2020-DSE
CHEM
PAPER 1B

B

Level 5 Exemplar
Paper 1B

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.

A140E01B

PART I

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

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

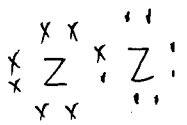
	Y (Br)	Z (I)
Atomic number	35	53
Number of occupied electron shells in the atoms	4	5
Number of electrons in the outermost shell in the atoms	7	7

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

2, 8, 18, 7

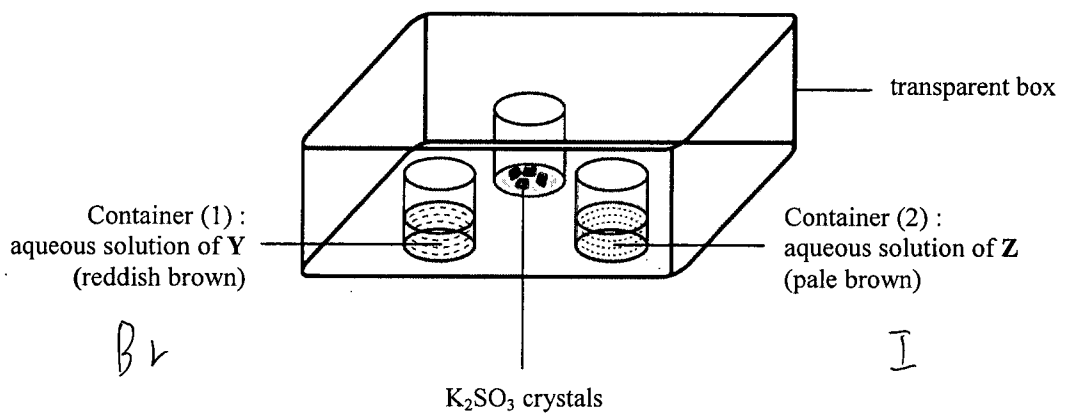
(1 mark)

(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.



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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.

$K_2SO_{3(s)} + 2HCl_{(aq)} \longrightarrow 2KCl_{(aq)} + SO_{2(g)} + H_2O_{(l)}$

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

The solution turns from reddish brown to colourless.

$SO_3^{2-} + H_2O + Br_2 \rightarrow SO_4^{2-} + 2H^+ + 2Br^-$

(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.

Both element Y and Z have the same number of electrons in the outermost electron shell in the atom. Thus, element Y and Z belong to the same group. They have same chemical property and ~~they~~ their aqueous solution can both be an oxidizing agent. So, similar observation could be observed. (5 marks)

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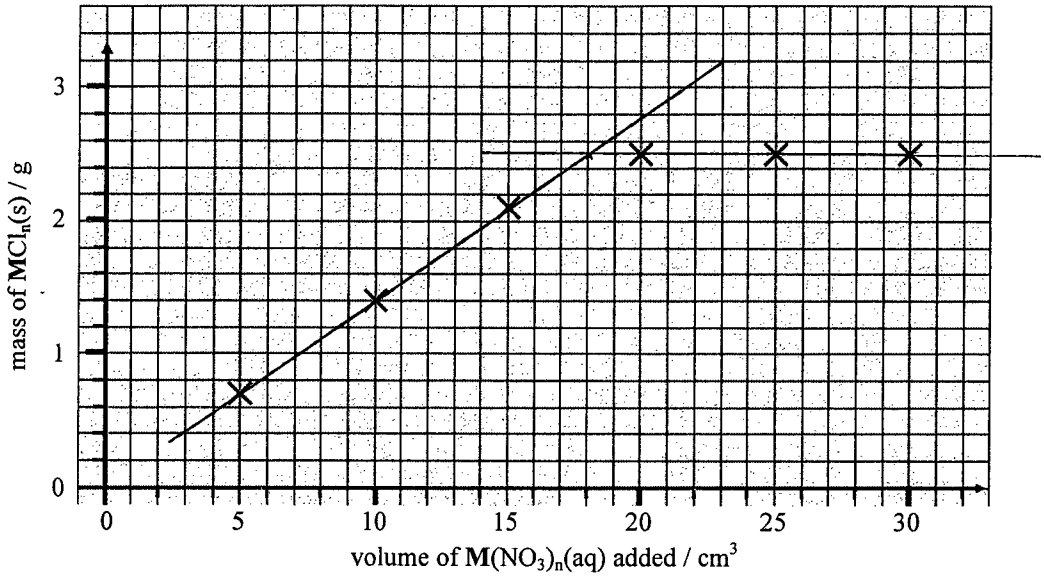
2. An experiment was performed to deduce the empirical formula of an insoluble chloride of a metal **M**. At room temperature, different volumes of a 0.50 mol dm^{-3} $M(NO_3)_n(aq)$ were added to six beakers each containing 50 cm^3 of 0.36 mol dm^{-3} HCl(aq). The $MCl_n(s)$ obtained in each beaker was filtered, washed, dried and weighed. The mass of $MCl_n(s)$ obtained and the corresponding volume of $M(NO_3)_n(aq)$ added were plotted on the graph below.



(a) Suggest why the masses of $MCl_n(s)$ for the last three points in the graph are the same.

Because all $HCl_{(aq)}$ in beakers is already reacted. $HCl_{(aq)}$ is the limiting reactant. No further reaction could be make after all HCl is reacted. (1 mark)

(b) (i) By **sketching** on the graph above, deduce the volume of the $M(NO_3)_n(aq)$ that can completely react with 50 cm^3 of 0.36 mol dm^{-3} HCl(aq).

Volume of $M(NO_3)_n(aq)$ = 18 cm^3

(ii) Hence, calculate the number of moles of $M(NO_3)_n(aq)$ that can completely react with the HCl(aq).

~~no of mole of HCl reacted : $(\frac{50}{1000})(0.36) = 0.018$ mole~~

no of mole of $M(NO_3)_n$ reacted : $(\frac{18}{1000})(0.5)$

$= 9 \times 10^{-3}$ mole

(3 marks)

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

no of mole of HCl reacted: $\left(\frac{50}{1000}\right)(0.36) = 0.018$ mole.

no of mole of M^{n+} reacted : 9×10^{-3} mole

$M^{n+} + nCl^- \rightarrow M(Cl)_n$.

n: $\frac{\text{no of mole of } Cl^- \text{ reacted}}{\text{no of mole of } M^{n+} \text{ reacted}} = \frac{0.018}{9 \times 10^{-3}} = 2$

∴ Empirical fomular of chloride of M: $M(NO_3)_2$

As Ag exist in Ag^+ while lead exist in Pb^{2+}.

M would be lead.

(3 marks)

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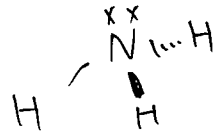
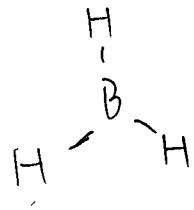
3. (a) Draw a three-dimensional diagram to represent the shape of each of the following molecules :

(i) NH_3

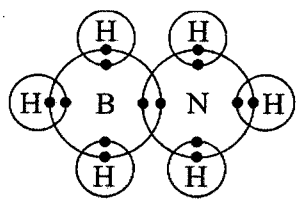


(ii) BH_3



(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.

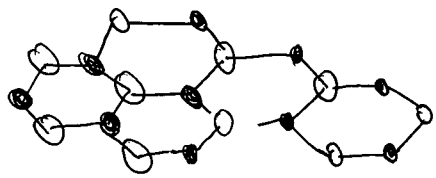
B-N would be a dative covalent bond.
There are a pair of lone pair electrons at the central atom ~~N~~ N in NH_3. While the central atom B in BH_3 do not attain octect structure. Thus, N share it's lone pair electron to B in BH_3 to form a dative covalent bond.

It need 2 more electron to attain octect rule.

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

Molecules of ~~ethane~~ ethane are held by weak Van der Waals' force while ~~H~~ H_3NBH_3 are held by strong covalent bond. Larger amount of energy is needed to break to strong covalent bond in H_3NBH_3. It has higher boiling point than ethane. Thus, H_3NBH_3 is a solid while ethane is a 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).



O Br ~~atom~~ Ion

N ~~atom~~ Ion

(6 marks)

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4. Eggshells mainly contain calcium carbonate ($CaCO_3$) 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. $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

Step (2) : 0.204 g of the powder was put into a conical flask. After that, 25.00 cm^3 of 0.200 M HCl(aq) and 5 cm^3 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 the surface area, so increase the reaction rate.

(1 mark)

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

Prevent reaction between $CaCl_2$ and HCl.

(1 mark)

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

Ensure all $CaCO_3$ is reacted with HCl.

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

No of mole of NaOH used : $\left(\frac{16.85}{1000}\right)(0.102) = 1.7187 \times 10^{-3}$ mol

no of HCl in the remains : 1.7187×10^{-3} mol.

no of mole of HCl prepared : $\left(\frac{25}{1000}\right)(0.2) = 5 \times 10^{-3}$ mole

no of mole of HCl reacted : $5 \times 10^{-3} - 1.7887 \times 10^{-3}$

$= 3.2813 \times 10^{-3}$ mole

Percentage by mass : $\frac{3.2813 \times 10^{-3} \times (40.1 + 12 + 16 \times 3)}{2 \times 0.204} \times 100\% \approx 80.5\%$

(3 marks)

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

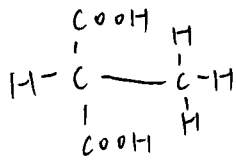
(a) When a piece of magnesium ribbon is placed into an aqueous solution of **W**, hydrogen gas evolves. According to this observation, suggest a functional group that **W** may contain.

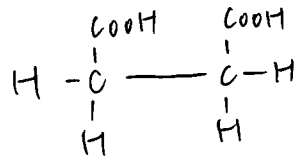
W may contain -COOH, carbonyl group.

(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 :

$$C_4H_6O_4(aq) + 2NaOH(aq) \rightarrow Na_2C_4H_4O_4(aq) + 2H_2O(l) \quad \Delta H^{\ominus} = y \text{ kJ mol}^{-1}$$

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' means the enthalpy change when ~~one mole of~~ an acid and alkali reacts to form one mole of water under standard condition.

$$\Delta H^{\ominus}_{neut} = \frac{y}{2}$$

(iii) The standard enthalpy change of neutralisation between HCl(aq) and NaOH(aq) is -57.3 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 kJ mol^{-1}.

Less negative. $C_4H_6O_4$ is an weak acid. ~~Some~~. It partially ionize in water to give out H^+ ions. Some of the energy are needed to break the bond to give out H^+ ions in $C_4H_6O_4$. So, the reaction will be less exothermic.

(6 marks)

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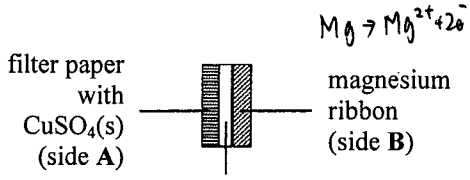
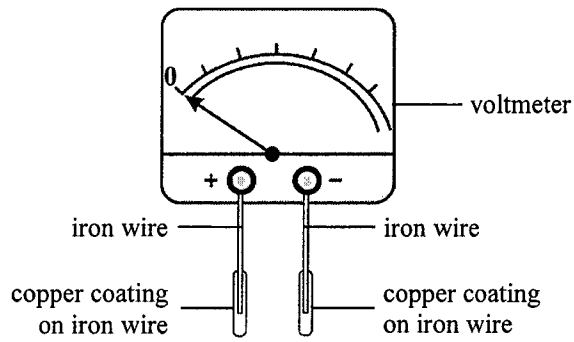
6. The diagrams below show the component of a chemical cell, an experimental set-up and how the pointer of the voltmeter deflects when the set-up is connected to the component.

component of a chemical cell



experimental set-up



The pointer of the voltmeter deflects to a positive reading when a few drops of water are added to the component

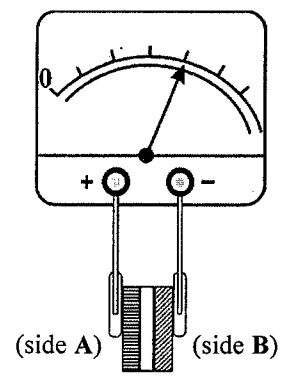


Diagram (1)

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

When few drop of water is added, $CuSO_4$ can dissolve in water to give Cu^{2+}. $Cu^{2+}_{(aq)}$ is a stronger oxidizing agent than H^+. The difference ~~between~~ in electrochemical series increase. ~~Thus, the voltage~~ Cu^{2+} will be reduced instead of H^+. Thus, voltage will be increased. So, the pointer of 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) anode

$Mg \rightarrow Mg^{2+} + 2e^-$

(ii) cathode

$Cu^{2+} + 2e^- \rightarrow Cu$

(2 marks)

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

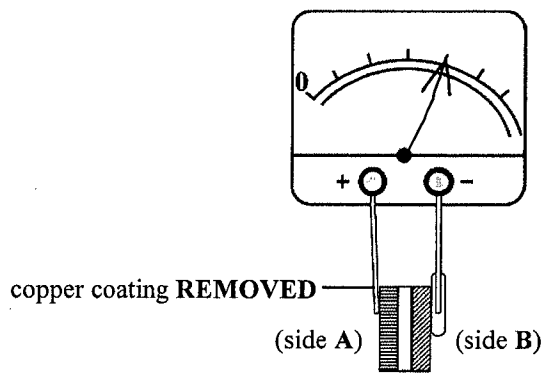

Diagram (2)

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.

$Fe_{(s)} + CuSO_{4(aq)} \rightarrow Cu_{(s)} + FeSO_{4(aq)}$

(ii) Name this type of reaction.

Displacement reaction

(2 marks)

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

$Ba(OH)_2 \cdot 8H_2O(s) + 2NH_4Cl(s) \rightarrow BaCl_2(s) + 10H_2O(l) + 2NH_3(g)$

(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.

Put a glass rod dipped with dilute HCl into the test tube containing NH_3.

White dense fume can be observed.

(2 marks)

(b) $Ba(OH)_2 \cdot 8H_2O(s)$ is an alkali. What is meant by the term 'alkali' ?

'Alkali' means a compound react with acid to give out salt and water as the only product.

(1 mark)

(c) The standard enthalpy change of formation of $Ba(OH)_2 \cdot 8H_2O(s)$ is -3345 kJ mol^{-1}.

(i) Write a thermochemical equation for the standard enthalpy change of formation of $Ba(OH)_2 \cdot 8H_2O(s)$.

$Ba_{(s)} + 9H_{2(g)} + \frac{3}{2}O_{2(g)} \rightarrow Ba(OH)_2 \cdot 8H_2O_{(s)}$

(ii) Calculate the standard enthalpy change of the reaction between $Ba(OH)_2 \cdot 8H_2O(s)$ and $NH_4Cl(s)$.
(Standard enthalpy changes of formation :
$NH_3(g) = -46$ kJ mol^{-1}, $H_2O(l) = -286$ kJ mol^{-1}, $NH_4Cl(s) = -314$ kJ mol^{-1},
$BaCl_2(s) = -859$ kJ mol^{-1})

$\Delta H_r^\ominus + \Delta H_f^\ominus[Ba(OH)_2 \cdot 8H_2O] + \Delta H_f^\ominus[NH_4Cl] \times 2 = \Delta H_f^\ominus[BaCl_2] + \Delta H_f^\ominus[H_2O] \times 10 + \Delta H_f^\ominus[NH_3] \times 2$

$\Delta H_r^\ominus = -859 - 286 \times 10 - 46 \times 2 + 3345 + 314 \times 2$

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

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

Decrease. Because the reaction is endothermic.

(4 marks)

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*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)

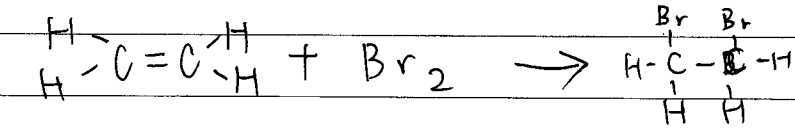
Firstly, break the crude oil to smaller molecules by cracking. Mixture of smaller hydrocarbons could be obtained.

$C_xH_y \rightarrow n\,C_2H_4$

Then, perform fractional distillation to obtain ethene from the mixture of hydrocarbon.

~~After that, add H_2 to ethene with the presence of Pt as the catalyst.~~

After that, react ethene with Br_2 in organic solvent. The ~~co~~ mixture will turn brown to colourless. Thus, 1,2-dibromoethane can be obtained.



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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 :

$$\underset{\text{brown}}{2NO_2(g)} \rightleftharpoons \underset{\text{colourless}}{N_2O_4(g)}$$

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

	$NO_2(g)$	$N_2O_4(g)$
Concentration at start / mol dm^{-3}	0.0400	0.0010
Concentration at equilibrium / mol dm^{-3}	0.0323	**a**

Decrease in conc of NO_2 : $0.04 - 0.0323 = 7.7 \times 10^{-3}$ mol dm^{-3}

Increase in conc of N_2O_4 : $\frac{7.7 \times 10^{-3}}{2} = 3.85 \times 10^{-3}$ mol

$a = 0.001 + 3.85 \times 10^{-3} = 0.00485$ //

$$K_c = \frac{[N_2O_4]}{[NO_2]^2} = \frac{(0.00485)}{(0.0323)^2}$$

$= 46.5$ mol^{-1} 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.

When temperture increase, the colour turns darker, which mean concentration of $[NO_2]$ increase. The position of equilibrium have shift to left hand side. When temperture increase, when foward reaction is exothermic, the position of equilibrium will shift to left hand side. Therefore, the ~~def~~ reaction is exothermic.

(2 marks)

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

$$H_2C{=}CHCH_2OH$$

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

(i) Write a chemical equation for this reaction.

NaOH

(ii) Name this type of reaction.

Addition reaction

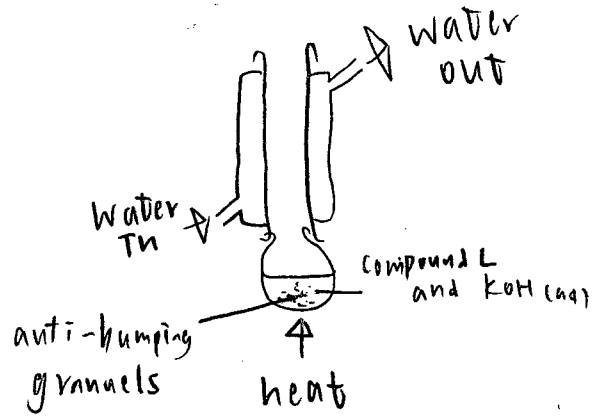
(2 marks)

(b) On heating under reflux, a compound **L** reacts with KOH(aq) to give **Y** and $CH_3COO^-K^+$.

(i) Suggest the structural formula of **L**.

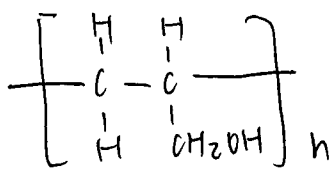
CH_3COOH

(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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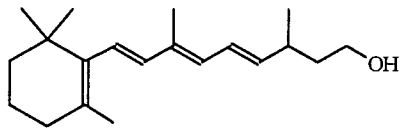
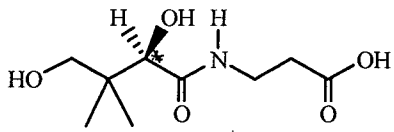
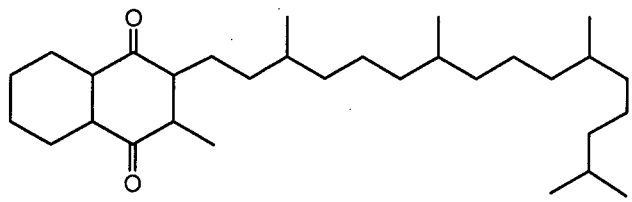
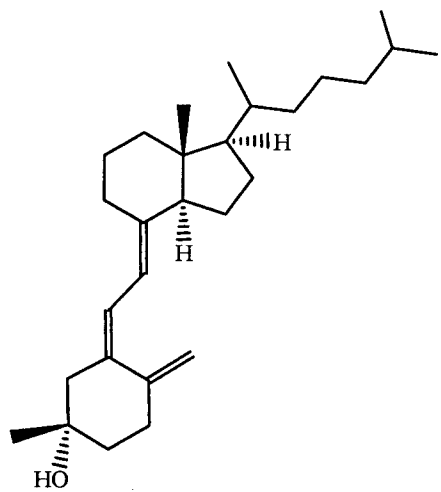
11. The structures of some compounds are shown below :

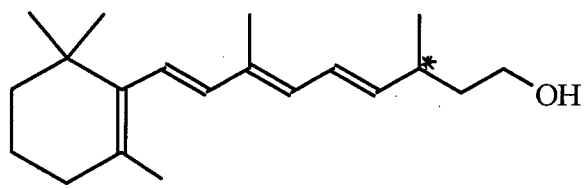
Compound	Structure
W	
X	
Y	
Z	

(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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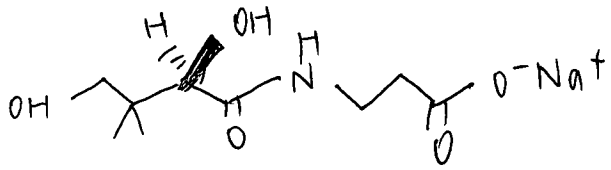
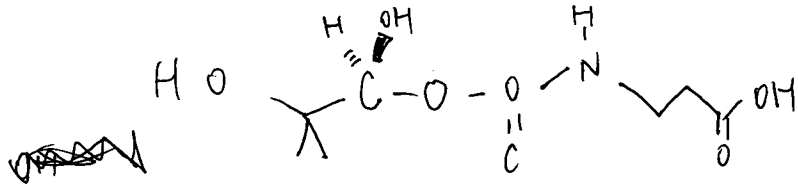
Answers written in the margins will not be marked.

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 :

$Br_2(aq)$ acidified $K_2Cr_2O_7(aq)$ $Na_2CO_3(aq)$

(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 (aq)

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

Effervescence occurs.
Only X contain -COOH bond. Only X is an acid to react with Na_2CO_3 to give out CO_2.

(3 marks)

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Answers written in the margins will not be marked.

Go on to the next page

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

$KO_2CCH(OH)CH(OH)CO_2Na(aq) + 3H_2O_2(aq) \rightarrow HCO_2K(aq) + HCO_2Na(aq) + 2CO_2(g) + 4H_2O(l)$
(colourless)

When 10 cm^3 of 0.25 M $KO_2CCH(OH)CH(OH)CO_2Na(aq)$ and 3 cm^3 of 6% $H_2O_2(aq)$ were mixed at 60°C, it was found that only a few gas bubbles evolved. Then a small amount of pink $CoCl_2(aq)$ 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 ion ~~have~~ are coloured in aqueous solution. Cobalt ion can be green ~~due to the~~ in Co^{3+}. ~~and~~ ~~it can~~ It can also be pink in Co^{2+}.

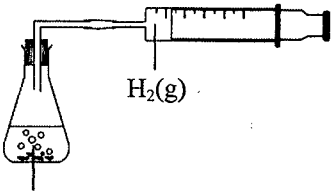
Cobalt can work as a catalyst. Orginally, ~~the~~ only few gas bubbles are evolved in the reaction. When $CoCl_2(aq)$ is added, it can work as catalyst to provide an alternative pathway with lower ~~the~~ activation energy. Thus, more particles gaining kinetic energy larger than activation energy. Thus, gas bubbles formed vigorously after $CoCl_2$ is added.

Lastly, cobalt have various oxidation state. Cobalt can form cobalt(III) cobalt. The oxidation number of cobalt at that time is +3. Cobalt can form $CoCl_2$. The oxidation number of Co in $CoCl_2$ is +2. (4 marks)

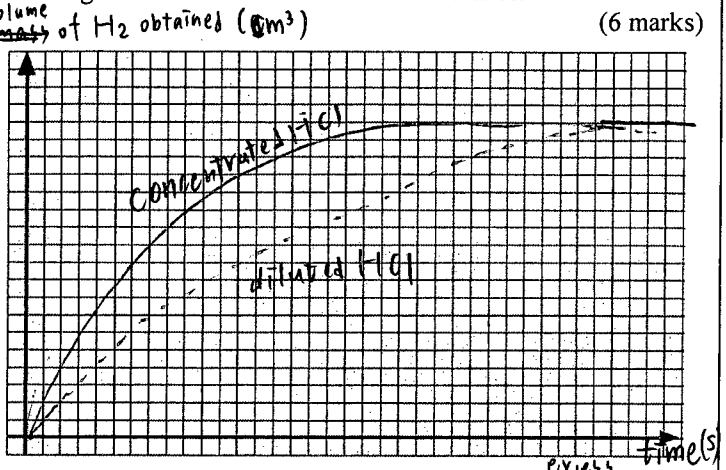
Answers written in the margins will not be marked.

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)



HCl(aq) + Zn(s)
(excess) (fixed mass)



~~Firstly, put the~~

Firstly, put a fixed mass of Zn and fixed volume of excess HCl into the conical flask. Measure the volume of H_2 obtained in serval time interval. Plot a graph of volume of H_2 against time.

Then, dilute the HCl with deionized water. Then pour the same volume of HCl in the conical flask and put Zn with same mass and shape. Measure the volume of H_2 obtained in serval time inverval. Plot the graph again with dotted line.

The concentration of hydrogen ion is lower in the reaction with diluted HCl. As no of particles decrease, chance of collision between particles decrease, number of effective collision decrease. Thus, rate of reaction decrease.

However, volume of H_2 obtained is the same. As excess HCl is added, Zn is the limiting reactant. The total mass of zinc reacted is the same. The number of mole of Zn reacted and H_2 formed is the same. Thus, volume of H_2 obtained should be the same.

END OF SECTION B
END OF PAPER

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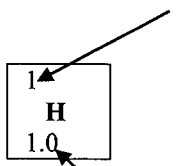
PERIODIC TABLE 周期表

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)

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

Level 5 Exemplar
Paper 2

由考生填寫 To be filled in by the candidate	
試題編號 Question No.	1
	3
	4
	9

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

試題編號 Question No.

1	2	3	4	5	6	7	8	9	10	11	12	
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13	14	15	16	17	18	19	20	21	22	23	24	≥25

試題編號 Question No.

1	2	3	4	5	6	7	8	9	10	11	12
X											

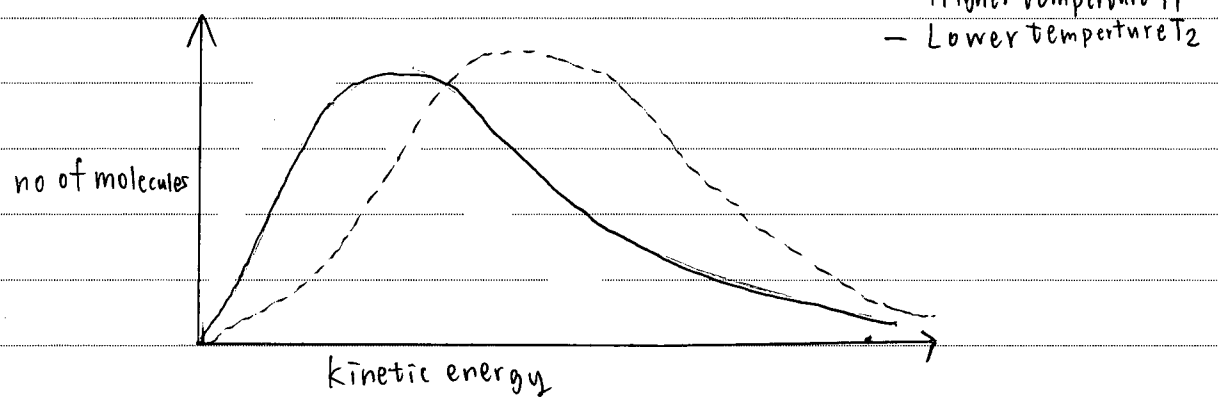
13	14	15	16	17	18	19	20	21	22	23	24	≥25

每題另起新頁作答。
Start each question on a new page.

aii) Mecury cell will produce mecury ions which is toxic while membrance cell will not produce toxic substance. Membrane cell usually have a higher yield.

iii) ~~Fe~~ powdered $Fe_{(s)}$

iii)



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每題另起新頁作答。
Start each question on a new page.

bi) (1) CH_3OH is produced is reaction (II), which is toxic.
No toxic reagent is used or produced in reaction (I)

(2) Solvent is used in reaction (II) while no solvent used in reaction (I).

ii) no of mole of methyl benzonate used : $\frac{3}{136}$ = 0.0220588 mole
no of mole of hexan-1-amin used : $\frac{2.23}{101}$ = 0.0220792 mole
∴ Methyl benzonate is the limiting reactant.
no of mole of N-hexylbenzamide produced : $\frac{3.89}{205}$ = 0.01897 mole
yield : $\frac{0.01897}{0.0220588} \times 100\%$ = 86.0%

iii) (1) In 30 atm instead of atmospheric pressure (1 atm), as the number of mole of gaseous reactant is larger than the total number of mole of gaseous product. The position of equilibrium will shift to the right hand side in 30 atm. Thus, the concentration of CH_3COOH increase. More CH_3COOH could be obtained.

(2) As forward reaction is exothermic, having lower temperture, the position of equilibrimm will shift to right hand side, obtaining more CH_3COOH to increase yield.
obtaining in 3oatm, the pressure would not be too high, thus the operating cost would not be extremely expensive. The position of equilibrimm would ~~[illegible]~~ shift to right hand side to increase yield of CH_3COOH as total number of mole of gaseous reactant is larger than gaseous product.

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每題另起新頁作答。
Start each question on a new page.

c i) Because I_2 is reacted to form I^- in reaction. The colour of mixture change from brown to colourless. Thus, the change in absorbance can represent rate.

~~i) Slope of line : $\frac{0.7-0.1}{0-14} = -0.0428$~~

ii) ~~The change in absorbance is independent with Concentration of I_2.~~ ~~Thus $w=0$.~~ Concentration of I_2 is independent of rate of reaction.
Thus, $w=0$.

~~iii) Rate $= k_1 [I_{2(aq)}]^0$~~

iii) Rate $= k_1 [CH_3COCH_{3(aq)}]^x [H^+_{(aq)}]^w$.

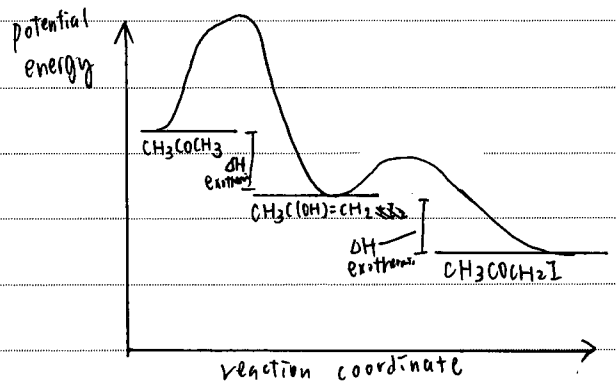
$\frac{0.7-0.1}{0-14} = k_1 (1)^x (0.2)^w$ ... ①

$\frac{0.7-0.1}{0-7} = k_1 (2)^x (0.2)^w$ ... ②

$\frac{②}{①} = 2 = (\frac{2}{1})^x \quad x=1$

iv) $mol^{-1}\ dm^3\ s^{-1}$

v)



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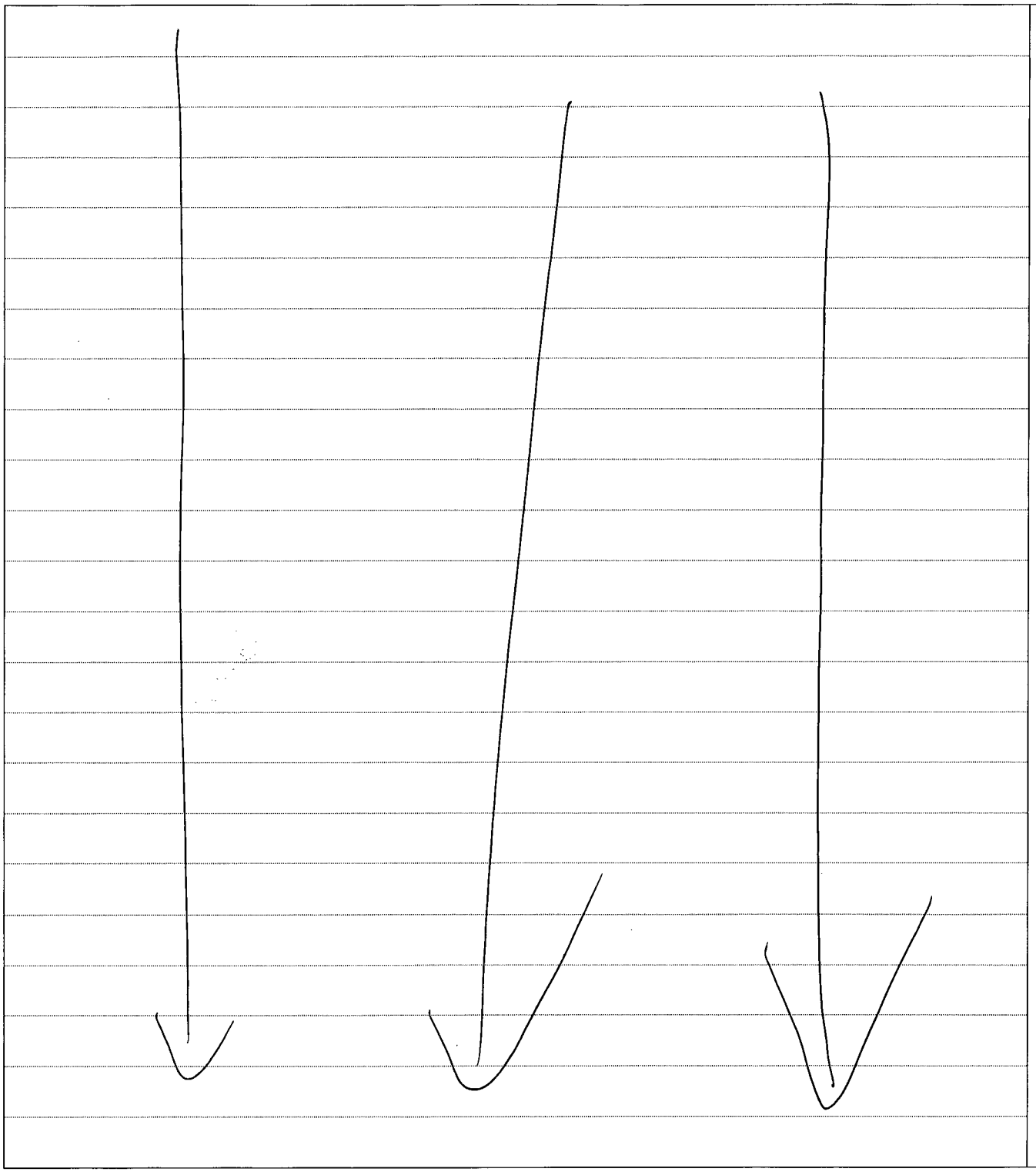
Start each question on a new page.



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Start each question on a new page.

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ai) ~~Burn~~ Heat both Na_2CO_3 and $Na_2CO_3 \cdot 10H_2O$ in separate test tube. Test the gas elvolve with dry blue cobalt paper by putting it on the tube of test tube. The dry cobalt paper turns from blue to pink in testtube containing $Na_2CO_3 \cdot 10H_2O$. No colour change on cobalt paper in test tube containing Na_2CO_3.

ii) blue black to colourless

iii) Adding Tollen's reagent to both test tube containing hexanal and hex-1-ene. A sliver surface could be observed in the inner surface of the test tube, which contains hexanal. No observable change in test tube containg hex-1-ene.

Adding Br_2 to both solution, the test tube containing hex-1-ene can turn from brown to colourless. No observable change in hexanal.

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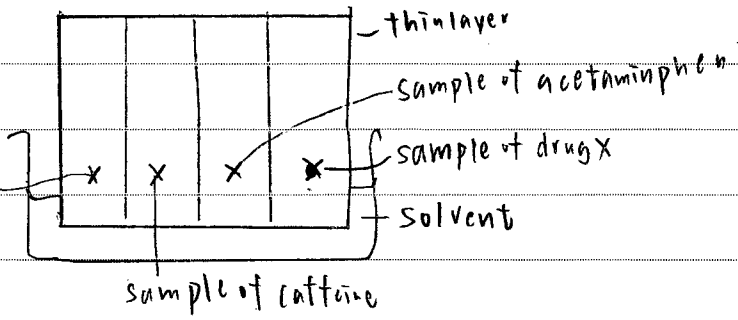
每題另起新頁作答。
Start each question on a new page.

b i)



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

iii) Drug Y contain ~~ASPH~~ aspirin.

iv)(1) There is a prescence of absorption peak at 2500-3300 cm^{-1} only in asprin, as only asprin contains O-H bond.
There is a prescence of absorption peak at 2200 to 2280 ms^{-1} only in caffeine, as only caffeine contain C≡N bond.

(2) The major peak at m/z = 43 refers to ~~CO~~CH_3CO^+.
As both asprin and acetaminophen contains CH_3CO^+, the sample may be asprin or acetaminphen. Thus, the information cannot confirm the sample.

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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.

c i) (1) orange to green

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

(2) Driver B has higher ethanol intake. As driver B can turns more silica gel with $K_2Cr_2O_7$ (aq) from orange to green. It breath contains more ethanol to oxidize more $K_2Cr_2O_7$.

(3) To ensure the ~~[illegible]~~ volume of tube to be small. Thus, all people can breath the same amount of air into the tube.

ii) no of mole of $K_2Cr_2O_7$ used: $(\frac{4.38}{1000})(0.025) = 1.095 \times 10^{-4}$ mole

no of mole of C_2H_5OH reacted: $1.095 \times 10^{-4} \times 3 = 3.285 \times 10^{-4}$ mole.

no of mass contains in $10cm^3$: $3.285 \times 10^{-4} \times (12+12+6+16)$

$= 0.015111$ g

no of mass per $100cm^3$: $0.015111 \times \frac{100}{10} = 0.15111$ g

$= 151.11$ mg

∴ The driver would ~~[illegible]~~ be found guilty

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