香港考試及評核局
Hong Kong Examinations and Assessment Authority

HKDSE 2018

# Candidates' Performance in Paper I (Q1 - 4, 10 - 14 )

8, 9 November 2018

# General and Common Weaknesses

- Weak in calculations
- Weak in conversion of units in calculations (e.g. $cm^3$ to $dm^3$)
- Weak in writing / balancing chemical equations.
- Confused with different types of chemical bondings and intermolecular interactions
- Confused with atoms, ions, and molecules

# General and Common Weaknesses

- Failed to describe chemical concepts / explaining chemical phenomenon clearly, precisely, and completely
- Unable to use the appropriate technical terminology
- Weak in planning synthetic schemes
- Did not read the questions carefully
- Gave ambiguous answers / incomplete answers

- Questions 1 – 4
  Chemistry (Part I) / CS (Chem)

# Q1 – Overall Good (CS: Fair)

1 (a)(i) correct: about three quarters (Chem)

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

Let $x$ be the percentage abundance of $^{6}Li$ in nature.

$$\frac{x \times 6 + (100 - x) \times 7}{100} = 6.9$$

$$6x + 700 - 7x = 690$$

$$-x = -10$$

$$x = 10$$

∴ the percentage abundance of $^{6}Li$ in nature is 10%.

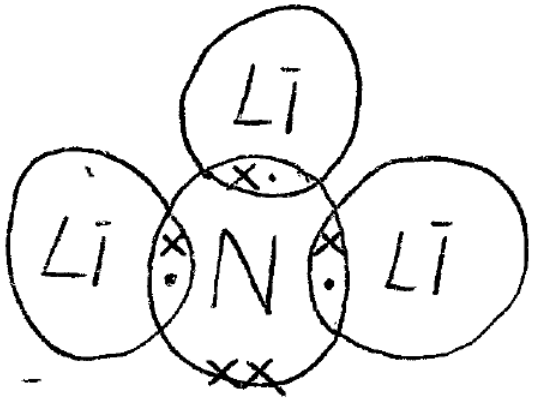
# 1 (a)(ii) correct: about half (Chem)

*Common mistake:* *$Li_3N$ is a covalent compound*

*Wrong number of electrons*

*"-3" charges for nitride ion*

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



# 1 (b) correct: about ¾ (Chem)

*Some failed to give a correct chemical equation:*

(b) In an experiment, 1.25 g of lithium nitride is formed when a piece of lithium is burnt in air.

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

$4 Li_3N + 3O_2 \longrightarrow 6Li_2O + 2N_2$

CHEM – E2

# 1 (b) correct: about ¾ (Chem)

(ii) 計算與氮反應了的鋰的質量。
(相對原子質量: Li = 6.9, N = 14.0)

~~Li mol:~~

$Li_3N$ mol : $\frac{1.25}{(3\times 6.9 + 14)} = 0.036$ mol

Li mol : $0.036 \times \frac{6}{2} = 0.108$ mol

設鋰質量 = X

$\frac{X}{6.9} = 0.108$ mol

$X = 0.1456$

答：氮反應了 0.15 g 鋰。

CHEM – C2

*Some confused with the ratio between Li and N*

# 1 (c) correct: a high proportion (Chem)

(c) 寫出當鋰在空氣中燃燒時，亦會生成的另一個化合物的名稱。

氧化鋰

CS(CHEM) – C2

*Some gave "$Li_2O$" instead of the compound name*

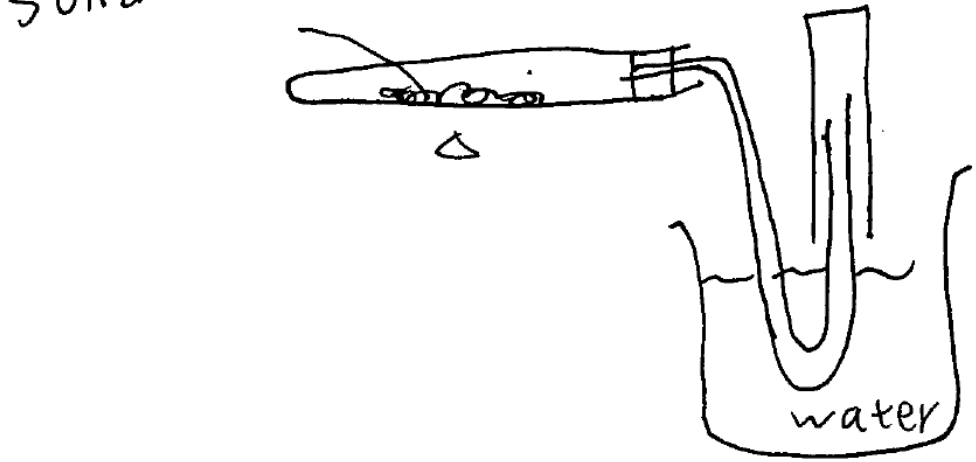
# Q2 – Overall Satisfactory (CS: Fair)

2 (a) correct: about one third (Chem)

*Common mistake: Collect by displacement of water*

*Mixing $NH_4Cl$ and $Ca(OH)_2$ in solution*

(a) Solid calcium hydroxide reacts with solid ammonium chloride to form ammonia gas. Draw a labelled diagram to show the set-up involved and how ammonia gas is collected.



# 2 (b)(i) correct: less than half (Chem)

*Common mistake: Unable to give a correct/complete explanation*

(i) Briefly explain why the water containing phenolphthalein was sucked into the flask.

The gas pressure in the flask is lower than the atmospheric pressure outside the flask.

CHEM – E3

(i) Briefly explain why the water containing phenolphthalein was sucked into the flask.

Ammonium gas dissolves in water and increases the gas pressure in water.

CHEM – E4

# 2 (b)(ii) correct: less than half (Chem)

*Common mistake: Did not give any explanation*

*Wrongly stated $NH_4^+$ is alkaline*

(ii) 寫出在燒瓶內與酚酞有關的一項觀察，並加以解釋。

燒瓶內的酚酞會由無色轉為粉紅色，因為氨氣鹼性。

CS(CHEM) – C2

# Q3 – Overall Satisfactory (CS: Poor)

3 (a) correct: about half (Chem) / 20% (CS)

*Common mistake:*

- *Ionic bonds exist between "$BaCl_2$ molecules"*
- *Ionic bonds exist between "Ba atoms" and "Cl atoms"*

(a) 解釋 $BaCl_2$ 抑或 $OCl_2$ 會具有較高熔點。

$BaCl_2$ 具較高熔點。

∵ $BaCl_2$ 具巨型離子結構，原子間以強大的離子鍵連結，需要更多能量才能破壞離子鍵

而 $OCl_2$ 是簡單分子結構，分子間只以微弱的范德華力連結，只需少量能力便足以把分子分離。

CHEM – C3

(a) Explain whether $BaCl_2$ or $OCl_2$ would have a higher melting point.

$BaCl_2$ would have a higher melting point.

$BaCl_2$ has a giant ionic structure while $OCl_2$ has a simple molecular structure. $BaCl_2$ ions are bonded by strong ionic bonds while $OCl_2$ molecules are bonded by weak van der Waals' forces. More energy is needed to break the strong ionic bonds in $BaCl_2$ than $OCl_2$.

CHEM – E3

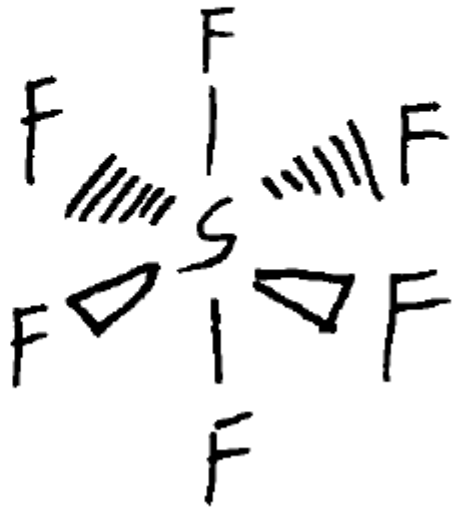
# 3 (b) correct: just less than half (Chem)

*Common mistake:*

- *Failed to state hydrogen bond is stronger than van der Waals' forces*
- *Wrongly stated van der Waals' forces between $PH_3$ are stronger than that between $CH_4$ because the molecular mass of $PH_3$ is higher than that of $CH_4$*
- *Some gave poorly presented answers which were difficult to understand*

# 3 (c) correct: about two thirds (Chem)

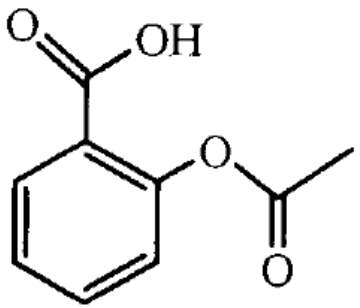
(c) 繪出代表 $SF_6$ 分子形狀的三維圖形。



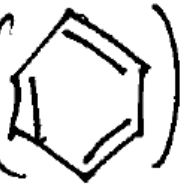

CHEM – C2

# 3 (b) (CS): answered quite poorly

(b) Aspirin is a pain-killer. Its structure is shown below :




(i) Name TWO functional groups in aspirin.

Benzene ring. 

carboxylic group (-COOH)

(ii) Explain why a suspension of aspirin and water can become clear when sodium hydrogencarbonate powder is added.

As carboxyl group of aspirin ionize in water to give out $H^+_{(aq)}$ to react with $NaHCO_{3(s)}$ (which dissolve in water), then gives out $CO_{2(g)}$, $H_2O_{(l)}$ only so no suspension is formed.

(4 marks)

CS(CHEM) – E5

# Q4 – Overall Good (CS: Fair)

4 (a) correct: less than half (Chem)

- *Some candidates failed to mention that petroleum was formed from marine organisms.*
- *Failed to mention the conditions for formation*

Petroleum is an important source of hydrocarbons.

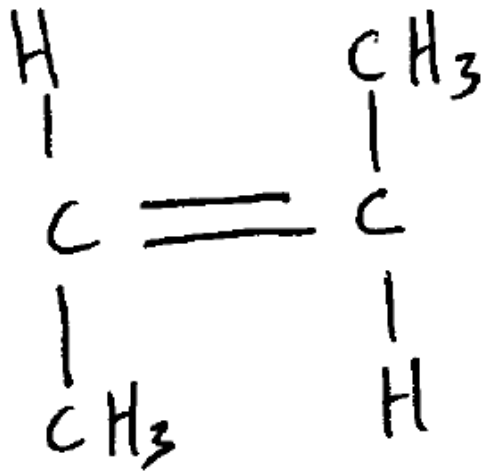
(a) Describe the origin of petroleum.

Petroleum is obtained from remains of aquatic life and swampy plants.

4 (b)(i) correct: high percentage (Chem)

4 (b)(ii) correct: two-thirds (Chem)

(i) 繪出 **E** (*反式*-異構體) 的結構。



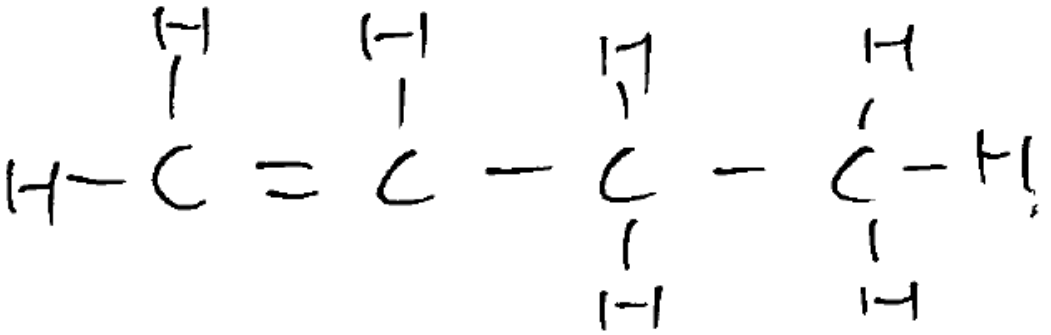
CHEM – C2

(ii) State the systematic name of one possible structure of **F**.

butene

CHEM – E3

(ii) State the systematic name of one possible structure of **F**.

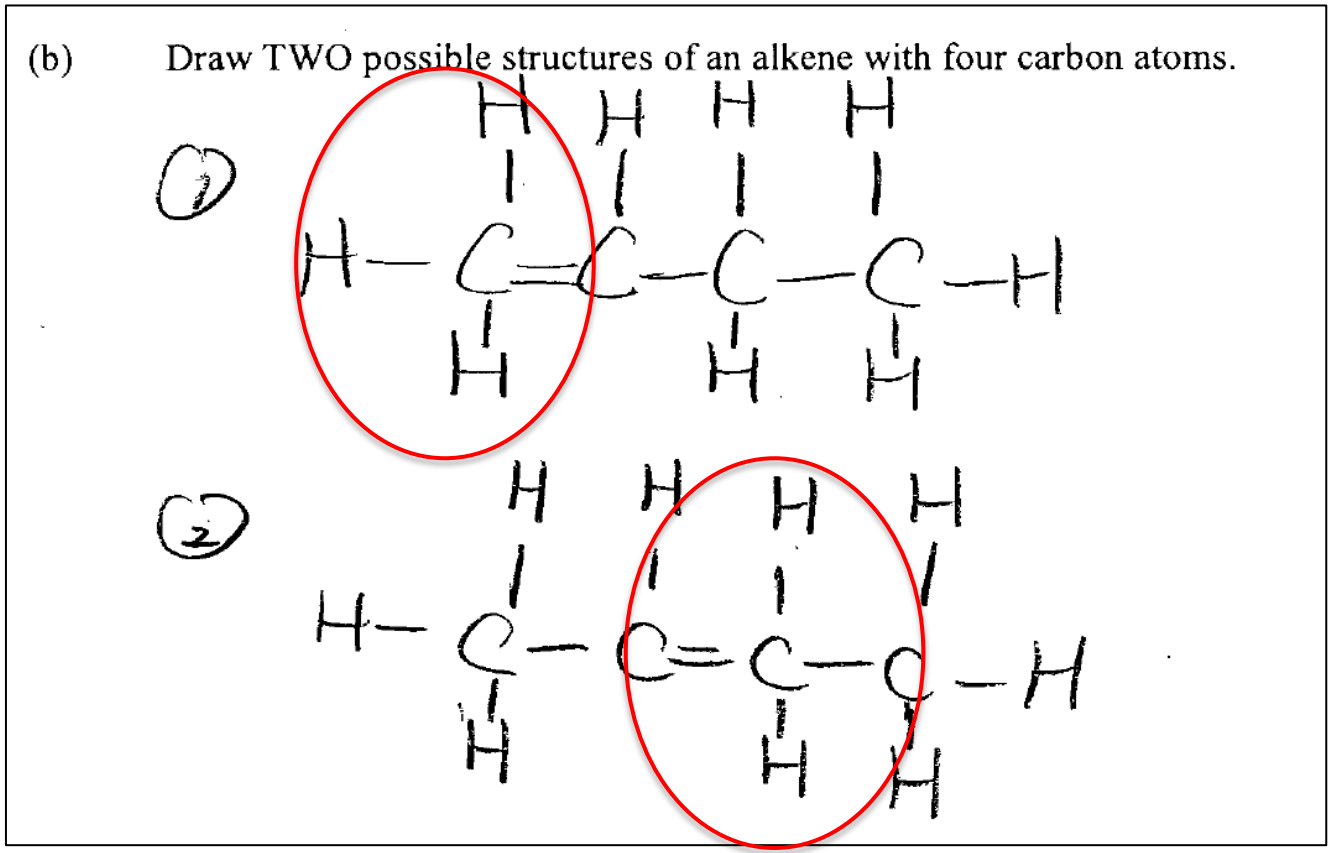


CHEM – E2

# 4 (b) correct: about 40%(CS)

*Common mistake:*

*- Incorrect number of bonds on carbon atoms*



# 4 (c)(i) correct: about 2/3 (Chem) / 8% (CS)

*Common mistake:*

*- (CHEM) – Failed to mention "catalyst"*

(c) Ethene and ethane are hydrocarbons.

(i) Suggest how ethene can be converted to ethane.

React with $H_2$.

CHEM – E3

* For CS, "catalyst" is not required.

(c) 乙烯和乙烷是碳氫化合物。

(i) 提出怎樣可把乙烯轉化為乙烷。

把乙烯與氫氣进行加成反应。

CS(CHEM) – C5

* For CS, “catalyst” is not required.

# 4 (c)(ii) correct: about 2/3 (Chem) / 40% (CS)

- *Common mistake:*
  *Ethane and ethene can be distinguished by $K_2Cr_2O_7/H^+$*
- *Incomplete/incorrect description of the expected observation*

- Questions 10 – 14
  Chemistry (Part II)

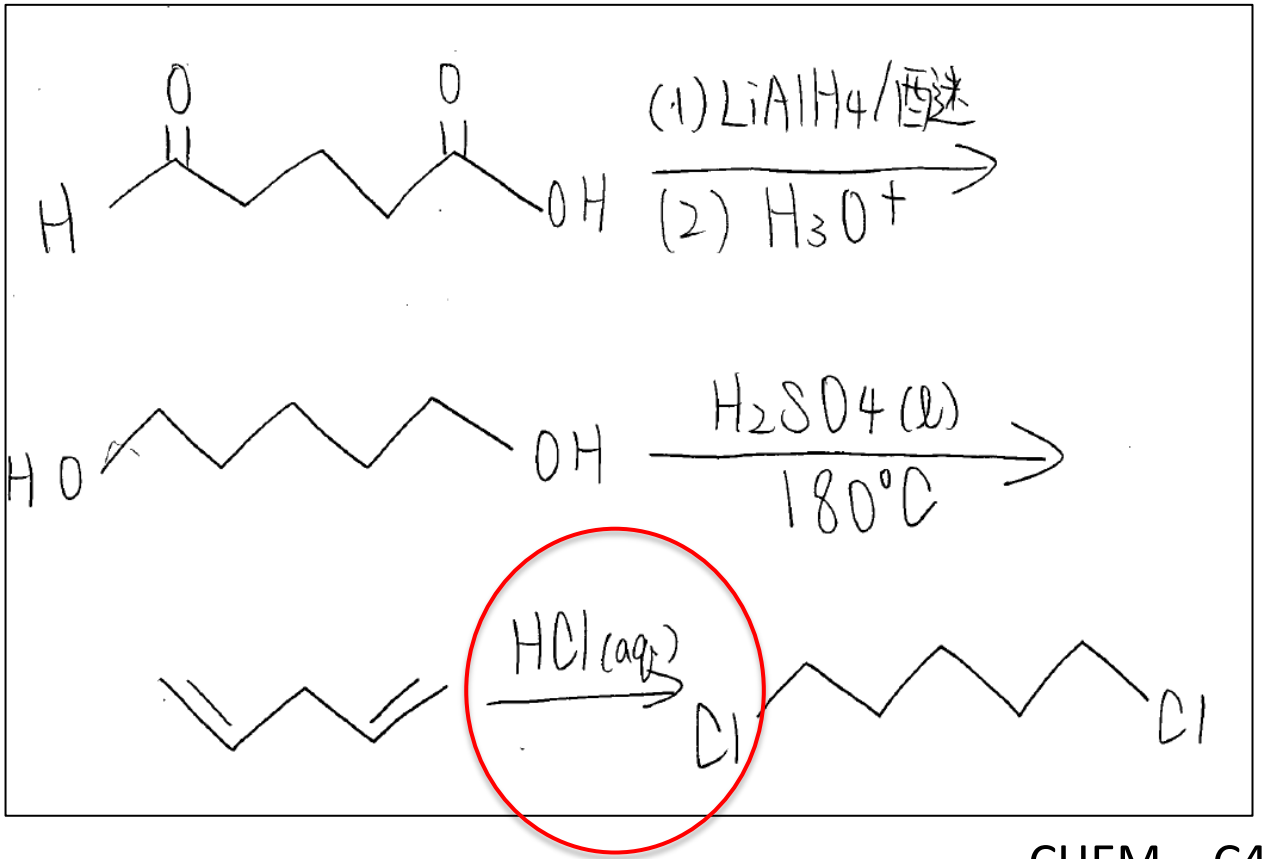
# Q10 – Satisfactory

Completely correct: about 1/3

*Common mistake:*

- *Missing / incorrect conditions for $LiAlH_4$*
- *Converting the intermediate pentane-1,5-diol into product using $Cl_2$*

# Commonly encounter alternative answer:




CHEM – C4

"For 2nd step, UV or peroxide is needed to achieve the expected selectivity"

# Q11 – Overall Satisfactory

11 (a)(i) correct: just below half

*Some candidates wrongly gave concentration of bromine as the answer.*

(a) 假設該參數對時間變化的速率可代表反應的速率。

(i) 根據以上曲線的形狀，提出這參數應是什麼。

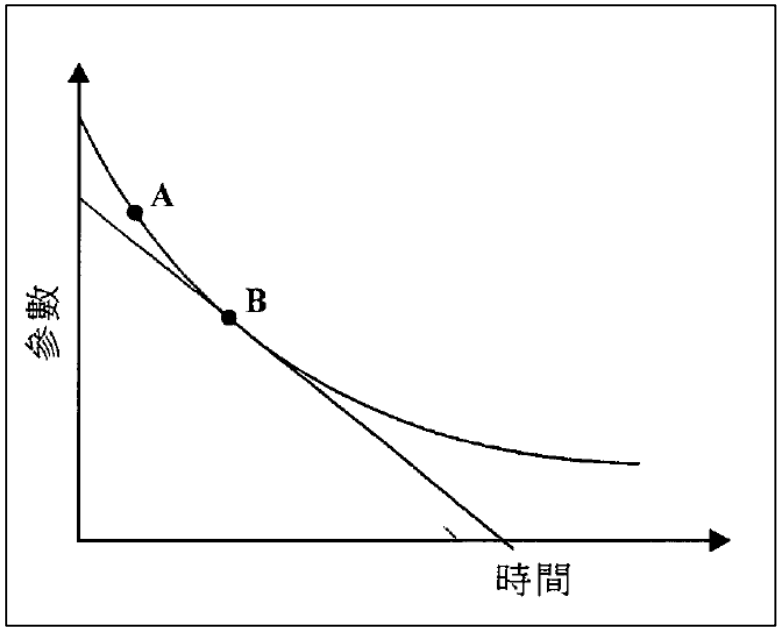
$Br_2(aq)$的濃度

CHEM – C3

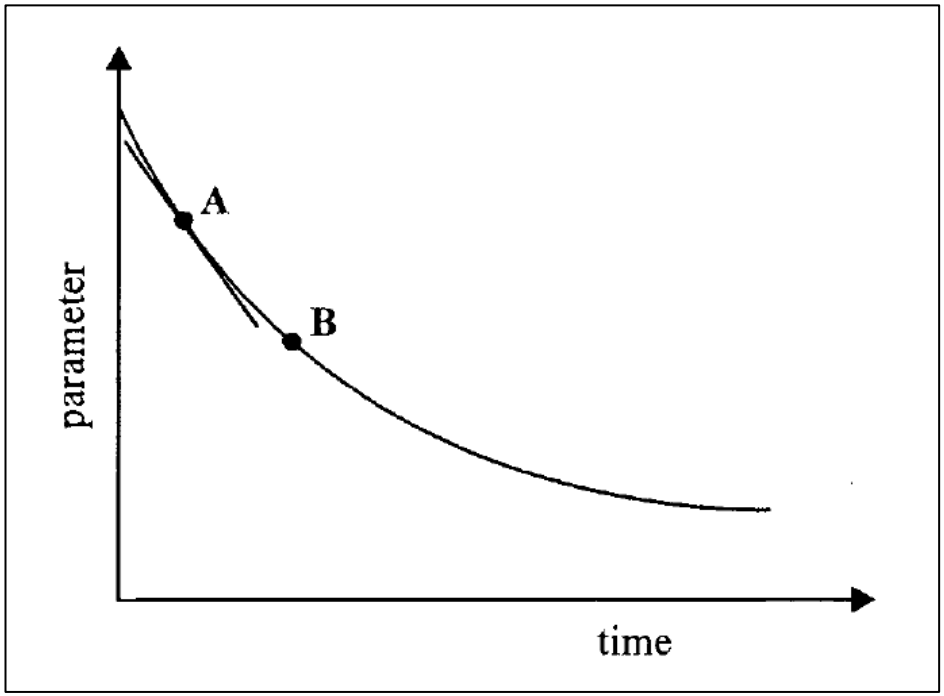
在一個研習 $Br_2(aq)$ 消耗速率的實驗中，把相同體積的 0.01 M $Br_2(aq)$ 和 1.0 M $HCO_2H(aq)$ 混合。使用比色計來量度該反應體系的某參數以跟隨這反應的進程，以下坐標圖顯示從反應開始的結果。

# 11 (a)(ii)

- *A high proportion of the candidates were able to correctly state the initial rate of the reaction can be obtained from the slope of the tangent.*
- *However, some candidates failed to draw the tangent on the graph correctly.*




CHEM – C3




CHEM – E3

# 11 (a)(iii)

- *About half of the candidates were able to explain the difference in rate between A and B in terms of effective collision frequency.*
- *Some failed to relate the parameter in the graph to the concentration of $Br_2$.*

(iii) According to the graph above, the rate of reaction at **A** is higher than that at **B**. Explain this at molecular level.

At A, concentration of $Br_2$ is higher than that at B. Thus, the collision frequency of molecules is higher at A. The rate of reaction is higher at A. (5 marks)

CHEM – E4

# 11 (b) correct: about 2/3

*Some candidates gave incomplete answers or vague answers*

(b) Suggest another method that can follow the progress of the reaction.

Measure the volume of gas produced in the reaction.

(1 mar

CHEM – E4

(b) 提出另一個可跟隨這反應進程的方法。

量度反應物的濃度 (1 分)

CHEM – C1

# Q12 – Overall Satisfactory

12 (a) correct: about half

Correct answers: Reduce fever

Reduce inflammation

Reduce risk of heart attack

Treating rheumatoid arthritis

12 (b)(i)

- About a third of the candidates were able to give a correct and complete answer.
- Some failed to state explicitly how sodium hydrogencarbonate reacts with aspirin.
- Some failed to state that a soluble (sodium) salt is formed.

(b) 解釋為什麼阿士匹靈和水的懸浮液，當加了碳酸氫鈉粉末後會變得清澈。

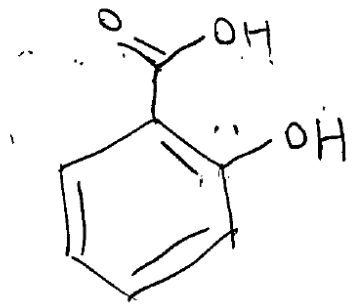
因為碳酸氫鈉跟阿士匹靈反應生成離子化合物，其於水的溶解度較高。

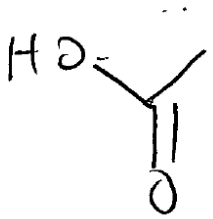
(2 分

CHEM – C4

# 12 (c)(i) correct: about half

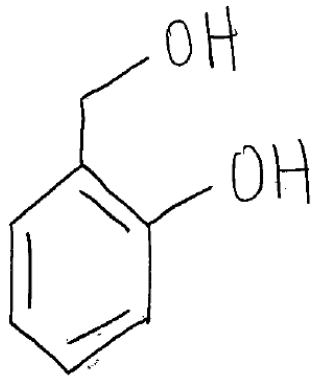
(i) Draw the structures of these two organic products.




CHEM – E5

(i) 繪出這兩個有機產物的結構。




$CH_3CH_2OH$

CHEM – C4

12 (c)(ii) correct: about half

- Some candidates wrongly stated because dilute acid is used in the reaction, and the acid is used up before the reaction goes to completion / the acid is not strong enough.

*Many students are not familiar with:*

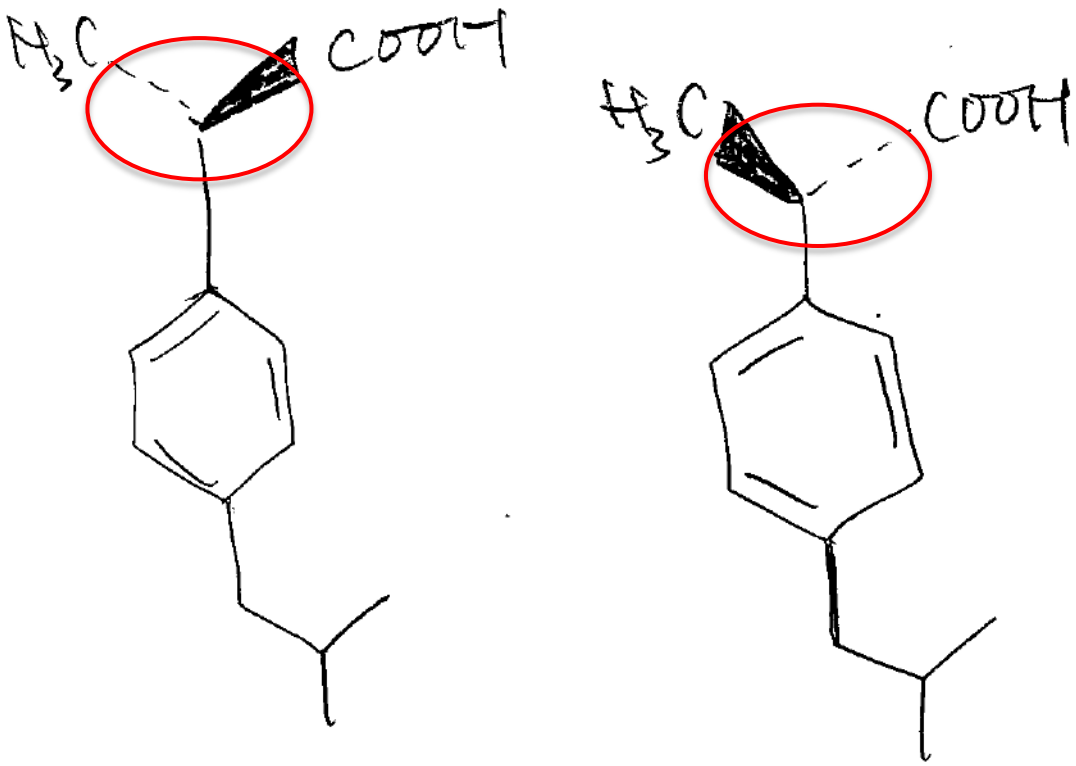
- *Hydrolysis of ester*
- *Reversible reactions / equilibrium*

# 12 (d) correct: about half

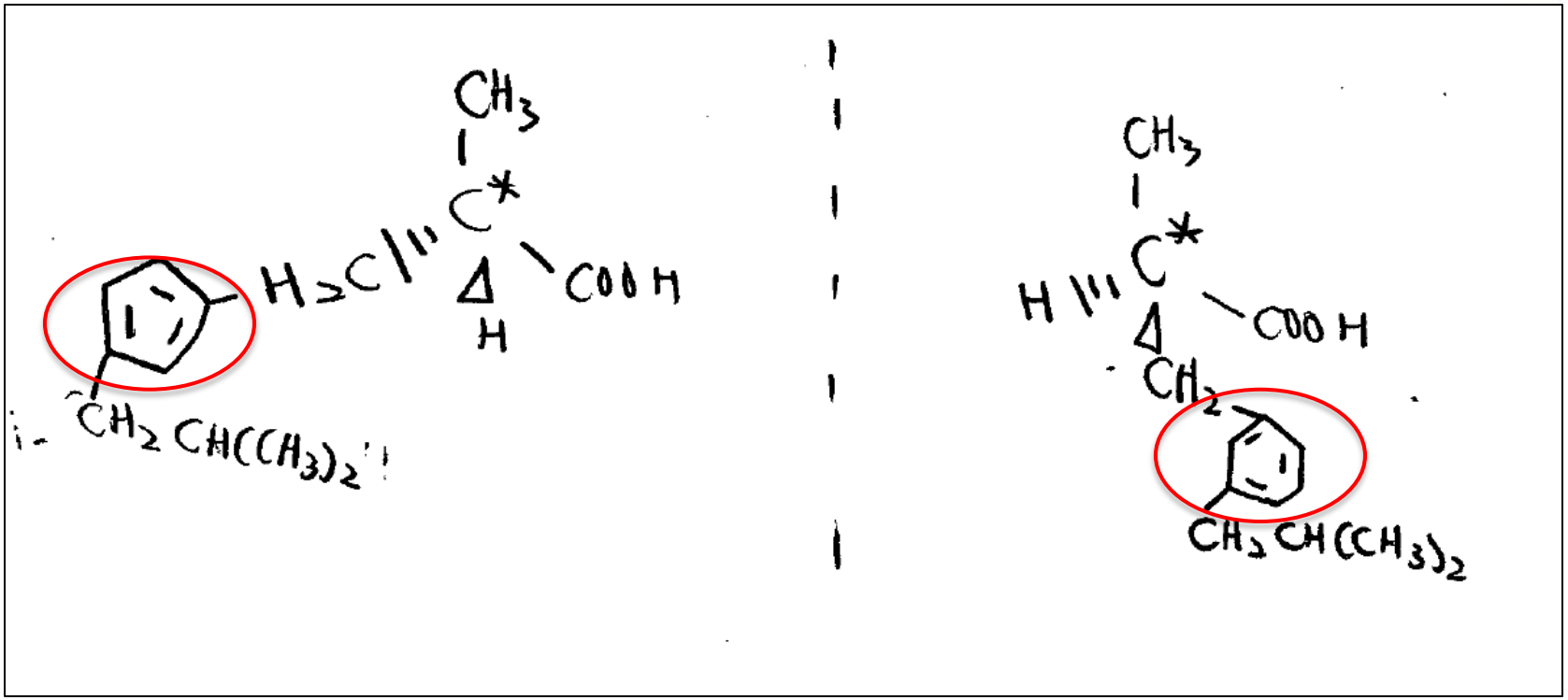
*Common mistake:*

- *careless mistakes in drawing the substituents that connected to the chiral center*
- *drew only one enantiomer in the answer*
- *gave two identical structures*

There exists enantiomerism in ibuprofen. Draw the three-dimensional stru
enantiomers.




CHEM – E4




CHEM – C3

# Q13 – Overall Satisfactory

13 (a) correct: just less than half

- Some candidates merely stated that the reaction attained equilibrium without clear elaboration.

(a) According to the graph, how do you know that the reaction is reversible ?

None of X, Y, Z is consumed completely after the reaction obtains an equilibrium at t = 25 minute (1

CHEM – E5

# 13 (b) correct: about 40%

*Common mistake:*

- *failed to extrapolate the correct final concentrations of **X**(g), **Y**(g) and **Z**(g) from the graph*
- *failed to work out the correct stoichiometric relationships between **X**(g), **Y**(g) and **Z**(g) from the given data*
- *Incorrect unit*

(b) Calculate the equilibrium constant $K_c$ for the reaction at the temperature of the experiment.

From the graph, Y was the reactant of forward reaction, X and Z is the product of forward reaction

The mole ratio of X : Z = 0.6 : 0.2

= 3 : 1

mole ratio of Z : Y = 0.2 : (0.7 − 0.3)

= 1 : 2

$$\therefore K_c = \frac{(0.6)^3 \times 0.2}{0.3^2} = 0.48 \text{ mol}^{-2}\text{dm}^6$$

(b) 計算在實驗溫度下這反應的平衡常數 $K_c$。

Y 的濃度下降 = 0.7 − 0.3

$= 0.4\ mol \cdot dm^{-3}$

X 的濃度上升 = $0.6\ mol \cdot dm^{-3}$

Z 的濃度上升 = $0.2\ mol \cdot dm^{-3}$

反應比例 Y : X : Z = 2 : 3 : 1

$$2Y_{(g)} \rightleftharpoons 3X_{(g)} + Z_{(g)}$$

$$\therefore K_c = \frac{[X_{(g)}]_{eqm}^{3} \cdot [Z_{(g)}]_{eqm}}{[Y_{(g)}]_{eqm}^{2}}$$

$$= \frac{0.6^3 \times 0.2}{0.4^2} = 0.27\ mol^2 \cdot dm^{-6}$$

uilibrium constant $K_c$ for the reaction at the temperature of the experim

$$2Y(g) \rightleftharpoons 3X(g) + Z(g)$$

$$K_c = \frac{[X(g)]^3[Z(g)]}{[Y(g)]^2}$$

$$= \frac{(0.6)^3(0.2)}{(0.3)^2}$$

$$= 0.48 \ mol^2 dm^{-6}$$

CHEM – E3

# 13 (c) correct: about 2/3

'*The rate of the forward reaction is zero at the 25th minute after the start of the reaction.*'

No, at 25th minute, equilibrium is reached. Rate of forward reaction equals to rate of backward reaction.

CHEM – E3

'*The rate of the forward reaction is zero at the 25th minute after the start of the reaction.*'

The reaction obtain an equilibrium state at t = 25. The forward and backward reaction at equilibrium state will not become zero according to the definition.

2. The comment is incorrect

(1 mark)

(Unclear answer)

CHEM – E5

# Q14 – Fair

Using $Na_2O$, $Al_2O_3$ and $SO_2$ as examples, illustrate the acid-base behaviour of the oxides of the third period elements with the aid of relevant reactions.

(6 marks)

- *About two thirds of the candidates were able to state that $Na_2O$ is basic, $Al_2O_3$ is amphoteric while $SO_2$ is acidic.*
- *Some failed to give the correct reactions when illustrating the acid-base behaviour of the oxides.*
- *Many candidates failed to give the correct spelling of 'amphoteric', and some candidates wrongly stated that $Al_2O_3$ is an 'atmospheric' oxide.*

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- Weak in conversion of units in calculations (e.g. $cm^3$ to $dm^3$)
- Weak in writing / balancing chemical equations.
- Confused with different types of chemical bondings and intermolecular interactions
- Confused with atoms, ions, and molecules

# General and Common Weaknesses

- Failed to describe chemical concepts / explaining chemical phenomenon clearly, precisely, and completely
- Unable to use the appropriate technical terminology
- Weak in planning synthetic schemes
- Did not read the questions carefully
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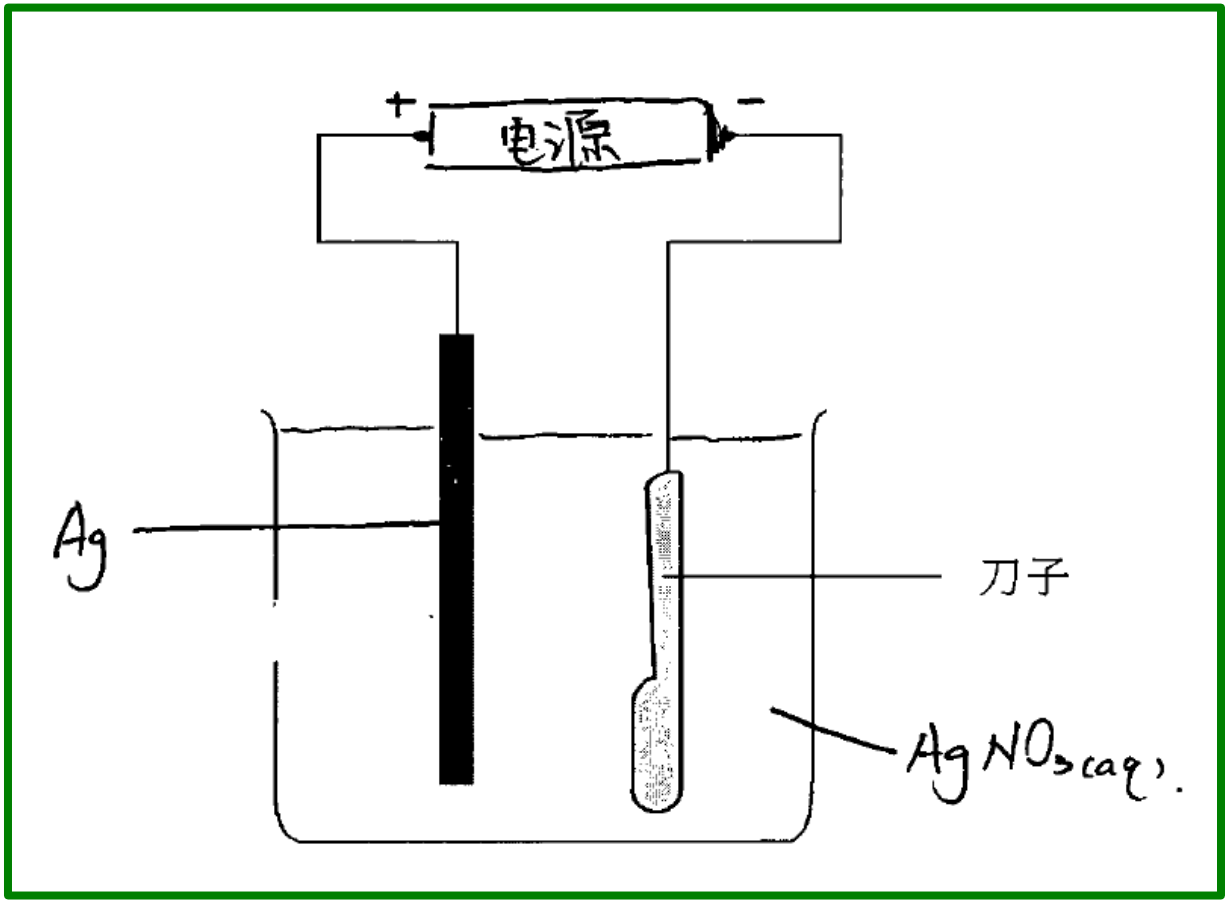
# HKDSE 2018 卷 I

## 第 5 至 9 題

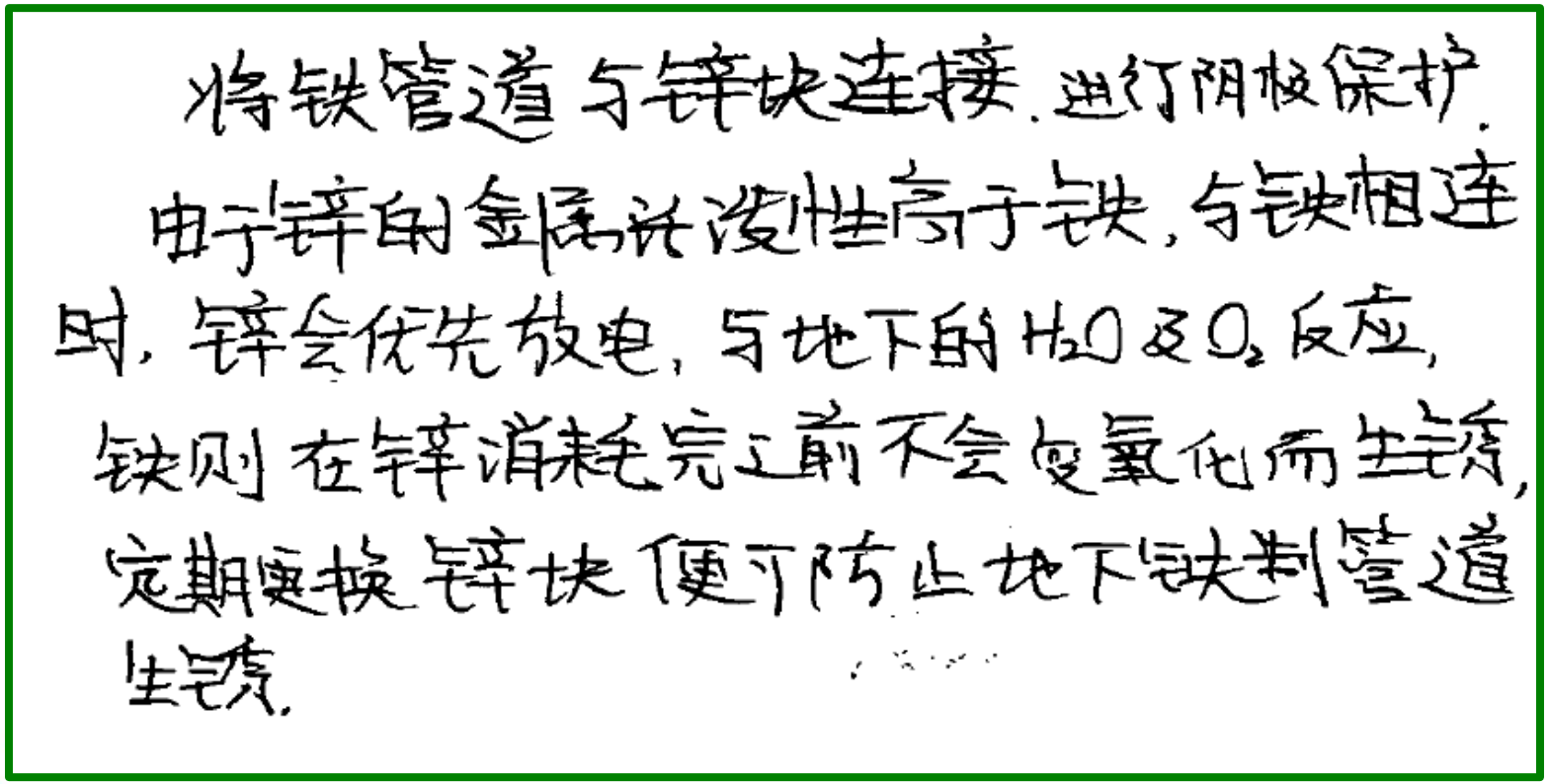
# 題5 表現良好

(a) 約2/3考生能夠正確完成實驗裝置的繪圖



# 題5 表現良好

(b) 約1/3考生描述一個可保護該鐵製管道的合適方法，其中只有1/4考生能提供正確解釋。



# 題5 表現良好

(b) 為數不多的考生提供以下答案：

「使用導線把鐵製管道接到電池的陰極...作保護」

「使用不銹鋼水管...」

「使用合金水管...」

# 題 6 (a)表現尚可

(i) 頗高比例考生能夠寫出正確的化學式。

$$6\,CO_{2(g)} + 6\,H_2O_{(l)} \longrightarrow C_6H_{12}O_{6(s)} + 6\,O_{2(g)}.$$

(ii) 約有50%的考生能夠正確計算所需的標準焓變 (+2,806 kJ $mol^{-1}$)

(iii) 能量轉換？

由熱能轉化成勢能。

# 題 6(b) 這個考生做得好嗎？

燃燒的甲醇的摩尔数 $= \frac{1.58}{32}$

$= 0.0494\ mol$

燃燒甲醇釋放的能量 $= 0.0494 \times 715$

$= 35.3\ kJ$

該水上升 1°C 所需能量 $= \frac{35.3}{18.5}$

$= 1.91\ kJ$

燃燒庚烷釋放的能量 $= 1.91 \times 25.8$

$= 49.2\ kJ$

庚烷的摩尔数 $= \frac{1.02}{100} = 0.0102\ mol$

庚烷的燃燒焓变 $= \frac{-49.2}{0.0102} = -4826.82\ kJ \cdot mol^{-1}$

# 題 7 表現令人滿意

(a)「錐形瓶」、「容量瓶」、「燒杯」、「滴定管」

(b) 約50%的考生能夠正確說明在滴定終點的顏色變化。錯誤答案：「黃變紅」

(c) 約2/3考生能夠正確計算「結晶水的數目」

(d) 約50%考生能夠描述「標準溶液」一詞的準確意義。錯誤答案：「已知體積」

# 題 7(c)
# 這個考生做得好嗎？

設結晶水的數目為 $18n$

$$Na_2B_4O_7 \cdot nH_2O + 2HCl \longrightarrow 2NaCl + H_2B_4O_7$$

$$\frac{0.452}{\dfrac{(23\times2+10.8\times4+16\times7+18n)}{0.125 \times \frac{18.98}{1000}}} = \frac{1}{2}$$

$$\frac{0.452}{201.2+18n} = 1.18625\times10^{-3}$$

$$0.452 = 0.2386735 + 0.021325n$$

$$n = 9.990703665$$

$$= 10.00 \text{ (至三位有效數字)}$$

∴ 結晶水的數目是 10

(3 分)

# 題 8 (a) 表現令人滿意

強酸是指在水中能夠完全电离產 $H^+$ 的酸

「酸濃度高的溶液」

「 pH 低於5的溶液」

「 酸的$H^+(aq)$ 在水中完全電離」

「完全離解生成 $H^+$」

# Q 8 (a)

when stronge acid dissolve in water, it can release all $H^+$ to water

酸的氫離子全部溶解。

completely Tonize In water to give out $H^+$

# Q 8 (b)

(b) When concentrated HCl(aq) is dropped into $KMnO_4(s)$, a yellowish green gas is formed.

(i) What is the yellowish green gas ?

$I^{2+}$ .

(ii) Explain whether the reaction forming the yellowish green gas is a redox reaction

Yes because oxygen is oxidated in the reaction.

# 題 8 表現令人滿意

(b) 該氣體是「氯」

(c) 約50%考生能夠正確描述預期的觀察，但其中只有約1/3考生能夠正確寫出離子方程式來代表該變化。

(d) 只有1/3考生能夠 *指出及解釋* 為什麼該實驗應在煙櫥內進行。

「有毒」≠「有害」

"theme cupboard"，"playground"，

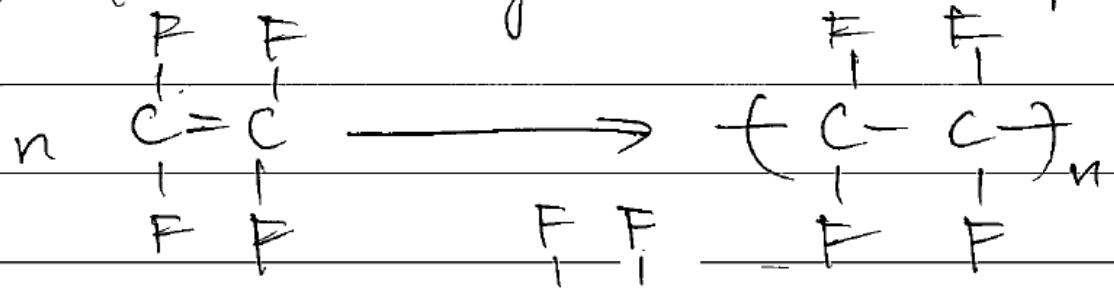
「廚窗」,「通風良好的實驗室」

# 題 9 表現尚可

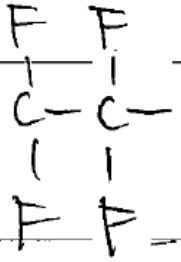
四氟乙烯是進行加成聚合作用，生成特氟綸。
這類反應中，是沒有消去任何分子，並由每一个分子
加合而成。
它們 具有 C=C 或 C≡C 官能，而四氟乙烯便
是 C=C 双官能。
它們是与自己進行反應，不需要如尼龍等兩个分子相連。

# Q9

Tetrafluoroethene undergoes addition polymerisation which its carbon-carbon double bond is broken and join together repeatedly to form a long and linear polymer chain



The monomer is



# 題 9 表現尚可

問：考生能使用有系統的方式來展示答案？

問：考生能分辨以下專有名詞？

碳碳雙鍵 / 重複單位 / 單體 / 聚合物 / 反應物 / 生成物

注意事項：

- 提供矛盾答案
- 使用不精確詞彙
  - 稀生性保護、烯鍵、蒸法、素膠
- 考生在頁面邊界以外書寫／繪圖

# 多謝