-dimensional diagram to represent the shape of each of the following molecules :

(i) NH_3

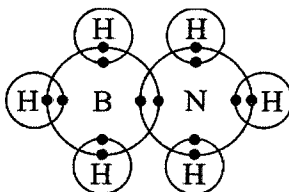


(ii) BH_3



(2 marks)

(b) H_3NBH_3 has a structure similar to that of ethane. Its electron diagram is shown below (showing electrons in the outermost shells only).



(i) Which of the H-B, B-N and N-H bonds would be dative covalent bond(s) ? Explain your answer.

B - N is dative covalent bond.

Both bonding electrons in B - N bond are provided by the lone pair electron of N atom in NH_3 .

C - c

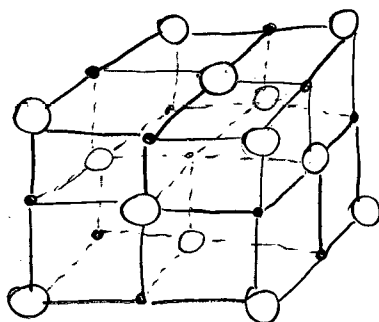
10.8 14

3. (b) (ii) Explain why H_3NBH_3 is a solid but ethane is a gas at room conditions.

H_3NBH_3 has higher boiling point than ethane. This is because in H_3NBH_3 is a giant ionic compound. Strong ionic bonds are present between H_3NBH_3 atoms.

Whereas in ethane, only weak van der Waals' forces exist between ethane molecules. Therefore, more heat is needed to overcome the strong ionic bonds between H_3NBH_3 atoms and boiling point is higher. Thus, H_3NBH_3 is solid but ethane is gas.

- (iii) Under suitable conditions, H_3NBH_3 can decompose into boron nitride and hydrogen. The structure of solid boron nitride is similar to that of graphite. Draw the structure of ONE LAYER of solid boron nitride (Note : B and N are in alternate positions).



○ Boron
● Nitrogen

(6 marks)

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4.

Eggshells mainly contain calcium carbonate and a small amount of organic substances. The percentage by mass of calcium carbonate in a sample of eggshell was determined by the following steps:

- Step (1): The sample was ground into powder.
 Step (2): 0.204 g of the powder was put into a conical flask. After that, 25.00 cm³ of 0.200 M HCl(aq) and 5 cm³ of ethanol were added.
 Step (3): The mixture was heated for 15 minutes.
 Step (4): After cooling down, the mixture was titrated with 0.102 M NaOH(aq) using an indicator X.

- (a) Explain why the sample was ground into powder in Step (1).

To increase surface area of the sample to increase the rate of reaction between the sample and HCl.

(1 mark)

- (b) Suggest why ethanol was added in Step (2).

Dissolve all the CaCl₂ produced.

(1 mark)

- (c) Suggest why the mixture was heated for 15 minutes in Step (3).

Evolves all CO₂ dissolved in the mixture.

(1 mark)

- (d) The mixture turned from colourless to pale pink at the end point of titration in Step (4). Name indicator X.

Phenolphthalein.

(1 mark)

- (e) 16.85 cm³ 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 sample.
 (Relative atomic masses: C = 12.0, O = 16.0, Ca = 40.1)

$$\text{mol of NaOH used} = 0.102 \times \frac{16.85}{1000}$$

$$= 1.7187 \times 10^{-3} \text{ mol}$$

$$\text{mole of CaCO}_3 = \left(\frac{25}{1000} \times 0.2 - 1.7187 \times 10^{-3} \right) \div 2$$

$$= 1.64 \times 10^{-3}$$

$$\frac{\text{mass}}{40.1 + 12 + 16 \times 3} = 1.64 \times 10^{-3}$$

$$\text{mass} = 0.1642$$

$$\frac{0.1642}{0.204} \times 100\% = 80.5\%$$

(3 marks)

5. The molecular formula of an organic compound **W** is $C_4H_6O_4$. It is soluble in water.

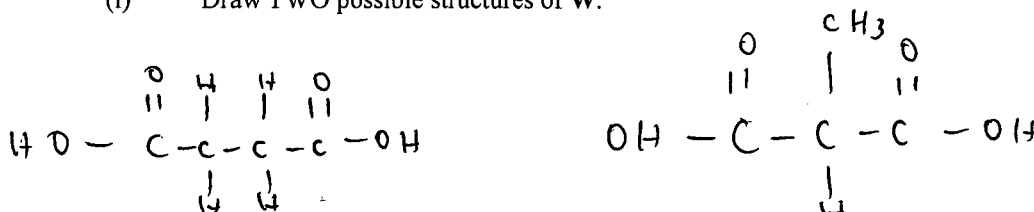
- (a) When a piece of magnesium ribbon is placed into an aqueous solution of **W**, hydrogen gas evolves. According to this observation, suggest a functional group that **W** may contain.

Carboxyl group.

(1 mark)

- (b) It is known that one mole of **W** can completely react with two moles of NaOH.

- (i) Draw TWO possible structures of **W**.



- (ii) Consider the following thermochemical equation of a neutralisation reaction in standard conditions :



State the meaning of the term 'standard enthalpy change of neutralisation', and deduce the standard enthalpy change of neutralisation for this reaction in terms of y .

standard enthalpy change of neutralisation is the enthalpy change when acid and alkali react to form 1 mol of H_2O under standard conditions.

$$\Delta H_n^\circ [C_4H_6O_4] = 0.5y \text{ kJ mol}^{-1}$$

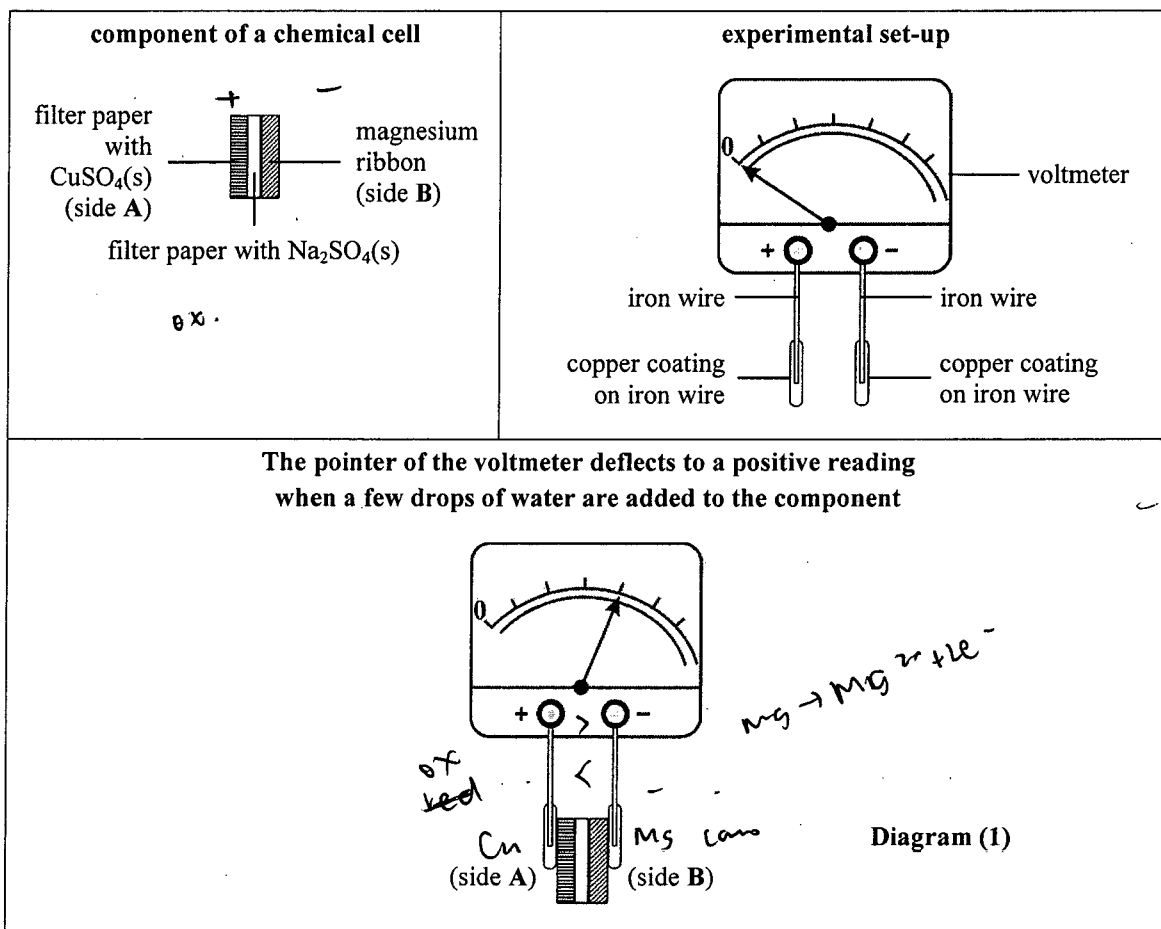
- (iii) The standard enthalpy change of neutralisation between $HCl(aq)$ and $NaOH(aq)$ is $-57.3 \text{ kJ mol}^{-1}$. Explain whether the enthalpy change deduced in (ii) above should be more negative than, less negative than or equal to $-57.3 \text{ kJ mol}^{-1}$.

More negative than -57.3 . As $C_4H_6O_4$ is dibasic acid while HCl is only monobasic, $C_4H_6O_4$ ionises to give 2 H^+ and therefore concentration of H^+ is higher and therefore more heat is given out in the neutralisation of $C_4H_6O_4$ and value is more negative

(6 marks)

6

The diagrams below show the component of a chemical cell, an experimental set-up and how the pointer of the voltmeter deflects when the set-up is connected to the component.



- (a) Why does the pointer of the voltmeter deflect as shown when a few drops of water are added to the component?

When few drops of water are added, CuSO_4 ionises to form Cu^{2+} and SO_4^{2-} , Na_2SO_4 ionises to form Na^+ and SO_4^{2-} . filter paper contains electrolyte which provides mobile ions to complete the circuit therefore a current flows through the cell and voltmeter deflects.

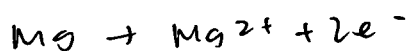
(2 marks)

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6. (b) Write the half equation for the change that occurs at each of the following electrodes when the pointer of the voltmeter deflects :

(i) ^{ox}
anode (-)



(ii) ^{red}
cathode (+)



(2 marks)

- (c) Consider the following design modified from **Diagram (1)** by only removing the copper coating at side A :

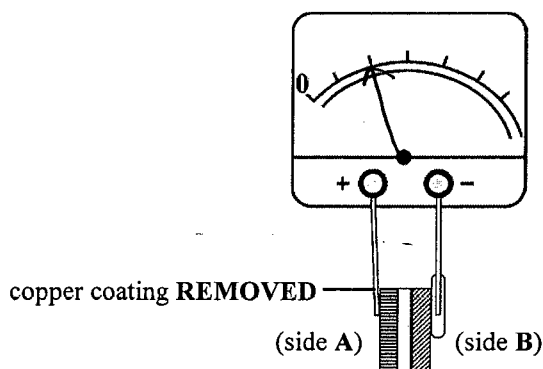


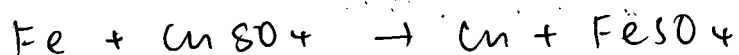
Diagram (2)

Draw on **Diagram (2)** the expected position of the pointer of the voltmeter when water is added to the component.

(1 mark)

- (d) In the design in part (c) above, a redox reaction occurs at side A when water is added to the component.

(i) Write a chemical equation for the reaction.

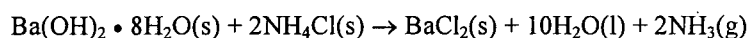


(ii) Name this type of reaction.

Precipitation

(2 marks)

7. An experiment is performed to study the following reaction :



- (a) When the two solid reactants are mixed and stirred in a conical flask, ammonia gas with a characteristic pungent smell is formed. Explain how ammonia gas can be tested.

Ammonia gas can be tested through testing the pungent gas with moist red litmus paper.

Ammonia gas turns moist red litmus paper blue.

(2 marks)

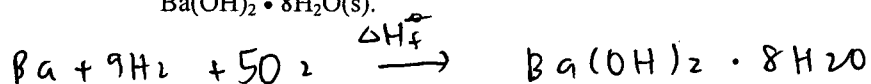
- (b) $\text{Ba(OH)}_2 \cdot 8\text{H}_2\text{O(s)}$ is an alkali. What is meant by the term 'alkali'?

Alkali ionises in water to give OH^- .

(1 mark)

- (c) The standard enthalpy change of formation of $\text{Ba(OH)}_2 \cdot 8\text{H}_2\text{O(s)}$ is $-3345 \text{ kJ mol}^{-1}$.

- (i) Write a thermochemical equation for the standard enthalpy change of formation of $\text{Ba(OH)}_2 \cdot 8\text{H}_2\text{O(s)}$.



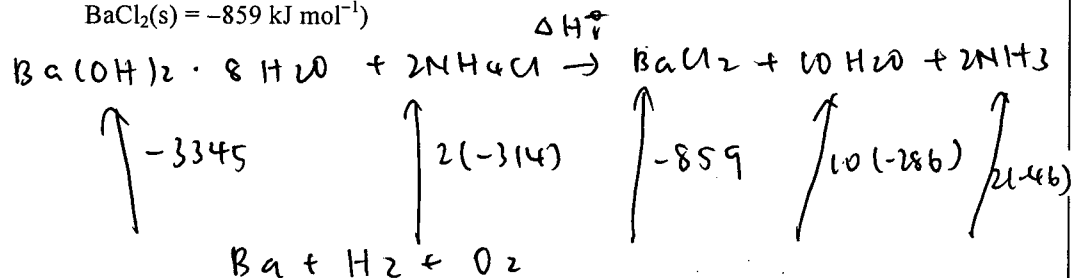
$$\Delta H_f^\circ = -3345 \text{ kJ mol}^{-1}$$

- (ii) Calculate the standard enthalpy change of the reaction between $\text{Ba(OH)}_2 \cdot 8\text{H}_2\text{O(s)}$ and $\text{NH}_4\text{Cl(s)}$.

(Standard enthalpy changes of formation :

$\text{NH}_3\text{(g)} = -46 \text{ kJ mol}^{-1}$, $\text{H}_2\text{O(l)} = -286 \text{ kJ mol}^{-1}$, $\text{NH}_4\text{Cl(s)} = -314 \text{ kJ mol}^{-1}$,

$\text{BaCl}_2\text{(s)} = -859 \text{ kJ mol}^{-1}$)



$$\Delta H_r^\circ = -3345 - 2(-314) = -859 - 10(-286) - 46(2)$$

$$\Delta H_r^\circ = +162 \text{ kJ mol}^{-1}$$

- (iii) Hence, explain whether the temperature of the mixture would increase, decrease or remain unchanged during the reaction.

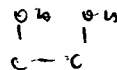
The temperature decreases. As the reaction is endothermic, heat is absorbed and thus temperature decreases.

(4 marks)

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ethene.

- *8. Describe how 1,2-dibromoethane can be produced from crude oil, via an alkene, using appropriate chemicals and processes. Write the chemical equations for the reactions involved.

(6 marks)

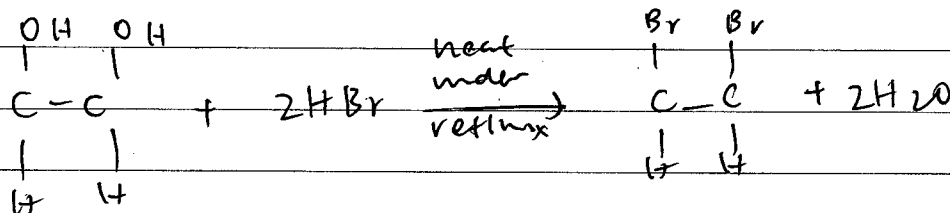
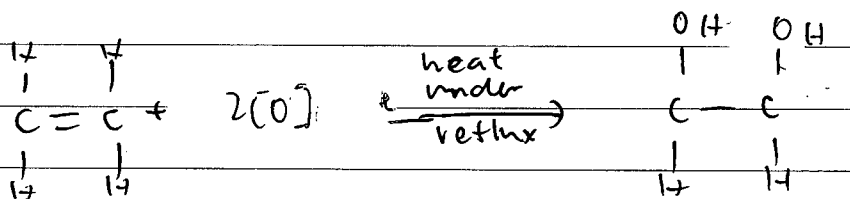
First, carry out cracking of crude oil to produce ethene, mixture of products. Then carry out fractional distillation of products to obtain ethene, as ethene has different boiling points as other products.

Then add: KMnO_4 and H_2SO_4 to ethene produced, and heat under reflux.

A ethane-1,2-diol is produced.

Then add HBr to ethane-1,2-diol and heat under reflux.

Then 1,2-dibromoethane is produced.



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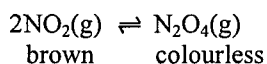
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PART II

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

9. Consider the following reaction mixture at 25°C in a closed container of fixed volume :



- (a) With reference to the table below, calculate **a**. Hence, determine the equilibrium constant K_c for the reaction at 25°C.

	$\text{NO}_2(\text{g})$	$\text{N}_2\text{O}_4(\text{g})$
Concentration at start / mol dm^{-3}	0.0400	0.0010
Concentration at equilibrium / mol dm^{-3}	0.0323	a

$$\begin{array}{rcl}
 2\text{NO}_2 & \rightleftharpoons & \text{N}_2\text{O}_4 \\
 \text{i } 0.04 & & 0.001 \\
 \Delta - 7.7 \times 10^{-3} & & + 3.85 \times 10^{-3} \\
 \text{e } 0.0323 & & 4.85 \times 10^{-3}
 \end{array}
 \quad a = 4.85 \times 10^{-3}$$

$$K_c = \frac{4.85 \times 10^{-3}}{(0.0323)^2} = 4.65 \text{ mol}^{-1} \text{dm}^3$$

(3 marks)

- (b) The temperature of the mixture is increased to 55 °C and its colour eventually turns darker. Deduce whether the reaction above is endothermic or exothermic.

Exothermic.

NO_2 is brown while N_2O_4 is colourless.

When temperature of mixture is increased,

equilibrium position shifts to the left to give

higher concentration of NO_2 , showing that

increase in temperature ^{does not} favour forward reaction,

as increase in temperature ^{not favour} does ^{not favour} exothermic

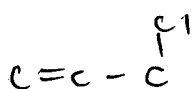
reaction. The above reaction is exothermic.

(2 marks)

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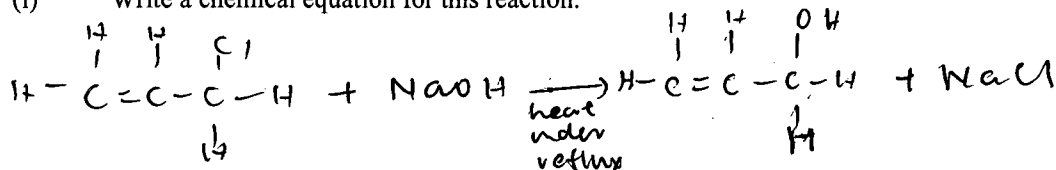


10. The structure of a compound Y is shown below :



- (a) Y can be prepared from reacting 3-chloropropene with an appropriate reagent.

- (i) Write a chemical equation for this reaction.



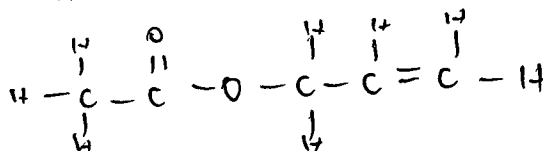
- (ii) Name this type of reaction.

Substitution reaction.

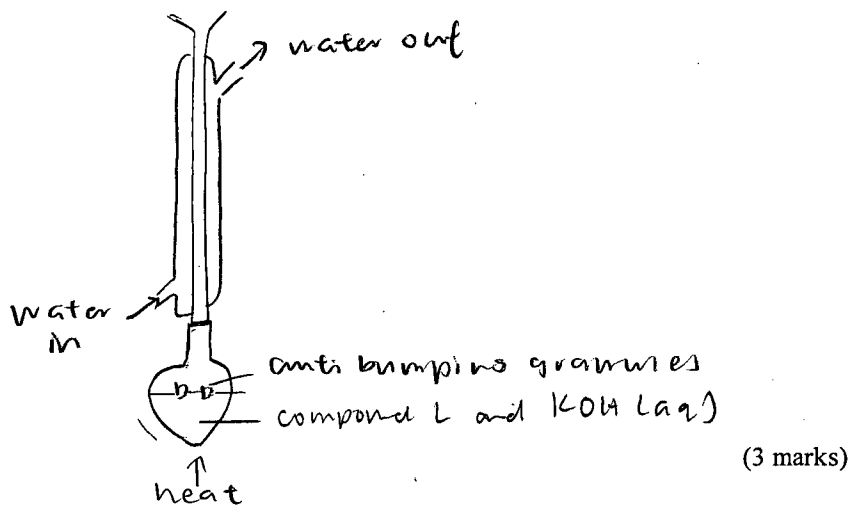
(2 marks)

- (b) On heating under reflux, a compound L reacts with KOH(aq) to give Y and $\text{CH}_3\text{COO}^-\text{K}^+$.

- (i) Suggest the structural formula of L.

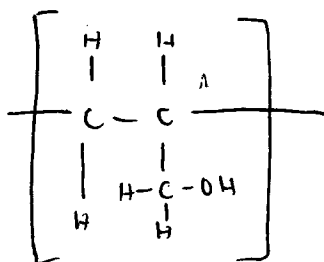


- (ii) Draw a labelled diagram to show the set-up for this reaction.



(3 marks)

- (c) Under suitable conditions, Y can form a polymer. Write the repeating unit of the polymer.



(1 mark)

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Answers written in the margins will not be marked.

11. The structures of some compounds are shown below :

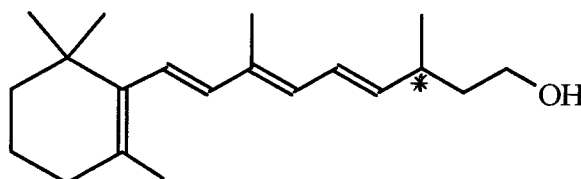
Compound	Structure
W	
X	
Y	
Z	

(a) Which one of W, X, Y or Z is a tertiary alcohol ?

Z

(1 mark)

(b) Label all chiral centre(s), if any, by using '*' on the structure of W below.



(1 mark)

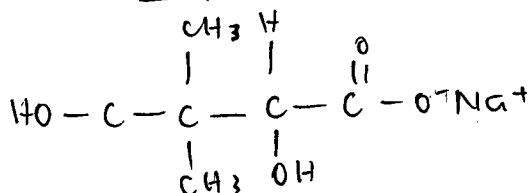
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11.

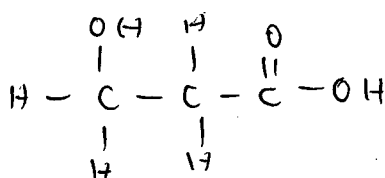
(c)

Heating **X** under reflux in 2 M NaOH(aq) can form an **optically active** organic compound **U** and an **optically inactive** organic compound **V**. Draw the respective structures of **U** and **V**.

U:



V:



(2 marks)

(d) Consider the following reagents :

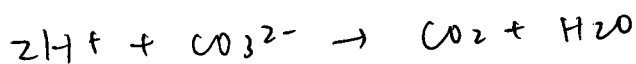
$\text{Br}_2(\text{aq})$ acidified $\text{K}_2\text{Cr}_2\text{O}_7(\text{aq})$ $\text{Na}_2\text{CO}_3(\text{aq})$

(i) Suggest which one of the reagents can be used to perform a chemical test, in order to distinguish **X** from **W**, **Y** and **Z**.

Na_2CO_3 can be used. Only Na_2CO_3 reacts with carboxyl group of **X**.

(ii) State the observation in the test involved in (i). Explain your answer.

Colourless gas bubbles evolved.



Na_2CO_3 reacts with $-\text{COOH}$ of **X** to form CO_2 .

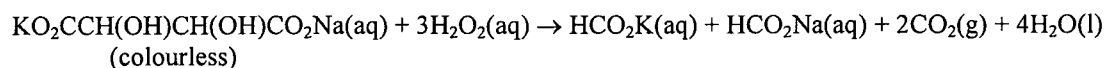
(3 marks)

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Answers written in the margins will not be marked.

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



When 10 cm³ of 0.25 M KO₂CCH(OH)CH(OH)CO₂Na(aq) and 3 cm³ of 6% H₂O₂(aq) were mixed at 60°C, it was found that only a few gas bubbles evolved. Then a small amount of pink CoCl₂(aq) solution was added to the mixture. Gas bubbles formed vigorously and the mixture turned to green due to the formation of a cobalt(III) compound. When no more gas evolved, the green mixture turned back to pink.

There is a view saying that cobalt illustrates THREE characteristics of transition metals according to the observation of this experiment. Suggest reasons to support this view.

Cobalt have variable oxidation states.

Cobalt has oxidation number of +2 in CoCl₂.

Cobalt has oxidation number of +3 in cobalt(III) compound.

Cobalt exists as coloured compounds.

Cobalt (III) compound is green.

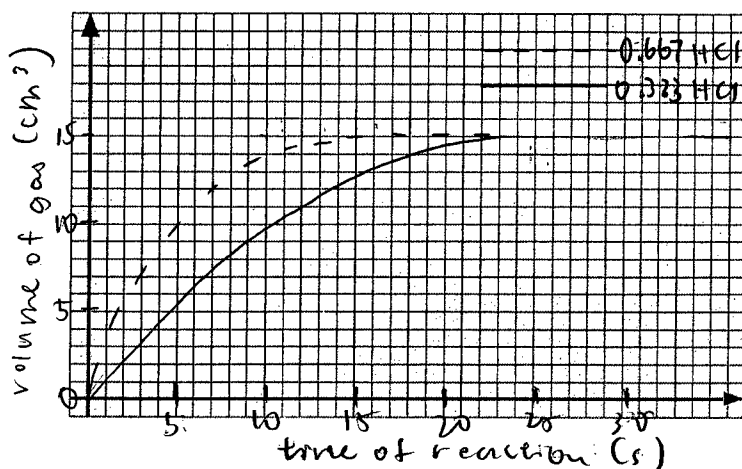
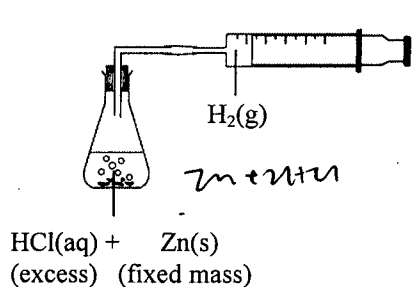
Cobalt acts as a catalyst to catalyse the reaction of KO₂CCH(OH)CH(OH)CO₂Na and H₂O₂, as cobalt is chemically unchanged at the end of the experiment.

(4 marks)

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Answers written in the margins will not be marked.

- *13. With reference to the set-up shown below, describe how the effect of concentration of HCl(aq) on the rate of the reaction can be studied. Your answer should include **TWO** labelled curves sketched on the graph below, one using **solid line** and the other one using **dotted line**. Label all curves and axes. (6 marks)



1. Add 0.2g of Zn(s) into the conical flask
2. Prepare 20 cm³ of 1 M HCl with 10 cm³ of water, concentration is 0.667 M.
3. Connect delivery tube to syringe
4. Add HCl to flask containing zinc.
5. Immediately connecting the delivery tubing once the HCl is added
6. Record the change in volume of gas in gas syringe in time interval of 5s
7. Repeat experiment with 10 cm³ of 1 M HCl added to 20 cm³ of water, concentration is 0.333 M.
8. Plot graph of volume of gas over time of reaction.

END OF SECTION B
END OF PAPER

Answers written in the margins will not be marked.

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GROUP 族

atomic number 原子序

relative atomic mass 相對原子質量

*

**

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

2020 DSE (D)

香港考試及評核局
HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

香港中學文憑考試
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

答題簿 ANSWER BOOK

考生須知

- (一) 宣布開考後，考生須首先在第 1 頁之適當位置填寫考生編號，並在第 1 及 3 頁之適當位置貼上電腦條碼。
- (二) 每題(非指分題)必須另起新頁作答，並須在每一頁的相應試題編號方格填畫「X」號，以表示選答的題號(見下例)，並在第一頁之適當位置填寫作答的試題編號。
- (三) 紙張兩面均應使用，並應每行書寫。不可在各頁邊界以外位置書寫。寫於邊界以外的答案，將不予評閱。
- (四) 如有需要，可要求派發方格紙及補充答題紙。每一紙張均須填寫考生編號、填畫試題編號方格、貼上電腦條碼，並用繩縛於簿內。
- (五) 試場主任宣布停筆後，考生不會獲得額外時間貼上電腦條碼及填畫試題編號方格。

INSTRUCTIONS

- (1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1 and 3.
- (2) Start each question (not part of a question) on a new page. Put 'X' in the corresponding question number box on each page to indicate the appropriate question number (see the example below), and write the question number(s) of the question(s) attempted in the space provided on Page 1.
- (3) Write on both sides using each line. Do not write in the margins. Answers written in the margins will not be marked.
- (4) Graph paper and supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this book.
- (5) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

例 Example:

試題編號 Question No. = 3

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Level 5 Exemplar & Comments Paper 2

由考生填寫 To be filled in by the candidate	
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試題編號 Question No.

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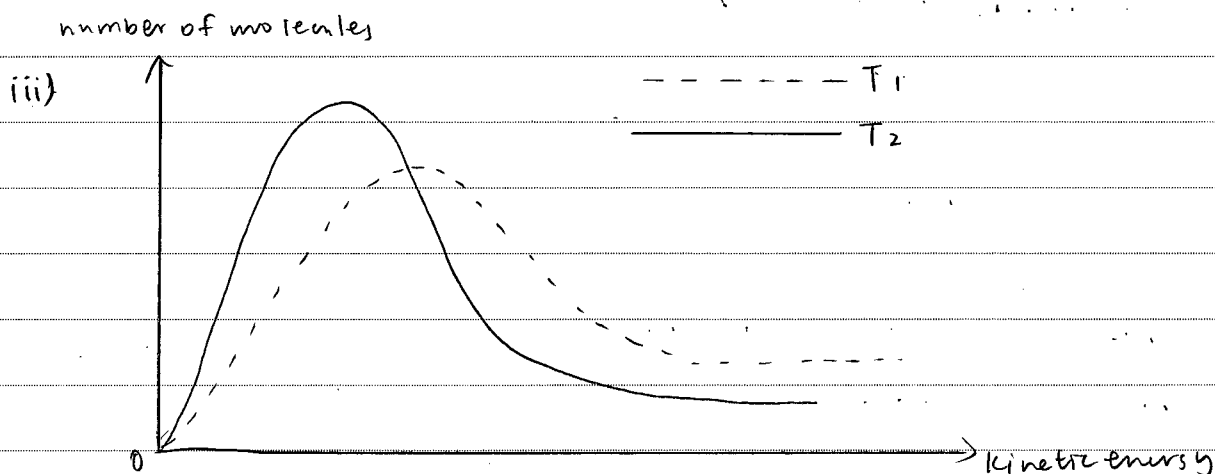
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每題另起新頁作答。

Start each question on a new page.

i) Membrane electrolytic cell does not use poisonous chemicals such as mercury, but flowing mercury cell does. Pure sodium hydroxide ^{can be} obtained in membrane electrolytic cell to be used to synthesize other useful products such as glass cleaners, but flowing mercury cell does not produce sodium hydroxide.

ii) finely divided iron.



bi) (i) less use of chemicals as catalyst used ii without solvent which prevents chemical waste.
(ii) The temperature of the reaction is lower, which reduces energy loss of the reaction than Reaction (I), and therefore Reaction (II) is greener as it saves energy.

$$\text{bii) mole of methyl benzoate} = \frac{3}{136} = 0.02206 \text{ mol}$$

$$\text{mole of hexan-1-amine} = \frac{2.23}{101} = 0.022079 \text{ mol}$$

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

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每題另起新頁作答。

Start each question on a new page.

iii) methyl benzoate is limiting reagent.

$$\frac{m_{\text{mass}}}{205} = \frac{3}{136}$$

$$m_{\text{mass}} = 4.52 \text{ g}$$

$$\frac{3.89}{4.52} \times 100\% = 86\%$$

iii) i) As the reactant side of the reaction has 1 mol of gas, with the increase in pressure higher than the atmospheric pressure, it favours the forward reaction. therefore, at 30 atm, yield of product will be higher than that at atmospheric pressure.

ii) As the reaction is exothermic, the temperature of the reaction cannot be too high as a high temperature does not favour forward reaction. However, the temperature is set at 180°C as higher temperature increases the rate of reaction to reach equilibrium.

Moreover, although higher pressure favours forward reaction, the cost of facility to maintain high pressure is very high.

Therefore, compromising between reaction rate and yield of products, as well as cost of facility, optimum conditions of 180°C and 30 atm are set.

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每題另起新頁作答。

Start each question on a new page.

(i) The reaction mixture changes from brown to colourless as the reaction proceeds. The decrease in intensity of colour, (rate of) thus the absorbance of reaction mixture, indicates the rate of reaction.

per unit time, which is the slope,
(ii) Absorbance of the reaction, which indicates the rate of reaction remains constant with the increase in time and decrease in $[I_2]$ showing that the order with respect to $[I_2]$ is zeroth order. n is 0.

(iii) rate of reaction of trial 1 : $\frac{0.7-0.1}{14} = 0.0429 \text{ min}^{-1}$

trial 2 : $\frac{0.7-0.1}{8} = 0.0857 \text{ min}^{-1}$
while $[H_2SO_4]$ & $[I_2]$ unchanged,

With doubling of $[CH_3COCH_3]$ the reaction rate doubles as well, showing that the order with respect to $[CH_3COCH_3]$ is 1.

X is 1.

(iv) Rate = $k_1 [CH_3COCH_3] [H^+]$

$\text{mol dm}^{-3} \text{ s}^{-1}$

$(\text{mol dm}^{-3})^2$

$= \text{mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$

=

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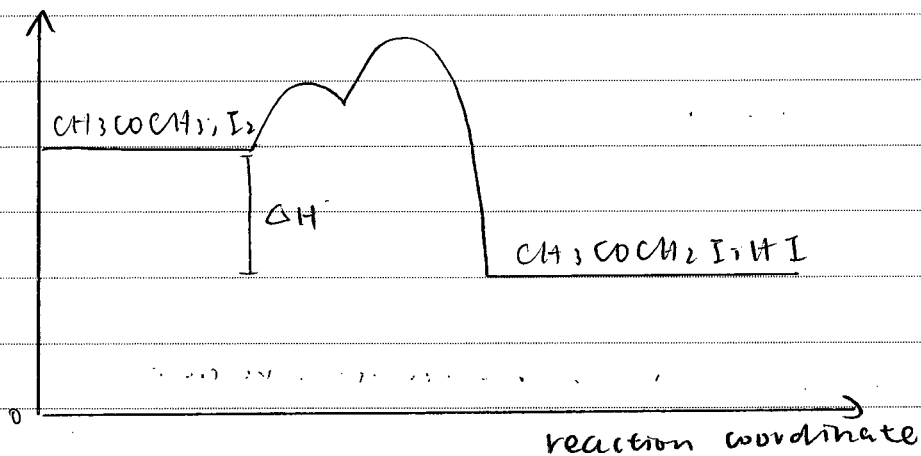
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每題另起新頁作答。

Start each question on a new page.

(v) potential energy



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每題另起新頁作答。

Start each question on a new page.

3 ai) Test with anhydrous cobalt (II) chloride paper.

$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ turns paper from blue to pink,

while Na_2CO_3 gives no observable change.

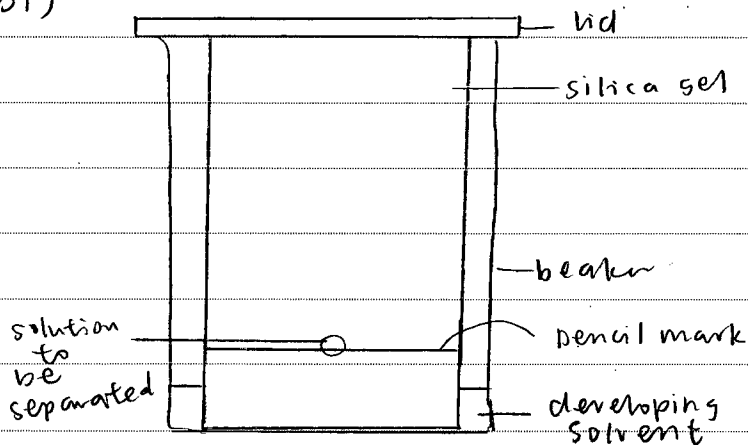
ii) colourless to blue/black

iii) Add Br_2 in organic solvent to hex-1-ene and hexanal respectively.

hex-1-ene changes Br_2 from brown to colourless,

while hexanal gives no observable change.

bi)



ii) $R_f = \frac{45}{130-10-20} = 0.45$

iii) Drug Y contains caffeine and aspirin.

their R_f values are the same.
respective

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13 14 15 16 17 18 19 20 21 22 23 24 ≥25

每題另起新頁作答。

Start each question on a new page.

iv) (1) In IR spectrum of caffeine, there is broad absorption peak at wavenumber 3350 to 3500 cm^{-1} due to presence of N-H while aspirin doesn't.

(2) Acetaminophen.

$M/z = 43$ shows the presence of ion: $\text{O}=\text{C}^+$
 CH_3 , which is only present in acetaminophen.

ci) (1) changes from orange to green.



(2) driver B has a higher ethanol intake.

As ethanol is highly volatile, the breath of ethanol which contains more ethanol, is able to carry ethanol to a longer distance as concentration of ethanol is higher. As ethanol of breath of B is able to react with $\text{K}_2\text{Cr}_2\text{O}_7$ in a, b, c, he has a higher ethanol intake.

(3) the volume of breath of the two drivers should be roughly the same.

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13 14 15 16 17 18 19 20 21 22 23 24 ≥25

每題另起新頁作答。

Start each question on a new page.

ii) mole ratio of C_2H_5OH : $K_2Cr_2O_7$
3 : 1

3 C_2H_5OH requires 1 mol of $K_2Cr_2O_7$.

$$\frac{4.38}{1000} \times 0.025 \times 3 = \frac{\text{mass}}{12 \times 2 + 6 + 16}$$

$$\text{mass} = 0.015111 \text{ g} = 15.111 \text{ mg}$$

$$\frac{15.111}{100} = 151$$

$\therefore 151 \text{ mg per } 100 \text{ cm}^3 > 55 \text{ mg per } 100 \text{ cm}^3$

$\therefore$ Yes, the driver is found guilty.

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Comments

The candidate's answers show good understanding of the chemical concepts and principles in the curriculum (e.g. Paper 1 Qs. 1, 3(b)(i), 4(a), 5(b)(ii), 6(b), 9(b), 10(a)(i) & (ii) & (b)(i), 11(a) & (b); Paper 2 Qs. 1(a)(ii) & (b)(i)(2) & (iii) & (c)(i) & (iv), 3(a)(iii) & (b)(iii)).

He/she demonstrates very good abilities of applying chemical concepts on unfamiliar situations for solving the problems (e.g. Paper 1 Qs. 6(a) & (c), 11(d)(i) & (ii); Paper 2 Qs. 1(c)(ii) & (iii), 3(c)(i)(2) & (3)).

The candidate performs well on chemical calculations (e.g. Paper 1 Qs. 4(e), 7(c)(ii), 9(a); Paper 2 Qs. 1(b)(ii), 3(b)(ii) & (c)(ii)).

He/she can effectively communicate ideas using scientific terminology, appropriate diagrams and chemical equations (e.g. Paper 1 Qs. 1(c)(i) & (ii), 3(a)(i) & (ii), 6(b) & (c), 10; Paper 2 Qs. 1(a)(iii), 3(b)(i) & (c)(i)(1)).

He/she can design appropriate method for carrying out scientific investigations (e.g. Paper 1 Qs. 7(a), 13).