

香港中學文憑考試 化學科 練習卷

學生表現示例

表現良好 示例一：卷一 乙部 第1題

第一部分

各題均須作答。把答案寫在預留的空位內。

1. 一個製備水合硫酸鋅的實驗涉及以下五個步驟：

- 步驟1：把30 cm³稀硫酸盛於燒杯中微熱；再把氧化鋅加進酸中直至過量。
- 步驟2：過濾反應混合物，並收集濾液。
- 步驟3：把濾液加熱直至它變得飽和；然後讓它冷卻至室溫以結晶出水合硫酸鋅。
- 步驟4：過濾所形成的晶體；然後用少量冷的蒸餾水沖洗晶體。
- 步驟5：弄乾晶體。

(a) 就步驟1，

(i) 寫出所發生反應的化學方程式；



(ii) 提出如何可知道氧化鋅為過量；

加至固體氧化鋅不再溶解，有沉澱物。

(iii) 解釋為什麼所用過量試劑是氧化鋅，而不是硫酸。

過量硫酸會使生成的鹽(硫酸鋅)污染。
過量氧化鋅可過濾除去。

(3分)

(b) 建議一個方法來顯示在步驟3已得到一個飽和溶液。

用玻璃棒沾溶液，
若有小晶體在玻璃棒生成，
即是飽和溶液。

(1分)

(c) 解釋為什麼在步驟4用少量冷的蒸餾水來沖洗晶體。

要少量，避免沖走晶體。
冷水，避免溶解晶體。
蒸餾水，避免粘附上雜質。

(2分)

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

(續後頁)

表現良好 示例一：卷一 乙部 第1題

1. (d) 就步驟5，建議一個方法來弄乾晶體。

放入烘箱

X

(1分)

(e) 提出一個可用來替代氧化鋅以進行這實驗的化學物品。

鋅

✓

(1分)

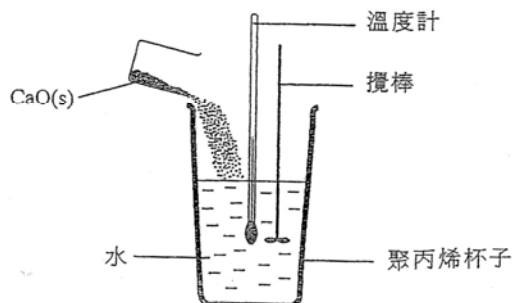
寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

表現良好 示例二：卷一 乙部 第7題

7. (a) 某學生做一個實驗來測定氧化鈣與水反應的焓變。下圖顯示所用的裝置：



實驗結果如下：

所用 CaO(s) 的質量	= 3.0 g
杯中水的體積	= 50.0 cm ³
杯中水的起始溫度	= 28.2°C
所生成 Ca(OH) ₂ (aq) 達致的最高溫度	= 46.7°C

- (i) 計算在實驗條件下，氧化鈣與水反應的焓變（以 kJ mol⁻¹ 為單位）。
 （假設：水的密度是 1.0 g cm⁻³，所生成 Ca(OH)₂(aq) 的比熱容是 4.2 J g⁻¹ K⁻¹；
 所用聚丙烯杯子、溫度計和攪棒的熱容均小至可略去不計。）

解：
 $m_{\text{水}} = 50.0 \times 1.0 = 50.0 \text{ g}$, $\Delta T = 46.7 - 28.2 = 18.5^\circ\text{C}$
 $\therefore \text{熱量} = mc\Delta T = 50.0 \times 4.2 \times 18.5 = 3885 \text{ J} = 3.885 \text{ kJ}$
 $\text{CaO 的摩子數} = \frac{3.0}{56.1} \approx 0.05 \text{ mol}$
 所以 CaO 与水反应的焓变 = $\frac{3.885}{0.05} \approx -77.6 \text{ kJ/mol}$
 (反应放热, 焓变取负值)

- (ii) 根據文獻，這反應的 ΔH^\ominus 是 $-82.2 \text{ kJ mol}^{-1}$ 。就文獻中的值與在 (i) 得到的值之間的差異，提出一項合理解釋。

反应时杯子的顶部没有密封，有一部分热量从空气中流失了，使得到的焓变减少了。

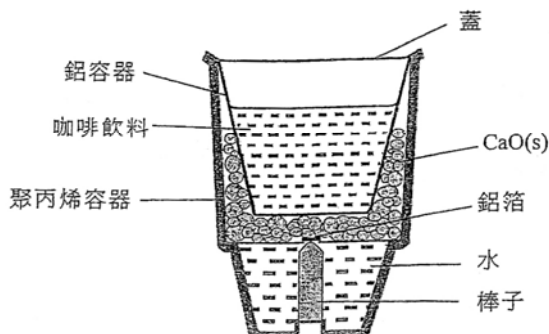
(5分)

寫於邊界以外的答案，將不予評閱。

(續後頁)

表現良好 示例二：卷一 乙部 第7題

7. (b) 下圖顯示一罐自熱咖啡飲料的設計。當罐底被擠壓時，棒子會刺破鋁箔而令水與氧化鈣混和，罐內的咖啡飲料便被加熱。



(i) 參照所涉及物料的性質，解釋為什麼

(I) 用聚丙烯容器來盛載氧化鈣。

聚丙烯擁有良好的密封性和保溫性，
既能防止CaO漏出也可以起保溫作用。

(II) 用鋁容器來盛載咖啡飲料。

鋁容器擁有良好的熱傳導率，
反應產生的熱能經傳遞快速加熱飲料。

(ii) 就使用氧化鈣於這類自熱飲料罐子，提出一項合理解釋。

氧化鈣比較廉價且與水反應的焓變較高，
可減低飲料的生產成本。

(4分)

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

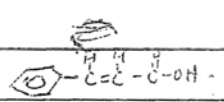
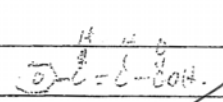
寫於邊界以外的答案，將不予評閱。

表現良好 示例三：卷二 第3題

丙	
(i) 羧基 (-COOH)	✓
(ii) 分液漏斗	✓
(iii) 步骤 1: 将不纯净的样品溶解于 NaOH 中, 其样品与 NaOH 反应, 能溶解生成羧酸盐, 溶解于 NaOH 溶液中	✓
步骤 2: 非极性有机杂质与己烷混合后, 溶解于己烷中, 可 X 则由于以羧酸盐形式存在, 故能留在水层。	
步骤 3: 加入 HCl, 目的是以酸, 将羧酸盐 还原 反应生成原来的有机羧酸 X, 但 X 不溶于水, 故形成油状。	✓
(iv) X 的可能结构为	
因为 X 能使 CH_2Cl_2 的 Br_2 褪色, 故 X 含有碳碳双键。	✓
而 X 的分子式为 $C_9H_{10}O_2$, 质量电荷比 148 的峰为分子离子峰;	✓
而 X 在 (a) 的过程中, 可推知含有羧基; 而在 (iv) 中, 质量电荷比为 77 的峰, 源自 $C_6H_5^+$, 为苯环结构, 而质量电荷比为 131 的峰则源自 $C_6H_5-CH=CH-CO^+$, 质量电荷比为 103 的峰则源自 $C_6H_5-CH=CH^+$,	✓
故 X 的可能结构为	
	✓

(續後頁)

表現良好 示例三：卷二 第3題

丙部	
(i) 羧基 (-COOH) ✓	1
(ii) 分液漏斗 ✓	1
(iii) 步驟 1: 將不純淨的樣本溶解於 NaOH 中, 其樣本與 NaOH 反應, 能溶解生成羧酸鹽, 溶解於 NaOH 溶液中 ✓	1
步驟 2: 非極性有機雜質與己烷摻勻後, 溶解於己烷中, 可 X 則由于以羧酸鹽的形式存在, 故能預成分層。	
步驟 3: 加入 HCl, 目的是以酸將羧酸鹽 反應 反應生成有機羧酸 X, 但 X 不溶于水, 故形成油滴。	1
(iv) X 的可能結構為	
	
因為 X 能與 CH_2Cl_2 的 Br_2 脫色, 故 X 含有碳碳 雙 雙鍵。 ✓	1
而 X 的分子式為 $\text{C}_9\text{H}_8\text{O}_2$, 質量電荷比 148 的峰為母離子峰; ✓	1
而 X 在 (a) 的過程中, 可推知含有羧基; 而在 (iv) 中, 質量電荷比為 77 的峰 m/z 源自 C_6H_5^+ 苯環結構, 而質量電荷比為 131 的峰則源自 $\text{C}_6\text{H}_5\text{CHCl}^+$, 質量電荷比為 163 的峰則源自 $\text{C}_6\text{H}_5\text{CH}=\text{CH}^+$ 。 ✓	1
故 X 的可能結構為	
	1

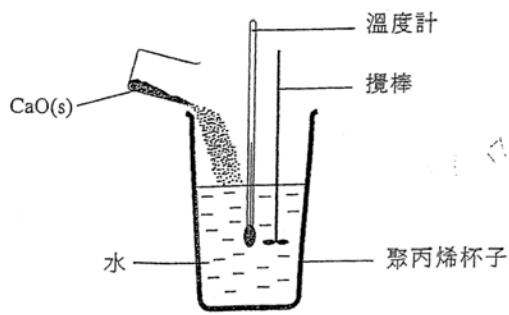
(續後頁)

表現良好 示例三：卷二 第3題

3 (a) (I)	在洗提液中, 加入甲基橙指示剂, 会形成 黄色 ^{高橙} 斑点。 X	
(II)	$R_f = \frac{9.5-3.0}{50-2.5-3.0}$ $= \frac{6.5}{44.5}$ ≈ 0.146	X
(III)	以柱层析法, 分离杂质	
(b) (i)	以少量的蒸馏水冲洗硫酸钡表面。	
(ii)	$\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4$ <p>∴ Ba^{2+} 与 BaSO_4 的摩尔比为 1:1</p> <p>∴ Ba^{2+} 与 BaSO_4 的质量比为 1:1</p> <p>∴ 在 BaSO_4 中, Ba^{2+} 的质量 = $\frac{137.3}{137.3+32.1+64} \times 0.291$</p> $\approx 0.171\text{g}$ <p>故原样本中 Ba^{2+} 的质量即为 0.171g.</p> <p>∴ Ba^{2+} 的质量百分率 = $\frac{0.171\text{g}}{0.305\text{g}} \times 100\%$</p> $\approx 56.1\%$	
(iii)	沉淀反应必须产生不溶于水的固体, 且以可溶性盐制备不溶性固体。	
	② 沉淀反应过程中产生的固体必须单一, 不能产生多种固体。	

表現中等 示例四：卷一 乙部 第7題

7. (a) 某學生做一個實驗來測定氧化鈣與水反應的焓變。下圖顯示所用的裝置：



實驗結果如下：

所用 CaO(s) 的質量	= 3.0 g
杯中水的體積	= 50.0 cm ³
杯中水的起始溫度	= 28.2°C
所生成 Ca(OH) ₂ (aq) 達致的最高溫度	= 46.7°C

Handwritten notes:
 J g⁻¹ K⁻¹
 K

(i) 計算在實驗條件下，氧化鈣與水反應的焓變 (以 kJ mol⁻¹ 為單位)。
 (假設：水的密度是 1.0 g cm⁻³，所生成 Ca(OH)₂(aq) 的比熱容是 4.2 J g⁻¹ K⁻¹；
 所用聚丙烯杯子、溫度計和攪棒的熱容均小至可略去不計。)

Handwritten calculation:

$$\Delta H^\ominus = MC \Delta T$$

$$= 3 \times \frac{100}{100} \times 60 \times 4.2 \times (28.2 - 46.7)$$

$$= 279720$$

$$= 27.97 \text{ kJ mol}^{-1}$$

(ii) 根據文獻，這反應的 ΔH^\ominus 是 -82.2 kJ mol⁻¹。就文獻中的值與在 (i) 得到的值之間的差異，提出一項合理解釋。

Handwritten explanation:
 因為熱流失至空氣 ✓

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

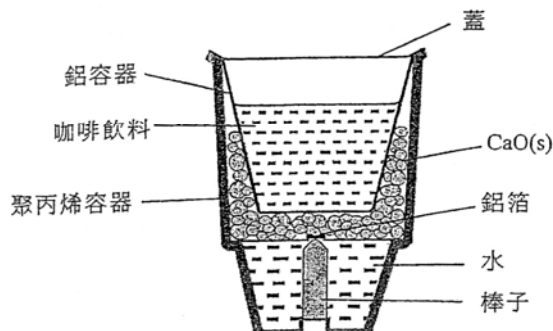
(5分)

寫於邊界以外的答案，將不予評閱。

(續後頁)

表現中等 示例四：卷一 乙部 第7題

7. (b) 下圖顯示一罐自熱咖啡飲料的設計。當罐底被擠壓時，棒子會刺破鋁箔而令水與氧化鈣混和，罐內的咖啡飲料便被加熱。



- (i) 參照所涉及物料的性質，解釋為什麼

(I) 用聚丙烯容器來盛載氧化鈣。

因為聚丙烯耐熱 ✓

(II) 用鋁容器來盛載咖啡飲料。

因為鋁抗腐蝕力強而且便宜，沒有毒性。 ✓

- (ii) 就使用氧化鈣於這類自熱飲料罐子，提出一項合理解釋。

因為氧化鈣和水作出的反應屬放熱反應。

(4分)

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

表現中等 示例五：卷二 第1題

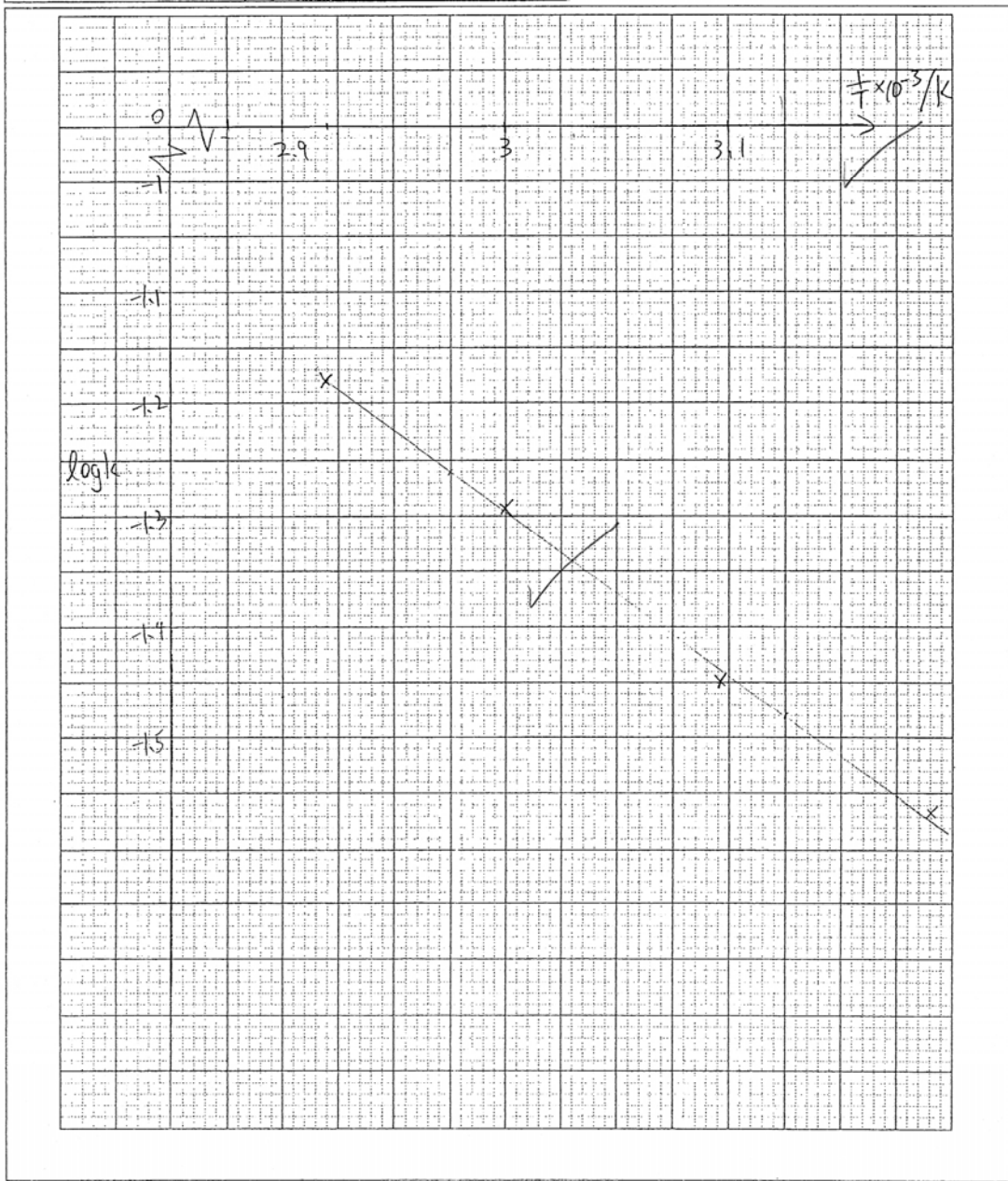
- (a) (i) 葉氏法能合成有效數量的L-抗壞血酸 X
- (ii) 還原作用 ✓
- (iii) I) 因為其他氧化劑較強 X
II) 因為過酸的环境会使酶失去催化功能 ✓
- (iv) 因為這方法直接將 KGA 轉化為 L-抗壞血酸, 能減少能源的耗用, 而且較環保
- b) (i) 從溫度 T 對應速率常數 k 的關係圖, 会得到一條穿過原點的直線, 而反應屬於一級 X
- (ii)
- | | | | | | |
|---------------------------|--------|--------|--------|--------|---|
| $\frac{1}{T} \times 10^3$ | 3.19 | 3.095 | 3.00 | 2.92 | |
| $\log k$ | -1.568 | -1.451 | -1.297 | -1.184 | ✓ |
- 斜率 = $-\frac{E_a}{2.3R}$ ✓
- $$\frac{-E_a}{2.3R} = \frac{-1.48 - (-1.26)}{(3.125 - 2.975) \times 10^{-3}}$$
- $$E_a = 28 \text{ kJ mol}^{-1} \quad \checkmark$$

請勿在此書寫。 Please do not write in the margin.

(續後頁)

表現中等 示例五：卷二 第1題

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.

(續後頁)

表現中等 示例五：卷二 第1題

(c) 濃鹽水中的 Cl^- 離子受正電荷的棒吸引，生成 Cl_2 ，
 方程式為 $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ ✓ 由於當中 Na^+ 離子
 可穿過透性膜，與注入的稀 NaOH 的 OH^- 生成
 NaOH 。水溶液中的 H^+ 被吸引到負電荷的棒生成
 氫氣，方程式為 $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ ✓

(ii) $\text{Cl}_2 + \text{NaOH} \rightarrow \text{NaOCl}^- + \text{Cl}^-$ X

(iii) 否，因為電解濃鹽水同時會釋出大量 Cl_2 ， Cl_2 是有
 毒的，帶酸性，同樣對空氣造成影響 ✓

請勿在此書寫。 Please do not write in the margin.

表現稍遜 示例六：卷一 乙部 第1題

第一部分

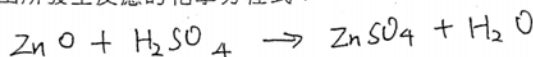
各題均須作答。把答案寫在預留的空位內。

1. 一個製備水合硫酸鋅的實驗涉及以下五個步驟：

- 步驟1：把30 cm³稀硫酸盛於燒杯中微熱；再把氧化鋅加進酸中直至過量。
 步驟2：過濾反應混合物，並收集濾液。
 步驟3：把濾液加熱直至它變得飽和；然後讓它冷卻至室溫以結晶出水合硫酸鋅。
 步驟4：過濾所形成的晶體；然後用少量冷的蒸餾水沖洗晶體。
 步驟5：弄乾晶體。

(a) 就步驟1，

(i) 寫出所發生反應的化學方程式：



(ii) 提出如何可知道氧化鋅為過量：

攪拌後，有氧化鋅未能溶於酸

(iii) 解釋為什麼所用過量試劑是氧化鋅，而不是硫酸。

因為為了所有硫酸也需氧化鋅產生反應，才可以結晶

(3分)

(b) 建議一個方法來顯示在步驟3已得到一個飽和溶液。

用玻璃棒攪碎渣液，變玻璃棒變色便飽和

(1分)

(c) 解釋為什麼在步驟4用少量冷的蒸餾水來沖洗晶體。

因為冷水能令晶體變冷卻，用少量水以免破壞晶體

(2分)

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

(續後頁)

表現稍遜 示例六：卷一 乙部 第1題

1. (d) 就步驟5，建議一個方法來弄乾晶體。
用乾布輕輕把晶體的水份吸收
X
(1分)

(e) 提出一個可用來替代氧化鋅以進行這實驗的化學物品。
氧化鋁
X
(1分)

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

表現稍遜 示例七：卷一 乙部 第2題

2. (a) 葡萄酒若盛於敞開的瓶一段時間後，會變得難以入口。提出為何如此。

因為葡萄酒與空氣產生反應，
使化學物改變，變得難以入口

(1分)

- (b) 一個常用來防止盛於已開瓶的葡萄酒變壞的方法，是把氫（一個化學活性低的氣體）注入瓶中，然後加上塞子。

- (i) 解釋為什麼氫的化學活性低。

因為氫是穩定氣體，
不容易產生反應

- (ii) 寫出用氫來防止葡萄酒變壞的原理。

氫能夠隔著空氣中的氧，
防止與葡萄酒產生反應

- (iii) 氮氣的化學活性也低。提出為什麼不用氮來防止盛於已開瓶的葡萄酒變壞。

氮氣對人體會造成傷害

(3分)

- (c) 另一個防止葡萄酒變壞的方法是從已開瓶的葡萄酒抽走空氣，然後加上塞子。提出使用這個方法來防止葡萄酒變壞的一項可能缺點。

令葡萄酒的氣壓變得不同

(1分)

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

寫於邊界以外的答案，將不予評閱。

表現稍遜 示例八：卷二 第2題

Answers written in the margins will not be marked.	2ai I II 4 ✓ III	Answers written in the margins will not be marked.
	ii 由于不同金属的原子大小亦不同，若加入其他较小体数的金属原子在铝金属原子间，其密度会上升，原子间的引力亦会随之增加。 X	
	III 可令机身变得更轻巧。 ✓	
	iii I II	

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

(續後頁)

表現稍遜 示例八：卷二 第2題

寫於邊界以外的答案，將不予評閱。 Answers written in the margins will not be marked.	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{C} = \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array} $	✓	寫於邊界以外的答案，將不予評閱。 Answers written in the margins will not be marked.	
	II 注冊法	✓		
	ii			
	II	与PS相比，SAN的碳鏈較長。分子間的引力較強，因此能承受比PS更高的溫度。		X
	iii	它是熱固性塑膠。它們的碳鏈以雙鍵連結，加上結構上它們是對映異構體。因此它們很剛硬，强度高，需要高能量才可將鏈合拆開。		✓

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

HKDSE Chemistry Practice Papers Samples of Student Performance

High Performance Sample 1: Paper 1 Section B Question 4

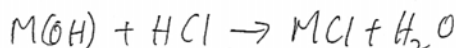
4. A student was given a sample of a water-soluble metal carbonate, $M_2CO_3(s)$. In order to deduce what M was, the student prepared a 100.0 cm^3 aqueous solution of the carbonate using 1.14 g of the sample. The student then withdrew several 10.0 cm^3 portions of the solution, and titrated each portion with $0.085 \text{ mol dm}^{-3} \text{ HCl(aq)}$ using methyl orange as indicator. The mean titre was 25.30 cm^3 .

(a) Describe how the 100.0 cm^3 aqueous solution was prepared.

Add 1.14 g of the sample to a 100 cm^3 volumetric flask. Add distilled water to the volumetric flask until the water level reach the graduation mark. Cover the flask and shake the flask up side down for a few times.

(3 marks)

(b) Based on the experimental results, determine the formula mass of M_2CO_3 and deduce what M is.



$$\text{molarity of } M = \frac{0.085 \times \frac{25.30}{1000}}{\frac{10}{1000}} = 0.21505 \text{ M}$$

$$\begin{aligned} \text{no. of mole of } M \text{ in } 1.14 \text{ g of sample} \\ = 0.21505 \times \frac{100}{1000} = 0.021505 \text{ mol.} \end{aligned}$$

Let x be the relative molecular mass of M.

$$\frac{1.14}{2x + 12 + 16 \times 3} \times 2 = 0.021505$$

$$x = 23.0$$

$$\therefore \text{The formula mass of } M_2CO_3 = 23 \times 2 + 12 + 16 \times 3 = 106$$

M is sodium

(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

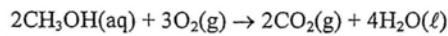
Answers written in the margins will not be marked.

High Performance Sample 2: Paper 1 Section B Question 8

8. The photograph below shows a laptop computer which is powered by Direct Methanol Fuel Cell (DMFC).



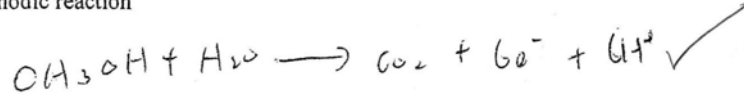
The operation of DMFC is based on the following reaction under an acidic condition:



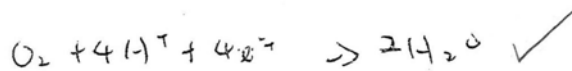
(a)

Write half-equations for the anodic and cathodic reactions when DMFC is producing a current.

anodic reaction oxi



cathodic reaction red +H⁺ H₂O



(b) A concentrated aqueous methanol solution is used as the fuel in DMFC.

(i) Suggest why pure methanol is NOT used.

It is because pure methanol is covalent molecules and it doesn't have mobile or delocalized electrons for the transmission of current.

(ii)

Circle TWO of the following hazard warning labels that should be displayed on the container of a concentrated aqueous methanol solution.



(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.

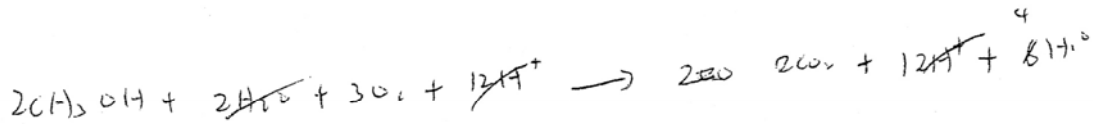
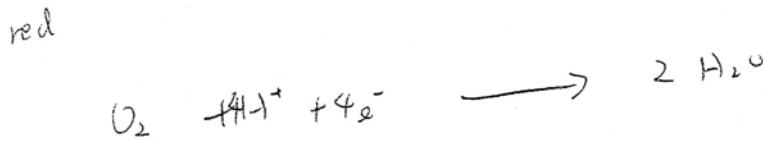
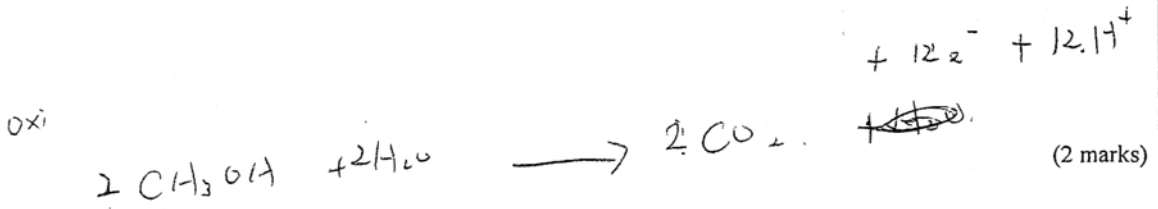
(cont'd)

High Performance Sample 2: Paper 1 Section B Question 8

8. (c) Would you expect DMFC to be widely used in powering laptop computers? Explain your answer.

No. It is because methanol is toxic and flammable. Once there's leakage. It is dangerous to human ~~with~~ and may cause fire under high temperature

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.

High Performance Sample 3: Paper 2 Question 1

(i) It synthesizes more vitamin C to meet the increasing demand due to rising population. ✓

(ii) Catalytic hydrogenation. ✓

(iii) (I) commonly oxidising agents can oxidize any hydroxyl group (-OH) in D-sorbitol so the product will involve a mixture of compound which may not be L-sorbose. ✓

(II) pH 4 to 6 are the optimum temperature for sorbitol dehydrogenase to work the best. (highest reaction rate)

(iv) This method involves no use of toxic reagent but the Reichstein process involves the use of toxic methanol. ✓

This method employs enzyme (gluconolactonase) but the Reichstein process involves no catalyst for forming L-ascorbic acid from KGA, so this process has lower energy requirement. ✓

(cont'd)

High Performance Sample 3: Paper 2 Question 1

(i) For first order reaction, the sum of orders of reaction with respect to different reactants is only 1. ^{that is} If the reaction involves only one reactant, the rate of reaction is directly proportional to the concentration of reagent.

$$(ii) \ln k = \ln A - \frac{E_a}{RT}$$

we can plot a graph of $\ln k$ against $\frac{1}{T}$, from the graph, the slope represents $-\frac{E_a}{R}$

Tabulation:

$\frac{1}{T} / \text{K}^{-1}$	3.20	3.10	3.00	2.92
$\ln k$	-3.61	-3.34	-2.99	-2.73

$$\text{From the graph, slope} = \frac{-2.99 - (-2.73)}{(3.00 - 2.92) \times 10^3}$$

$$= -3250 = -\frac{E_a}{R}$$

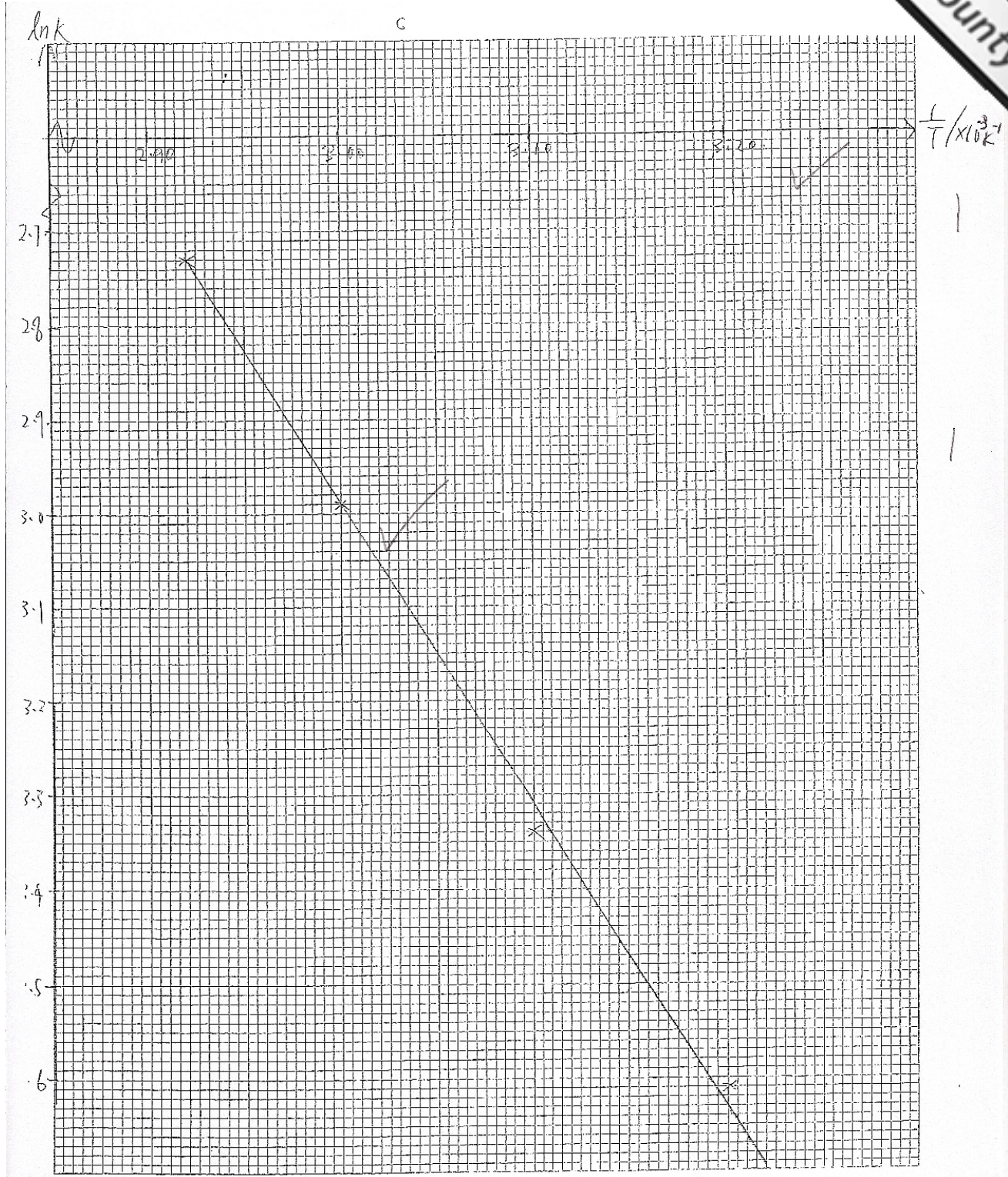
$$E_a = -(-3250) \times 8.31$$

$$= +27007.5 \text{ J mol}^{-1}$$

$$= +27.0 \text{ kJ mol}^{-1} //$$

(cont'd)

High Performance Sample 3: Paper 2 Question 1



(cont'd)

High Performance Sample 3: Paper 2 Question 1

(i) At anode, Cl^- and OH^- ions move to it, the concentration of Cl^- is much higher than OH^- , it is discharged due to concentration effect to form Cl_2 .



Excess Na^+ remains because Cl^- is discharged.

At cathode, Na^+ , H^+ ions move to it, the H^+ ions will be preferentially discharged because it has lower position than Na^+ in the electrochemical series, thus H_2 is formed.



As H^+ is discharged, excess OH^- remains.

The membrane only allows ~~the~~ Na^+ to move from anode compartment to cathode compartment, ^{but not gases, water and acids.} excess Na^+ can meet excess OH^- in cathode compartment resulting in concentrated NaOH .



(iii) I disagree with him because large amount of electrical energy is required to form a small amount of H_2 because the enthalpy of decomposition of H_2O into H_2 and O_2 is large. Manufacture of H_2 is done by steam-methane reforming process instead.

Mid Performance Sample 4: Paper 1 Section B Question 4

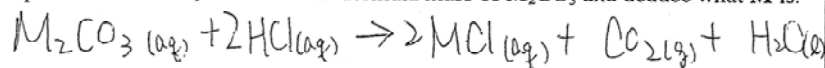
4. A student was given a sample of a water-soluble metal carbonate, $M_2CO_3(s)$. In order to deduce what M was, the student prepared a 100.0 cm^3 aqueous solution of the carbonate using 1.14 g of the sample. The student then withdrew several 10.0 cm^3 portions of the solution, and titrated each portion with $0.085 \text{ mol dm}^{-3}$ HCl(aq) using methyl orange as indicator. The mean titre was 25.30 cm^3 .

- (a) Describe how the 100.0 cm^3 aqueous solution was prepared.

Add the carbonate sample into a beaker with some deionized water. Stir the mixture and pour adequate amount of deionized water into the beaker until all solid sample completely dissolves in it. Pour the solution into a 100 cm^3 volumetric flask. Add more deionized water into the flask until the meniscus of the liquid surface reaches the graduation mark of 100 cm^3 on the volumetric flask.

(3 marks)

- (b) Based on the experimental results, determine the formula mass of M_2CO_3 and deduce what M is.



$$\begin{aligned} \text{Number of moles of HCl used} &= 0.085 \times (25.30 / 1000) \\ &= 2.1505 \times 10^{-3} \text{ mol} \end{aligned}$$

\therefore Number of moles of M_2CO_3 in the 10.0 cm^3 portion $>$
 Number of moles of HCl used = 1 : 2

$$\begin{aligned} \therefore \text{Number of moles of } M_2CO_3 \text{ in the } 10.0 \text{ cm}^3 \text{ portion} \\ &= (2.1505 \times 10^{-3}) \div 2 \\ &= 1.07525 \times 10^{-3} \text{ mol} \end{aligned}$$

$$\begin{aligned} \text{Number of moles of } M_2CO_3 \text{ in the sample} \\ &= (1.07525 \times 10^{-3}) \times 10 = 0.0107525 \text{ mol} \end{aligned}$$

$$\text{Formula mass of } M_2CO_3 = \frac{1.14}{0.0107525} = 106.0 \text{ g mol}^{-1}$$

Let m be the relative atomic mass of M

$$2m + 12.0 + 16.0 \times 3 = 106.0$$

$$m = 23.0$$

\therefore The relative atomic mass of M is 23.0 and M is Na

(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

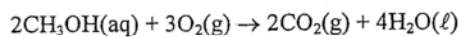
Answers written in the margins will not be marked.

Mid Performance Sample 5: Paper 1 Section B Question 8

8. The photograph below shows a laptop computer which is powered by Direct Methanol Fuel Cell (DMFC).

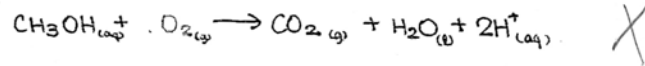


The operation of DMFC is based on the following reaction under an acidic condition:

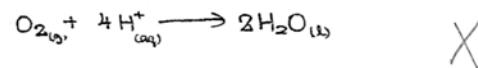


(a) Write half-equations for the anodic and cathodic reactions when DMFC is producing a current.

anodic reaction



cathodic reaction



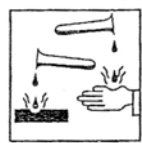
(2 marks)

(b) A concentrated aqueous methanol solution is used as the fuel in DMFC.

(i) Suggest why pure methanol is NOT used.

The cell must function under an acidic condition. ✓
Water must be present for acids to ionize to form H⁺ ions so a solution should be used.

(ii) Circle TWO of the following hazard warning labels that should be displayed on the container of a concentrated aqueous methanol solution.



CORROSIVE 腐蚀性



TOXIC 有毒



FLAMMABLE 易燃



OXIDISING 氧化性

(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.

(cont'd)

Mid Performance Sample 5: Paper 1 Section B Question 8

8. (c) Would you expect DMFC to be widely used in powering laptop computers? Explain your answer.

No.

Since the cell requires a continuous supply of methanol to function and is not rechargeable. It is inconvenient, to refill methanol solution into the laptop. A secondary cell will be more welcomed instead. ^{and quite dangerous}

(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.

Mid Performance Sample 6: Paper 2 Question 2

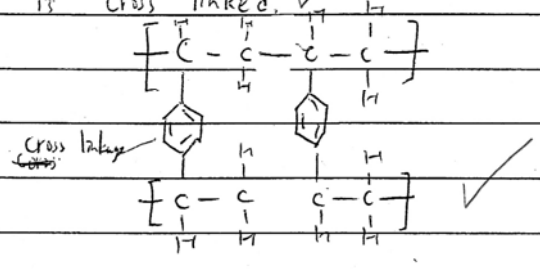
a i I)	Face-centred cubic ✓	
II)	The number of atoms in one unit cell = $\frac{1}{2} \times 6 + \frac{1}{8} \times 8 = 4$ ✓	
III)	The mass of a unit cell of aluminium = $\frac{27}{6.02 \times 10^{23}} \times 4 = 1.79 \times 10^{-22}$ g The density = $\frac{1.79 \times 10^{-22}}{(4.05 \times 10^{-10})^3} = 2.7 \times 10^6 \text{ g m}^{-3} = 2.7 \text{ g cm}^{-3}$ ✓	
ii I)	The atoms of another metal place in the empty of space of a aluminium cubic which increase the coordination number of atoms. The strength of aluminium alloy will increase. X	
II)	The alloy is <u>light</u>	
iii I)	Since the intermolecular force between layer is weak that can be easily break down ✓	
II)	For making chips X	
2 b i I)	 <chem>C=Cc1ccccc1</chem> ✓	
II)	Injection moulding ✓	
ii I)	Since there are chiral centres in the molecule, which form different enantiomers. The structure of SAN should be in 3-dimension to state the differences between enantiomers. X	

(cont'd)

Mid Performance Sample 6: Paper 2 Question 2

ii) Both polymer chain in SAN and PS are held by van der Waals' force. But the molecular size of SAN is larger than that of PS. Larger the molecular size, larger the van der Waals' force; SAN has stronger intermolecular force which required more energy to break down. Thus, it can withstand higher temperature.

b)iii) After polymerization of 1,4-divinylbenzene, it forms polymer chains which is cross linked.



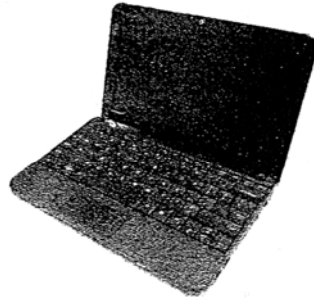
The cross linkage is a strong bond which do not break down even in high temperature. Also, the bulky effect on the cross link make the plastic material hard and rigid.

Thus the plastic not melt upon heat.

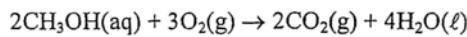
The hard and rigid properties are due to the cross-link between polymer chain.

Low Performance Sample 7: Paper 1 Section B Question 8

8. The photograph below shows a laptop computer which is powered by Direct Methanol Fuel Cell (DMFC).



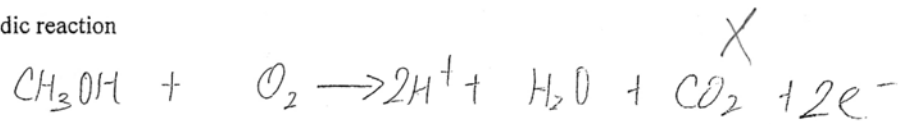
The operation of DMFC is based on the following reaction under an acidic condition:



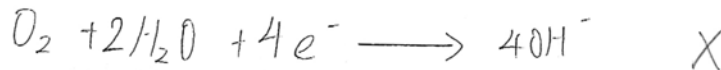
(a)

Write half-equations for the anodic and cathodic reactions when DMFC is producing a current.

anodic reaction



cathodic reaction



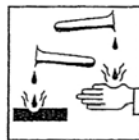
(2 marks)

(b) A concentrated aqueous methanol solution is used as the fuel in DMFC.

(i) Suggest why pure methanol is NOT used.

Pure methanol is toxic

(ii) Circle TWO of the following hazard warning labels that should be displayed on the container of a concentrated aqueous methanol solution.



CORROSIVE 腐蚀性



TOXIC 有毒



FLAMMABLE 易燃



OXIDISING 氧化性

(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.

(cont'd)

Low Performance Sample 7: Paper 1 Section B Question 8

8. (c) Would you expect DMFC to be widely used in powering laptop computers ? Explain your answer.

No, it's because DMFC is toxic during leakage which need to have a extra care when handle it

X

(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.

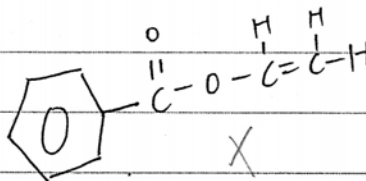
Low Performance Sample 8: Paper 2 Question 3

3ai) ester X

3aii) separating funnel

3aiii) For step 1, it's to
 For step 2, it's to separate the organic substances and inorganic substances
 For step 3, it's to form carboxylic acid to make the solution acidic for the esterification.

3aiv) $(9 \cdot 12 + 8 \cdot 1 + 2 \cdot 16)n = 148$
 $n = 1$ X
 \therefore molecular formula is $C_9H_8O_2$
 At $m/z = 77$, it is likely to be C_6H_5 . The other part may be $C_3H_3O_2$. Since it is not soluble in water, it should be ester.

 Because of decolorization of Br_2 in CH_2Cl_2 , it should be alkene present. ✓

3av) (I) add dye to the organic compound to make it visible X

3av) (II) $R_f = \frac{9.5}{(50 - 2.5 - 3)} = 0.2135$ ✓

(III) add alcohol to the sample in order to remove the colourless organic compound because the compound's more soluble in the alcohol-water solvent. ~~Then use separating~~ X

Please do not write in the margin. 請勿在此書寫。

(cont'd)

Low Performance Sample 8: Paper 2 Question 3

3b (i) Drying the precipitate by filter paper. X
 Firstly, use water to clean the surface of BaSO_4 and X

(ii) $\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4$
 Since Ba^{2+} 's limited, 0.291
 no. of $\text{BaSO}_4 = \text{no. of Ba}^{2+}$
 $\frac{0.291}{(137.3 + 32.1 + 16 \times 4)} = 0.001247$ ✓
 $\frac{\text{mass of Ba}^{2+}}{\text{mass of Barium sulfate}} \times 100\% = \frac{0.001247(137.3)}{0.308} \times 100\% = 56.13\%$ ✓

(iii) the compound's in solid. X
 The compound's not complex. X
 structure of the

Please do not write in the margin. 請勿在此書寫。