

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2016

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. Refer to the following information of phosphorus (P) and chlorine (Cl).

	P	Cl
Atomic number	15	17
Relative atomic mass	31.0	35.5

- (a) State the electronic arrangement of a phosphorus atom.

2, 8, 5

(1 mark)

- (b) All chlorine atoms have the same atomic number. Explain why some chlorine atoms have different mass numbers.

They are isotopes of chlorine which have different number of neutrons.

(1 mark)

- (c) A compound of phosphorus and chlorine has a relative molecular mass smaller than 250. It contains 22.6% of phosphorus by mass.

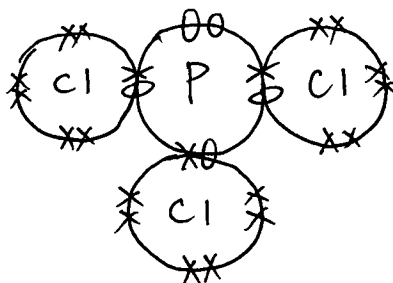
- (i) Deduce the molecular formula of the compound.

Assume there is 100g of compound

	P	Cl
Mass	22.6	77.4
Mole	0.73	2.18
Ratio	1	3

Molecular formula : PCl_3

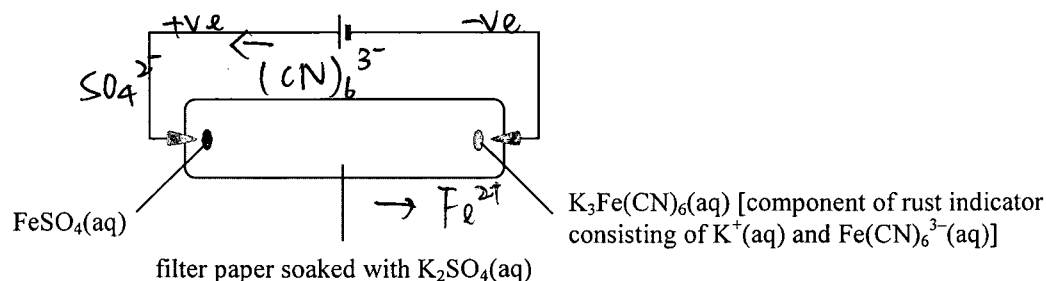
- (ii) Draw the electron diagram for the compound, showing electrons in the outermost shells only.



(3 marks)

Answers written in the margins will not be marked.

2. The set-up of an experiment for studying the movement of ions is shown below.



- (a) Explain why the filter paper is soaked with $K_2SO_4(aq)$ instead of water.

To increase its electrical conductivity

(1 mark)

- (b) State the colour of $FeSO_4(aq)$.

Green

(1 mark)

- (c) Explain what would be observed around the middle of the filter paper when the circuit is closed for a period of time.

Fe^{2+} travels to the right to the negative pole while $Fe(CN)_6^{3-}$ travels to the left to the positive pole. They meet in the middle and react to form a blue complex.

Blue colour observed in the middle.

(2 marks)

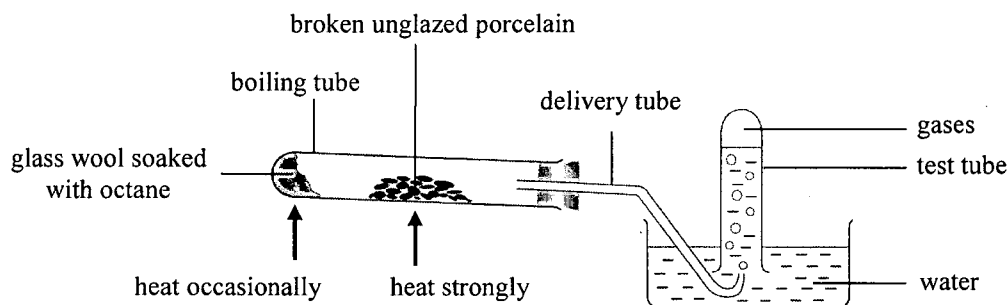
- (d) The experiment is repeated, but the two poles of the cell have been reversed at the very beginning. Explain what would be observed around the middle of the filter paper when the circuit is closed for a period of time.

change
No colour will be observed in the middle.
As Fe^{2+} remain in the left hand side, attracted by the negative pole. $Fe(CN)_6^{3-}$ remain at the right hand side which is positive. Only K^+ and SO_4^{2-} travel in opposite direction but they are colourless.

(2 marks)

Answers written in the margins will not be marked.

3. The diagram below shows an experimental set-up in which the glass wool soaked with octane is heated occasionally and the broken unglazed porcelain is heated strongly. Some gases are collected in the test tube over water.



- (a) Name the type of reaction that occurs in the boiling tube. Suggest one importance of this type of reaction in industry.

Cracking. It breakdowns larger hydrocarbons into smaller hydrocarbons such as alkenes, which can be used to make many useful products. (2 marks)

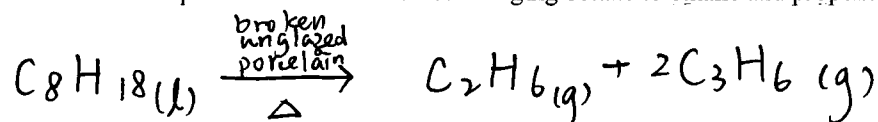
- (b) Explain why, instead of a large piece of unglazed porcelain, broken unglazed porcelain is used in this experiment.

To increase its surface area for reaction.

(1 mark)

- (c) Suppose that during the experiment, octane changes to ethane gas and propene gas only and they can be collected in the test tube.

- (i) Write the balanced equation for the reaction of changing octane to ethane and propene.



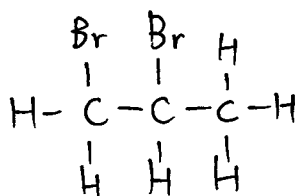
Answers written in the margins will not be marked.

3. (c) (ii) The gases collected in the test tube are shaken thoroughly with a few drops of Br_2 (in CH_3CCl_3) solution.

(1) State the expected observation.

The [^]solution changes from orange to colourless.
 $\text{Br}_2 / \text{CH}_3\text{CCl}_3$

(2) Draw the structure of the product formed from the reaction between propene and Br_2 .



(3 marks)

- (d) When no more gas can be collected, what should be done to end the experiment for safety consideration? Explain your answer.

Remove the delivery tube first before remove the heat. Or otherwise the cold water may suck back and crack the hot boiling tube.

(2 marks)

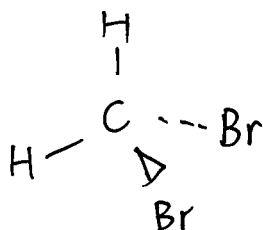
4. Consider the molecules CO_2 , CS_2 and CH_2Br_2 .

(a) For each of the following molecules, draw its three-dimensional structure.

(i) CS_2

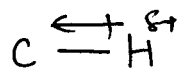
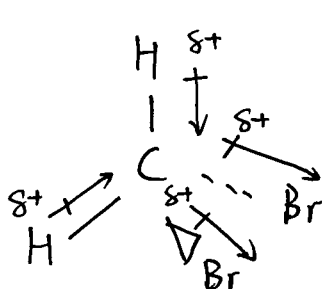


(ii) CH_2Br_2

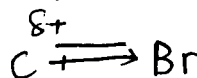


(2 marks)

(b) Identify, with explanation, the polar bond(s) in CH_2Br_2 .



C is more electronegative than H



Br is more electronegative than C

(2 marks)

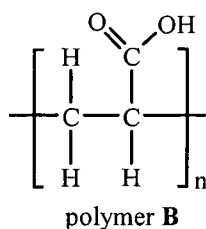
(c) Suggest why, under room temperature and pressure, CO_2 is a gas but CS_2 is a liquid.

Both CO_2 and CS_2 are in simple molecular structure. CS_2 has a greater molecular size and therefore a stronger van der Waal's force between molecules than CO_2 . The stronger intermolecular force make it to be a liquid under room temperature and pressure.

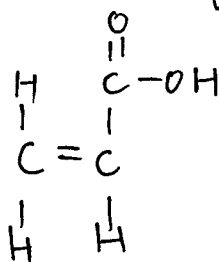
(2 marks)

Answers written in the margins will not be marked.

5. Polymer **B** shown below can be used as water absorbing material in diapers. It can be formed from the polymerisation of compound **A**.



- (a) Draw the structure of compound **A** and state its systematic name.



prop-2-enoic acid

(2 marks)

- (b) State the type of polymerisation for the formation of **B** from **A**.

Addition polymerization

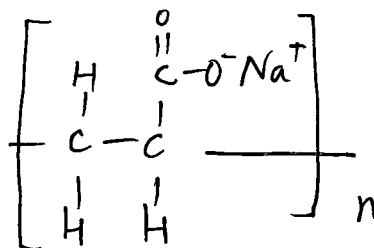
(1 mark)

- (c) Suggest why the relative molecular mass of **B** is expressed using a range of values instead of a single fixed value.

B have many chains of molecules, its exact molecular mass is not known.

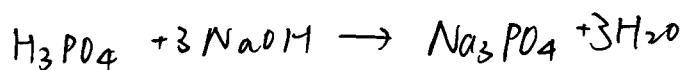
(1 mark)

- (d) It is known that the reaction of polymer **B** with NaOH(aq) forms polymer C which can absorb water better. Draw the structure of **C**.



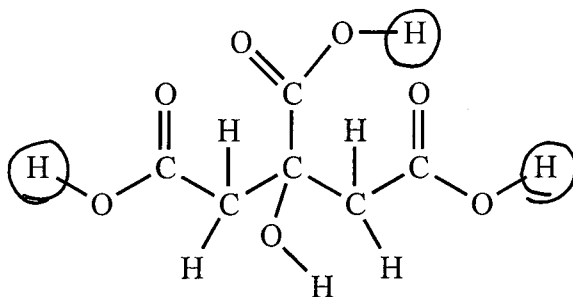
(1 mark)

Answers written in the margins will not be marked.



6. Citric acid is a tribasic acid found in lemon. It is a white solid and soluble in water.

- (a) In the structure of citric acid shown below, circle ALL ionisable hydrogen atom(s) making it a tribasic acid.



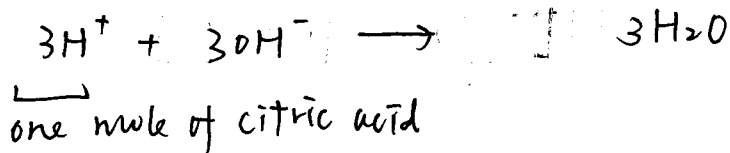
(1 mark)

- (b) A solid sample contained citric acid and other soluble inert substances. 1.65 g of the sample was dissolved in deionised water and diluted to 250.0 cm³ in apparatus X. After that, 25.00 cm³ of the diluted solution was withdrawn and titrated with 0.123 M NaOH(aq) using phenolphthalein as an indicator. 18.45 cm³ of the NaOH(aq) was required to reach the end point. (Molar mass of citric acid = 192.0 g)

- (i) What is apparatus X?

Volumetric flask

- (ii) Calculate the percentage by mass of citric acid in the solid sample.



$$\text{No. of mole of NaOH used} = 0.123 \times 0.01845 = 2.27 \times 10^{-3}$$

$$\text{No. of mole of acid reacted} = \frac{2.27 \times 10^{-3}}{3} = 7.56 \times 10^{-4}$$

$$\text{No. of acid before dilution} = \frac{7.56 \times 10^{-4}}{0.025} \times 0.25$$

$$\text{Percentage by mass} = \frac{7.56 \times 10^{-3} \times 192}{1.65} \times 100\% = 88\%$$

(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

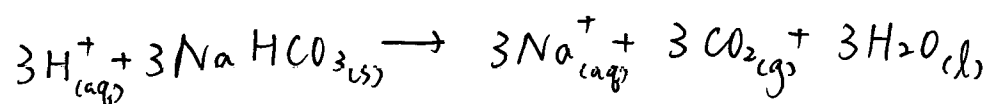
Answers written in the margins will not be marked.

6. (c) A few drops of lemon juice are added to sodium hydrogencarbonate powder.

(i) State the expected observation.

Colourless gas evolved.

(ii) Write the ionic equation for the reaction involved.



(2 marks)

7. The enthalpy change of formation of $\text{MgCO}_3(\text{s})$ can be obtained using an indirect method. Firstly, the enthalpy change for the reaction of $\text{MgCO}_3(\text{s})$ with $\text{H}_2\text{SO}_4(\text{aq})$, and that of $\text{Mg}(\text{s})$ with $\text{H}_2\text{SO}_4(\text{aq})$ are respectively determined experimentally. After that, the enthalpy change of formation of $\text{MgCO}_3(\text{s})$ can be obtained through calculation with given enthalpy changes of formation of $\text{CO}_2(\text{g})$ and $\text{H}_2\text{O}(\text{l})$.

- (a) According to definition, under which condition could the 'heat change' of a reaction be regarded as the 'enthalpy change'?

Under room temperature and atmospheric pressure.

(1 mark)

- (b) Explain why, instead of a direct method, an indirect method is used to obtain the enthalpy change of formation of $\text{MgCO}_3(\text{s})$.

Change in
Heat content of solid is difficult to measure.

(1 mark)

- (c) In order to determine experimentally the enthalpy change for the reaction of $\text{MgCO}_3(\text{s})$ with $\text{H}_2\text{SO}_4(\text{aq})$, an accurate mass of $\text{MgCO}_3(\text{s})$ was firstly allowed to react with excess $\text{H}_2\text{SO}_4(\text{aq})$ in a polystyrene foam cup. The maximum rise in temperature of the mixture was then found. After calculation, the enthalpy change for the reaction can be obtained.

- (i) Suggest one possible error for the above experimental procedure.

There may be heat loss to surroundings.

- (ii) Explain whether the enthalpy change for the reaction of $\text{CaCO}_3(\text{s})$ with $\text{H}_2\text{SO}_4(\text{aq})$ can be obtained using a similar experimental procedure.

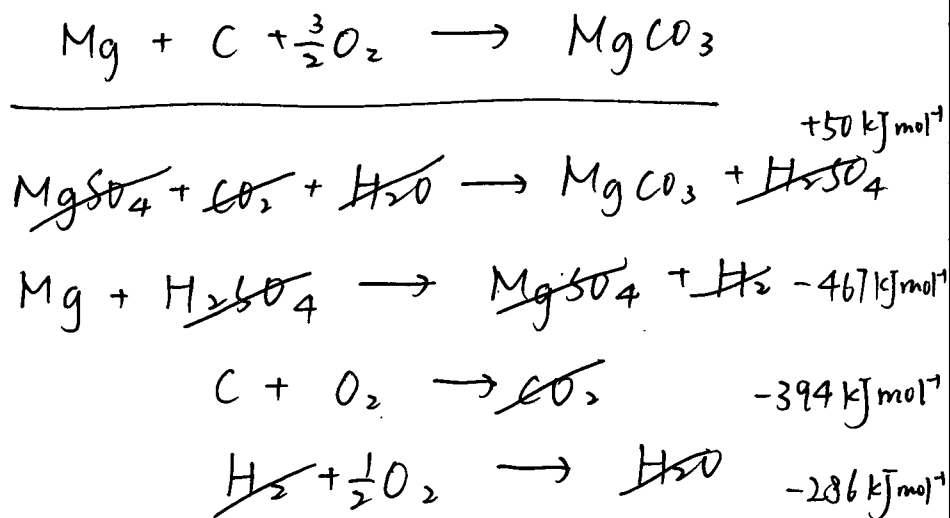
No. CaSO_4 formed is insoluble and will coat on the surface to prevent further reaction.

(2 marks)

Answers written in the margins will not be marked.

7. (d) Using the information given below, calculate the standard enthalpy change of formation of $\text{MgCO}_3(\text{s})$.

Standard enthalpy change for the reaction of $\text{MgCO}_3(\text{s})$ with $\text{H}_2\text{SO}_4(\text{aq})$	$= -50 \text{ kJ mol}^{-1}$
Standard enthalpy change for the reaction of $\text{Mg}(\text{s})$ with $\text{H}_2\text{SO}_4(\text{aq})$	$= -467 \text{ kJ mol}^{-1}$
Standard enthalpy change of formation of $\text{CO}_2(\text{g})$	$= -394 \text{ kJ mol}^{-1}$
Standard enthalpy change of formation of $\text{H}_2\text{O}(\text{l})$	$= -286 \text{ kJ mol}^{-1}$



$$\begin{aligned}
 \Delta H_f &= +50 - 467 - 394 - 286 \\
 &= -1097 \text{ kJ mol}^{-1}
 \end{aligned}$$

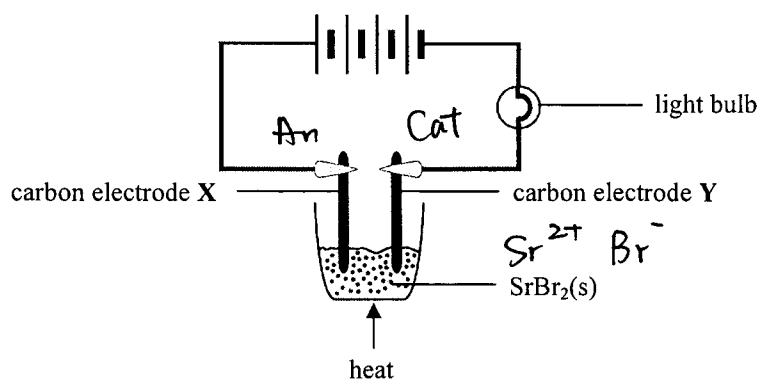
(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

8. Consider the experimental set-up shown below :



- (a) In the above experiment, the bulb lights up when the $\text{SrBr}_2(\text{s})$ becomes molten. (Atomic number of Sr = 38)

- (i) State the observation at carbon electrode X.

Brown colour observed.

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



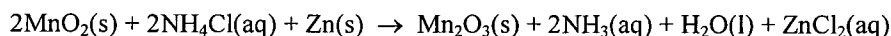
(2 marks)

- (b) Explain why the experiment should be performed in a fume cupboard.

Bromine evolved is toxic.

(1 mark)

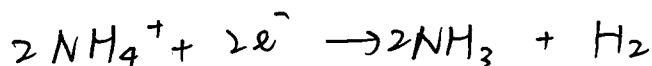
- (c) Zinc-carbon cells are used in the above experiment. The equation below shows the reaction that occurs in the zinc-carbon cells when the bulb lights up.



- (i) Deduce, in terms of change in oxidation number, the oxidising agent in a zinc-carbon cell.

MnO_2 . The oxidation number of Mn decreased from +4 to +3.

- (ii) Write a half equation for the change that occurs at the cathode in a zinc-carbon cell.



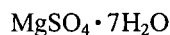
(3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

- *9. Three unlabelled reagent bottles each contains one of the white solids listed below :



Outline how you would carry out tests to distinguish these three solids.

(6 marks)

Prepare three boiling tube and put the three solids into them respectively. ^{Label them with A, B and C} Stopper the boiling tube with a delivery tube and connect it to another test tube with anhydrous copper(II) sulphate inside. Apply heat to the solid until colourless liquid is evaporated out. Only $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ will give out water which turns the anhydrous copper(II) sulphate from white to blue upon heating.

Consider the remaining two solids, Dissolve them in sodium hydroxide solution. Both of them will give white precipitate. Add excess sodium hydroxide solution to them, only solution containing zinc will redissolve and that solution must be ^{originally} zinc(II) sulphate. While the solution containing magnesium will still have the precipitate.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

PART II

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

10. In an experiment, 2.0 mol of $\text{SO}_2(\text{g})$ and 2.0 mol of $\text{O}_2(\text{g})$ are allowed to react in a closed container maintained at 950 K. The chemical equation for the reaction is shown below :



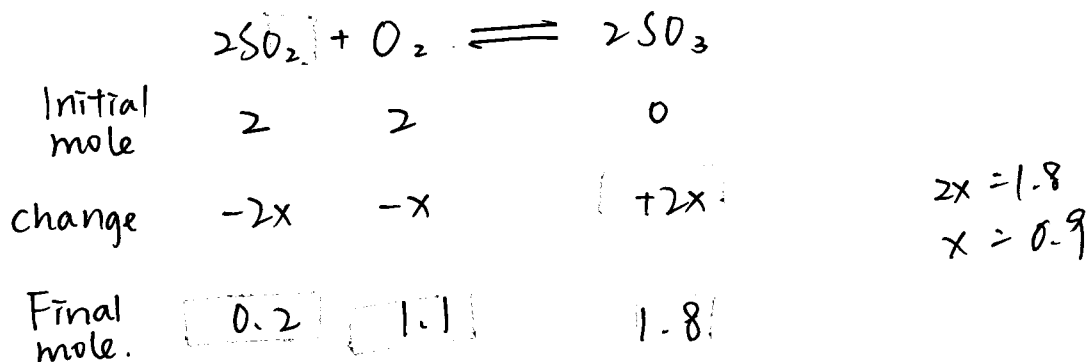
When the reaction attains dynamic equilibrium, 1.8 mol of $\text{SO}_3(\text{g})$ is obtained.

- (a) What is meant by the term 'dynamic equilibrium' ?

The forward reaction rate becomes equal to the backward reaction rate.

(1 mark)

- (b) At 950 K, the equilibrium constant K_c for the above reaction is $878 \text{ dm}^3 \text{ mol}^{-1}$. Calculate the volume of the container.



Let the volume be $V \text{ dm}^3$

$$K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]} = 878$$

$$\frac{\left(\frac{1.8}{V}\right)^2}{\left(\frac{0.2}{V}\right)^2 \left(\frac{1.1}{V}\right)} = 878$$

$$\frac{3.24}{V^2} = 878 \left(\frac{0.044}{V^3}\right)$$

$$V = 11.9 \text{ dm}^3$$

(3 marks)

Answers written in the margins will not be marked.

10. (c) If the above equilibrium mixture is subjected to each of the following changes, will the number of moles of $\text{SO}_3(\text{g})$ obtained increase, decrease or remain unchanged? Explain your answer in each case.

- (i) increasing the temperature

No. of moles of SO_3 obtained decrease.
As the forward reaction is exothermic,
increasing temperature shift equilibrium
position to the left.

- (ii) adding a suitable catalyst

Remain unchanged. Catalyst has no
effect on the no. of moles of SO_3 produced.

(2 marks)

11. Under certain conditions, a pink compound X 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 2.0 M NaOH(aq) and H₂O(l) at 25°C. After that, one drop of X was added to each of them and the time needed for the pink colour to disappear was recorded. The relevant data is shown below :

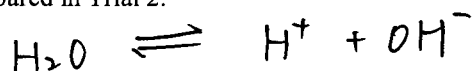
	Volume of 2.0 M NaOH(aq) used / cm ³	Volume of H ₂ O(l) used / cm ³	Time needed for the pink colour to disappear / s
Trial 1	5.0	0	61
Trial 2	4.0	1.0	76
Trial 3	3.0	2.0	101

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

So that the concentration can be determined directly by the volume of NaOH added.

(1 mark)

- (b) Given that at 25°C, $[H^+(aq)][OH^-(aq)] = 1.0 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$, calculate the pH of the NaOH(aq) solution prepared in Trial 2.



$[H^+]$ and $[OH^-]$ share equal mole.

$$\therefore \frac{1 \times 10^{-14}}{2} = 5 \times 10^{-15}$$

There are $[H^+] = 5 \times 10^{-15} \text{ M}$ in water

After NaOH is added,

$$[H^+] = \frac{5 \times 10^{-15}}{1 \times 10^{-3}} \times \frac{1}{5 \times 10^{-3}} = 1 \times 10^{-9}$$

$$pH = -\log [H^+]$$

$$pH = 9$$

(3 marks)

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

Concentration of NaOH. When a higher conc. of NaOH is used, the time required for the formation of colourless product reduce.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

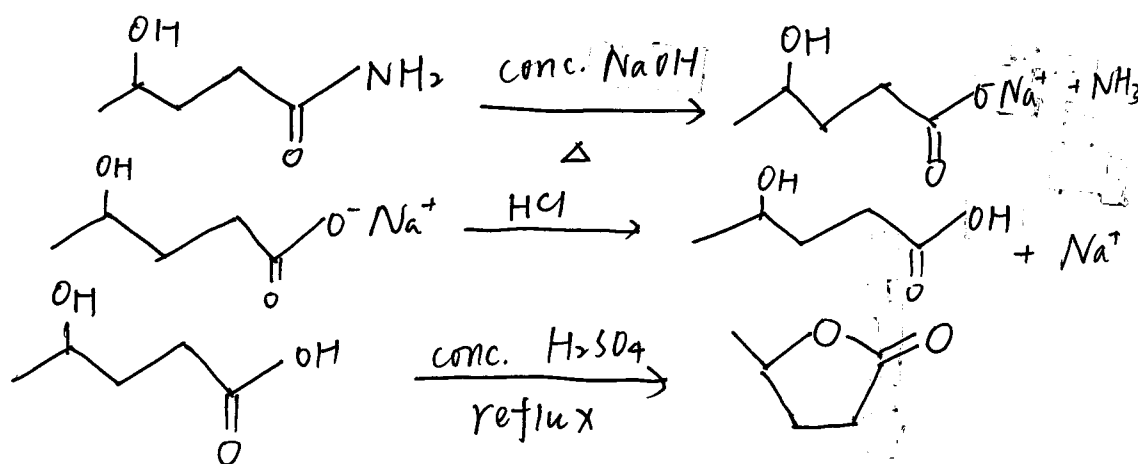
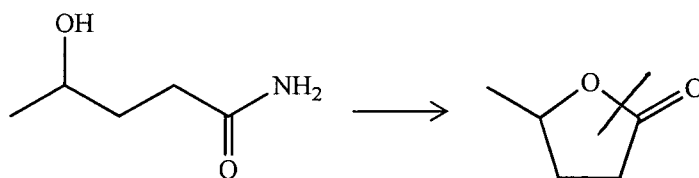
Answers written in the margins will not be marked.

11. (d) Detection of colour change using naked eye is not accurate enough. Suggest an instrumental method that can be used to more accurately detect the colour change.

colorimetry.

(1 mark)

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

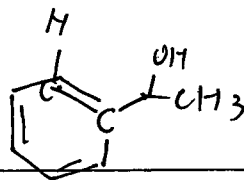


(3 marks)

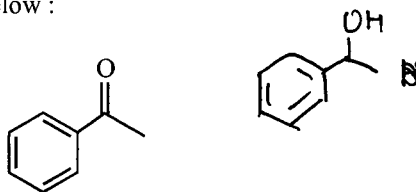
Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

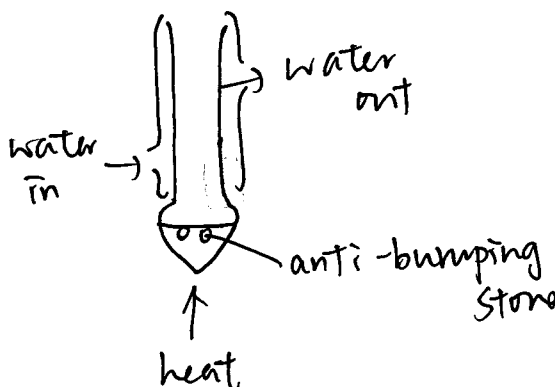


13. The structure of acetophenone is shown below :



Heating a mixture of acetophenone and NaBH_4 in methanol solvent under reflux can give two isomeric compounds P and Q. P and Q have the same melting point and same solubility in methanol.

- (a) Draw a labelled diagram of the set-up for heating the mixture under reflux.



(2 marks)

- (b) Suggest another reagent that can also react with acetophenone in a suitable solvent to give P and Q.

LiAlH_4 in dry ether

(1 mark)

- (c) What kind of isomers are P and Q?

enantiomers

(1 mark)

- (d) State one different physical property between P and Q.

The turns the polarimeter in opposite directions.

(1 mark)

- (e) Suggest a chemical test to show how acetophenone and P can be distinguished.

Add 2,4-dinitrophenylhydrazine,
only acetophenone
^ can give an orange precipitate
while P has no reaction with it.

(2 marks)

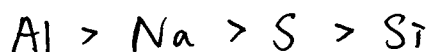
Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

- *14. Arrange sodium, aluminium, silicon and sulphur in decreasing order of electrical conductivity at room conditions, and explain your answer in terms of bonding and structure.

(5 marks)



Both aluminium and sodium exist in giant metallic structure. Atoms are immersed in a 'sea of electron'. Aluminium has three delocalized electrons while sodium only has one. Therefore Aluminium can conduct electricity better than sodium.

Sulphur exists in simple molecular structure and Silicon exists in giant covalent structure. Both of them have no delocalized electrons or mobile ions to conduct electricity. They can only conduct electricity in their molten state. As only weak van der Waal's force exist between sulphur molecules, it requires fewer energy to melt sulphur. While the covalent bond between silicon atoms requires more energy to break. Therefore, sulphur has a higher ease to conduct electricity.

END OF SECTION B

END OF PAPER

Answers written in the margins will not be marked.

GROUP 族

PERIODIC TABLE

atomic number 原子序

relative atomic mass 相對原子質量

I		II		relative atomic mass 相對原子質量											
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
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
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
87	Fr (223)	88	Ra (226)	89 **	Ac (227)	104	Rf (261)	105	Db (262)	29	Cu 63.5	28	Ni 58.7	27	Co 58.9
				30	Zn 65.4	31	Ga 69.7	32	Ge 72.6	33	As 74.9	34	Se 79.0	35	Br 79.9
				47	Ag 107.9	46	Pd 106.4	45	Rh 102.9	44	Ru 101.1	43	Tc (98)	42	Mo 95.9
				80	Hg 200.6	81	Tl 204.4	82	Pb 207.2	83	Bi 209.0	84	Po (209)	85	At (210)
				112.4	Cd 112.4	113	In 114.8	114	Sn 118.7	115	Sb 121.8	116	Te 127.6	117	I 126.9
				127	As 127.6	128	Se 132.9	129	Br 132.9	130	Kr 83.8	131	Xe 131.3	132	Rn (222)
				159	Er 157.4	160	Tm 168.9	161	Yb 173.0	162	Lu 174.9	163	Hf 178.5	164	Ta 180.9
				173	Yb 173.0	174	Lu 174.9	175	Hf 178.5	176	Ta 180.9	177	W 183.9	178	Re 186.2
				201	Hg 200.6	202	Tl 204.4	203	Pb 207.2	204	Bi 209.0	205	Po (209)	206	At (210)
				223	Pb 207.2	224	Bi 209.0	225	Po (209)	226	At (210)	227	Rn (222)	228	Fr (223)

1

H
1.0

2, , , , , , 4

2. 1. 7

*	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)

2016 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)。
- (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).
- (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		
☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13	14	15	16	17	18	19	20	21	22	23	24	≥25	

Level 5 Exemplar

Paper 2

由考生 填寫 To be filled in by the candidate	由閱卷員填寫 Marker's Use Only	由試卷主席 填寫 Examiner's Use Only
	閱卷員編號 Marker No.	試卷主席編號 Examiner No.

[illegible]

試題編號 Question No.

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

☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

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.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

1a (i) As the forward reaction is exothermic, a too high temperature will shift equilibrium position to the left and decrease the yield. While if temperature is too low the reaction rate will be very slow. So a moderate temperature is used.

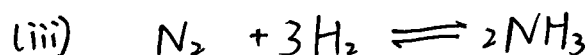
(ii) Total kinetic energy of molecules.

(iii) (1) carbon monoxide and hydrogen

(2) Methanol.

b (i) By fractional distillation of liquidified air

(ii) To conserve energy and save costs for burning fuels to obtain enough energy. Also prevent discharging hot waste water to the environment.

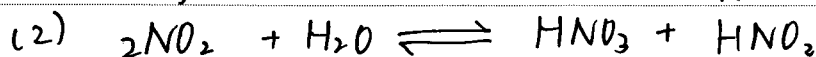
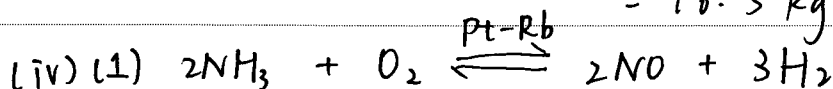


$$\text{No. of moles of N}_2 = \frac{420}{28} = 15$$

$$\text{No. of moles of H}_2 = \frac{96}{2} = 48 \text{ (excess)}$$

$$\text{No. of mole of NH}_3 \text{ produced} : 15 \times 2 \times 0.15 = 4.5$$

$$\text{Mass of NH}_3 : 4.5 \times (14 + 3) = 76.5 \text{ kg.}$$



寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

本頁積分 Page total

試題編號 Question No.

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

☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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.

1c(i) When $[HCl]$ is tripled and $[C_{12}H_{22}O_{11}]$ remain constant, the initial rate is tripled. The order of reaction with respect to $[HCl]$ is 1.

When $[C_{12}H_{22}O_{11}]$ is doubled and $[HCl]$ is doubled, the reaction rate is multiplied by 4 times.

As $[HCl]$ is first order, $[C_{12}H_{22}O_{11}]$ should also be 1. ^{the order of reaction with respect to}

$$(2) \text{ Rate} = k[HCl][C_{12}H_{22}O_{11}]$$

$$(3) \quad 6 \times 10^{-7} = k[0.1][0.01]$$

$$k = 6 \times 10^{-4} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$$

(ii) It lowers the activation energy needed for reaction, so that the reaction rate can be increased.

(iii) Hydrolysis of starch gives glucose as the only product which means its atom economy is 100%. High atom economy make it greener.

Enzymatic hydrolysis of starch does not use harmful reagents such as HCl which is used in hydrolysis of sucrose.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

本頁積分 Page total

試題編號 Question No.

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

☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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.

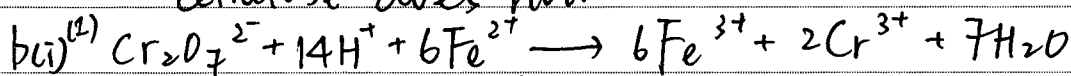
3a(i) NaOH is a deliquescent, it absorb water from air

lii) Add HCl to the solution, a greenish-yellow gas will evolved which is chlorine, if hypochlorite ions are presented. ^{and even dissolve itself.}

liii) Similarity: Both of them will give a broad absorption at wave number 3230 to 3670 cm⁻¹ ^{indicate the O-H group}

Difference: Only chitin will give an absorption at wave number 1680 to 1800 cm⁻¹ ^{due to the C=O group} while

cellulose does not.



$$(2) \text{ No. of mole of } \text{Fe}^{2+} \text{ used: } 0.0642 \times 0.02688 = 1.73 \times 10^{-3}$$

$$\text{No. of mole } \text{Cr}_2\text{O}_7^{2-} = \frac{1.73 \times 10^{-3}}{6} = 2.88 \times 10^{-4}$$

$$\text{Molarity} = \frac{2.88 \times 10^{-4}}{0.025} = 0.0115 \text{ M}$$

3b(ii) It is complimentary to the orange colour of dichromate solution.

(2) The absorbance increase with the concentration of $\text{Cr}_2\text{O}_7^{2-}$.

(3) Molarity of the diluted sample = 0.0007 M

$$\text{Before dilution: } 0.0007 \times 100 = 0.07 \text{ M}$$

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

本頁積分 Page total

--

試題編號 Question No.

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

☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
--------------------------	--------------------------	-------------------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

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.

(iii)

Titration is more appropriate. As the colour ^{intensity} is too ^{light} to be determined by colorimetry.

c Li) X gives a strong peak at m/e = 43 while Y gives a strong peak at m/e = 91. The ester group in X has high tendency to be broken and giving $[CH_3CO]^+$ at m/e = 43. While The carboxyl group in Y is likely to be bombarded out, leaving $[C_6H_5]^+$ at m/e = 91.

(ii) (1) Place the solution mixture in a separating funnel.

Add Na_2CO_3 solution until no more gas bubbles evolved. Allow the solution stand and separate into two layers. As Y can react with Na_2CO_3 they together form the lower aqueous layer while X in the upper organic layer. Run-off the lower ^{aq} layer into a beaker. Add HCl to the solution so as to provide hydrogen ion for Y and turn it from salt to acid again.

Carry out fractional distillation to distillate out Y. Heat ^{small amount of on an evaporating dish} distillate until all water evaporates. Solid Y is then obtained.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。

Answers written in the margins will not be marked.

本頁積分 Page total

--

試題編號 Question No.												
1	2	3	4	5	6	7	8	9	10	11	12	
☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
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.

12). Melt: the solid directly ^{by applying heat} and record the temperature when it starts to melt. The melting point should be similar to 77°C.

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

本頁積分 Page total

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

本頁積分 Page total

--	--

