Paper 1
卷一

Section A

甲部

1	D	**11**	A	**21**	D	**31**	C
2	B	**12**	A	**22**	A	**32**	B
3	B	**13**	C	**23**	B	**33**	D
4	D	**14**	C	**24**	C	**34**	A
5	C	**15**	B	**25**	B(中文卷) D(英文卷)	**35**	C
6	D	**16**	A	**26**	D	**36**	A
7	D	**17**	C	**27**	C		
8	D	**18**	B	**28**	D		
9	A	**19**	D	**29**	A		
10	D	**20**	C	**30**	B		

Section B

乙部

1(a) (難度: Lv2)
2,8,18,8,1 (1)

1(b) (難度: Lv2)
As there are 2 isotopes only, so,
x% = 1-y%

85(1-y%) + 87(y%) = 85.5
y = 75(1)
So, x = 25(1)

因為只有 2 種同位素，所以
x% = 1-y%

85(1-y%) + 87(y%) = 85.5
y = 75(1)
因此, x = 25(1)

1(c) (難度: Lv2)
Rubidium would have a higher reactivity, as the reactivity of group I element increases down the group.
銣會有較高的活潑性，因為第Ⅰ族的元素活潑性會沿族下降而上升。(1)

1(d) (難度: Lv2)
Potassium will give out a lilac flame but Rubidium does not./ Potassium will float on the water but Rubidium will sink.(1)
鉀會給出一個淡紫色的火焰而銣並不會。/鉀會浮在水面不過銣會沉。(1)

1(e) (難度: Lv3)
The metallic bond of Li is stronger than Rb
As the size of Li^+ is smaller than Rb^+(1)
So, the attraction between the delocalized electron and nucleus is stronger for Li^+ due to shorten distance.(1)
Li 的金屬鍵比 Rb 強
因為 Li^+的體積比 Rb^+小(1)
所以由於距離較短 Li^+原子核與離域電子之間的吸引力會更強。(1)

Comment: 留意此題目為比較題型，考生需要比較 Li 和 Rb，不應分別指出 Li 有兩層電子殼 (electron shell)而 Rb 有 5 層。

2(a) (難度: Lv3)

The oxide of carbon has lowing melting point than the oxide of silicon.
For the oxide of carbon, it has a simple molecular structure, only weak van der waal's force is needed to break in order to melt it, so less energy is needed.
For the oxide of silicon, it has a giant covalent structure, strong covalent bond has to break in order to melt it, so more energy is needed.
碳的氧化物比硅的氧化物有較低的熔點。
就碳的氧化物而言，它擁有簡單分子結構，在熔解的過程只需要拆開弱的范德華力。因此不需要太多的能量。
就硅的氧化物而言，它擁有巨型共價結構，在熔解的過程需要拆開強的共價鍵，因為需要更多能量。

Comment: 考生沒有留意比較對象為 C/Si 的氧化物(oxides)而直接比較 Si 和 C。

答案需要指出熔解時拆解的吸引力而非單單指出物質中有的吸引力。

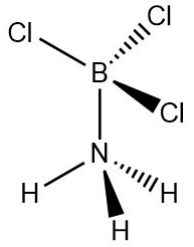
i.e. CO_2 中亦有共價鍵(covalent bond)，但不會在熔解過程中拆解。

正確指出那種氧化物(oxides)有有更高的熔點(1)

正確指出兩種氧化物的結構(structure of the oxides)(1)

正指指出要拆解的吸引力(attraction)(1)

2(b) (難度: Lv4)



(1)

2(c) (難度: Lv4)

NH_3BF_3 has a higher boiling point than NH_3BCl_3.(1)
There are hydrogen bonds between the molecules of NH_3BF_3. But only van der waal's force between NH_3BCl_3. (1)
More energy is needed to break the stronger hydrogen bond.(1)
NH_3BF_3 比 NH_3BCl_3 有更高的沸點(1)
在 NH_3BF_3 的分子之間有存有氫鍵，不過在 NH_3BCl_3 之間只有范德華力。(1)
更多能量需要用以拆解強氫鍵。(1)

Comment: 考生於比較分子(molecules)的沸點(boiling point)/熔點(melting point)題目時宜先考慮氫鍵(hydrogen bond)的存在。

3(a) (難度: Lv2)

$NH_3(g) + HCl(g) \longrightarrow NH_4Cl(s)$

Allow the gas react with hydrogen chloride, dense white fumes will be observed.

容讓氣體與氯化氫反應，會觀察到白色煙霧。(1)

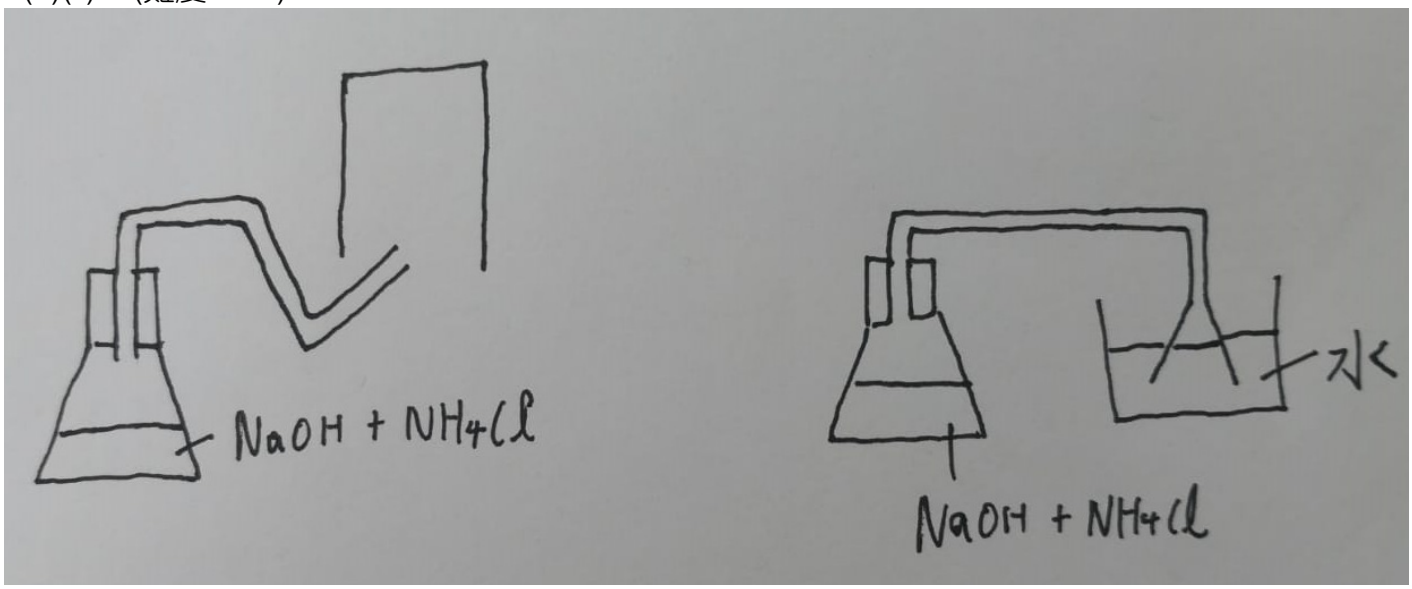
Comment: 考生需要留意 NH_3 將濕潤的紅色石蕊試紙(wet red litmus paper) 並非化學測試。

3(b)(i) (難度: Lv4)

As NH_3 is soluble in water, some of NH_3 dissolved in the solution.(1)

因為 NH_3 是可溶於水，部分 NH_3 會溶於該溶液中。(1)

3(b)(ii) (難度: Lv5)



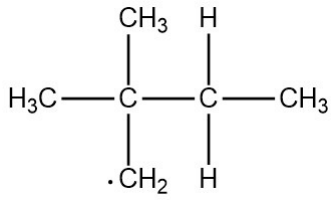
(1)

As it is an open system the pressure will not accumulate, so it can reduce the chance that NH_3 redissolve into the aqueous solution.

因為它是個開放體系氣壓並不會累積，因此它能減少 NH_3 重溶至水溶液的情況。(1)

4(a) (難度: Lv2)
Initiation(1)
引發反應(1)

4(b) (難度: Lv3)

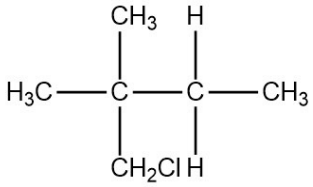


(1)
(接受其他可行答案)

4(c)(i) (難度: Lv2)
Using limited Cl_2(1)
使用限量的 Cl_2(1)
(不接受使用少量的 Cl_2)

Comment: 此處控制主生成物(Major product)需要留意的是 Cl_2 及烷烴(Alkanes)的份量比例，單單指出 Cl_2 的份量而沒有顧及烷烴(Alkanes)的份量不能得分。

4(c)(ii) (難度: Lv5**)



(1)
There are more site for H.(1)
有更多能反應的 H(1)

5(a) (難度: Lv5)

E: Zn(1)

F: Cu(1)

E can be the negative electrode of the chemical cell. It can provide electrons to Fe to prevent the formation of Fe^{2+}.

E 作為化學電池的負極。它能提供電子予 Fe 以防止 Fe^{2+}的生成。(1)

Comment: E 採用比 Fe 活潑(reactive)的金屬並非最佳解釋，因為若 F 比 E 活潑(reactive)時 E 會作為化學電池(chemical cell)的正極(positive electrode)反而會加快鐵的生鏽(rusting)。

5(b) (難度: Lv2)

Al_2O_3 will be formed when Aluminium contact with O_2.(1)

Al_2O_3 can block the oxygen and water. Hence, it can act as a protective layer. (1)

$Fe_2O_3 \cdot nH_2O$ will be peeled off, hence, the iron can react with H_2O and O_2.(1)

Al_2O_3 會在與 O_2 接觸時產生。(1)

Al_2O_3 能夠阻擋氧氧及水。因此它能作為一個保護層。(1)

$Fe_2O_3 \cdot nH_2O$ 會剝落，因此 Fe 能夠與 H_2O 和 O_2 反應。(1)

6(a) (難度: Lv4)
NO
1. H_2O is liquid in standard condition. (1)
2. The coefficient of $C_2H_5NO_2$ is not 1. (1)

不能
1. H_2O 在標準狀態下是液態。(1)
2. $C_2H_5NO_2$ 的系數並不是 1。(1)

6(b) (難度: Lv5*)
Bond broken during the reaction: 2 x N-H, 1 x C-N, 2 x C-H, 1 x C-C, 1 x C=O, 1 x C-O,1 x O-H and 9/4 O=O
Energy required for bond breaking: 2 x 391 + 286 + 2 x 414 + 346 + 804 + 358 + 463 + 9/4 x 498 = 4987.5kJmol^{-1}(1)

Bond formed during the reaction: 4 x C=O, 5 x O-H and 1/2 x N≡N
Energy released for bond forming: 4 x 804 + 5 x 463 + 1/2 x 945 = 6003.5kJmol^{-1}(1)

The enthalpy change of the reaction = +4987.5 + (-6003.5)
= -1016 kJmol^{-1} (1)

在反應中破壞的鍵: 2 x N-H, 1 x C-N, 2 x C-H, 1 x C-C, 1 x C=O, 1 x C-O,1 x O-H 和 9/4 O=O
破壞鍵所需要的能量: 2 x 391 + 286 + 2 x 414 + 346 + 804 + 358 + 463 + 9/4 x 498 = 4987.5kJmol^{-1}(1)

在反應中破壞的鍵: 4 x C=O, 5 x O-H 和 1/2 x N≡N
破壞鍵所需要的能量: 2 x 391 + 286 + 2 x 414 + 346 + 804 + 358 + 463 + 9/4 x 498 = 4987.5kJmol^{-1}(1)

反應的焓變 = +4987.5 + (-6003.5)
= -1016 kJmol^{-1} (1)

6(c) (難度: Lv5*)
Let the mass of C_6H_{14} in the mixture be x g, then, mass of $C_2H_5NO_2$ is (10-x) g(1)

No. of mole of C_6H_{14} = x/(12x6+14)

No. of mole of $C_2H_5NO_2$ = x/(12 x 2 + 5 + 14 + 16 x 2)

Energy released during combustion = $\frac{x}{86} \times (-4163) + \frac{10-x}{75} \times (-1016) = -243.88$ (1)

By solving the equation, x equals to 3.11

So, the mass of C_6H_{14} is 3.11g(1)
Then, the mass of $C_2H_5NO_2$ = 6.89g(1)

設 C_6H_{14} 在混合物中的質量為 x g, 然後 $C_2H_5NO_2$ 的質量為(10-x) g(1)
C_6H_{14} 的摩爾數 = x/(12x6+14)
$C_2H_5NO_2$ 的摩爾數 = x/(12 x 2 + 5 + 14 + 16 x 2)
在燃燒的過程中釋出的能量 $= \frac{x}{86} \times (-4163) + \frac{10-x}{75} \times (-1016) = -243.88$ (1)
藉解方程，x 相等於 3.11

所以，C_6H_{14} 的質量為 3.11g(1)
然後，$C_2H_5NO_2$ 的質量為 = 6.89g(1)

7(a) (難度: Lv4)

No, As H_2SO_4 reacts with $CaCO_3$ to form an insoluble $CaSO_4$(s) which prevent further reaction

between the acid and $CaCO_3$. (1)

不能，因為 H_2SO_4 會與 $CaCO_3$ 反應以生成不溶的 $CaSO_4$(s) 並防止酸與 $CaCO_3$ 再次反應。(1)

7(b) (難度: Lv2)

Transfer the solution to 500.0 cm^3 volumetric flask(1)

Add distilled water/deionised water up to the graduation mark of the volumetric flask. Shake the volumetric flask to ensure its content is well mixed.(1)

轉換該溶液至 500.0 cm^3 的容量瓶(1)

加入蒸餾水/去離子水直至至液面到達瓶上的刻度。搖動容量瓶，以確保瓶內物質充分混和。(1)

7(c) (難度: Lv4)

$2HCl(aq) + CaCO_3(s) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

$NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l)$

no. of mole of NaOH reacted = 17/1000 x 1.0 = 0.017mol

no. of mole of HCl reacted with NaOH = 0.017mol

no. of mole of HCl in 500cm^3 = 0.017 x20 = 0.34146mol

no. of mole of HCl added = 200/1000 x 2.0 = 0.4mol

no. of mole of HCl reacted with $CaCO_3$ = 0.4 - 0.34146 = 0.05854mol

no. of mole of $CaCO_3$ = 0.05852/2 = 0.02927mol

mass of $CaCO_3$ = 0.02927 x (40.1+ 12 + 16x3) = 2.93g

percentage by mass of $CaCO_3$ in the sample = 2.93/3 =97.7%

$2HCl(aq) + CaCO_3(s) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

$NaOH(aq) + HCl(aq) \rightleftharpoons NaCl(aq) + H_2O(l)$

已反應的 NaOH 的摩爾數 = 17/1000 x 1.0 = 0.017mol

與 NaOH 反應的 HCl 的摩爾數 = 0.017mol

在 500 cm^3 的 HCl 的摩爾數 = 0.017 x20 = 0.34146mol

加進的 HCl 的摩爾數 = 200/1000 x 2.0 = 0.4mol

與 $CaCO_3$ 反應的 HCl 的摩爾數 = 0.4 - 0.34146 = 0.05854mol

$CaCO_3$ 的摩爾數 = 0.05852/2 = 0.02927mol

$CaCO_3$ 的質量 = 0.02927 x (40.1+ 12 + 16x3) = 2.93g

在樣本 $CaCO_3$ 的質量百分比 = 2.93/3 =97.7%

Comment: 於考試卷的題目有錯，為此致歉。

若於該題目中，有計算 mol 得 1 分

若於該題目中，有計算稀釋比例(dilution rate)得 1 分

若於該題目中，能有計算質量百分比(percentage by mass) 得 1 分

8(a) (難度: Lv3)

Anode: $2Cl^- \longrightarrow Cl_2 + 2e^-$(1)
Cathode: $2H^+ + 2e^- \longrightarrow H_2$(1)

陽極: $2Cl^- \longrightarrow Cl_2 + 2e^-$ (1)
陰極: $2H^+ + 2e^- \longrightarrow H_2$(1)

8(b) (難度: Lv5)

This expected result is incorrect. (1)
Cl^- preferentially discharged because of the high concentration of Cl^-. (1)
During the reaction, the concentration of Cl^- will drop, as a result, OH^- would be preferentially discharge because it has a higher position in E.C.S.(1)
As a result, there must be Cl^- existing in the solution.

該預期結果是不正確。(1)
Cl^-會優先放電是由於高濃度的 Cl^-存在(1)
在反應的過程中，Cl^-的濃度下降，因此，OH^-會優先放電因其在電化序有更高的位置。(1)
因此，在溶液中必定存在 Cl^-

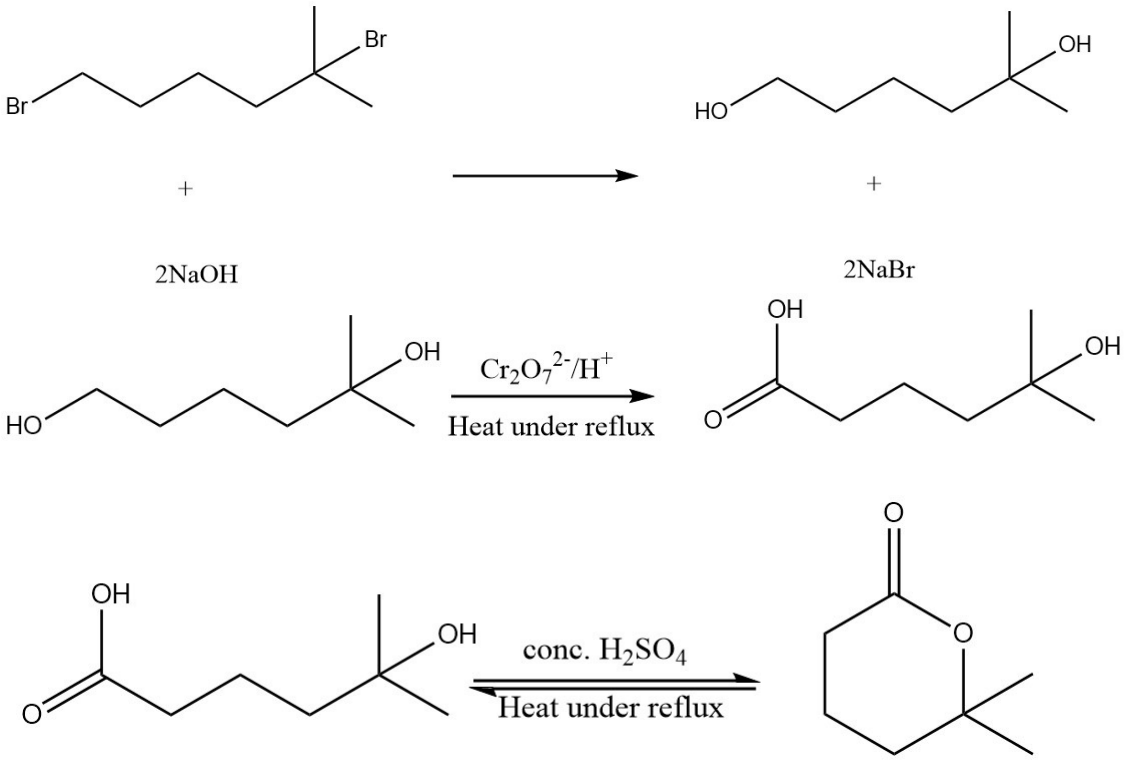
8(c) (難度: Lv4)

Pass through the gas into test tube containing NaBr(aq) and NaI(aq) respectively.
After a brown color observed, adding organic solvent into the mixture respectively. (1)
The test tube of NaBr would give orange color, (1)
the test tube of NaI would give a violet color. (1)
將氣體分別地通入盛有 NaBr(aq)及 NaI(aq)的試管
當溶液變成棕色後，分別地加入有機溶劑(1)
原來盛有 NaBr(aq)的試管會給出一層橙色的溶液，(1)
原來盛有 NaI(aq)的試管會給出紫色的溶液。(1)

9. (難度: Lv4)
Chemical knowledge
Dish with a NaCl, phenolphthalein and $K_3Fe(CN)_6$, connect Zn to Fe and Cu to Fe respectively(1)
The Fe connects with Cu will have a lower rusting rate than the Fe connects with Zn(1)
Compare which sample will give out a blue color first, the first sample(Fe that connects with Cu) give out the blue showing it has a higher rusting rate.(1)
Communication mark(1)

化學知識
準備一個含有 NaCl, 酚酞和 $K_3Fe(CN)_6$ 的皿分別將 Fe 與 Zn 和 Fe 與 Cu 連接(1)
連接 Cu 的 Fe 生鏽速率會比連接 Zn 的 Fe 生鏽速率更高。(1)
比較哪個樣本會較快變得藍色，最快給出藍色顯示出更高的生鏽速率，與 Cu 連接的 Fe 會較快出現藍色。(1)
傳意分數(1)

10. (難度: Lv4)



(3)

11. (難度: Lv4)

Chemical knowledge

- During the equilibrium, both reactant and products exited. (reversible)(1)
- the rate of forward reaction is the same as the rate of backward reaction(1)
- The concentration of reactants and products remain unchanged. (1)
- Equilibrium can be reached under closed system only.(1)
- With an example corresponding to the equation provided(1)

Communication mark(1)

化學知識

- 於化學平衡中，反應物及生成物將會同時存在（可逆的）(1)
- 正向反應的反應速率與逆向反應的反應速率(1)
- 反應物和產物的濃度是不變的(1)
- 化學平衡需要發生於封閉系統(1)
- 有合適的例子對應題目提供的反應(1)

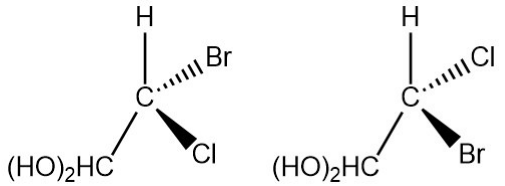
傳意分數(1)

12(a) (難度: Lv4)
ethanedioic acid 乙二酸(1)
2-bromo-2-chloroethane-1,1-diol 2-溴-2-氯乙-1,1-二醇(1)

12(b) (難度: Lv4)
As the NaOH will react with the halogen substituent. (1)
Also, a salt is obtained instead of the dioic acid.(1)

因為 NaOH 會與鹵素取代基反應。(1)
而且最終生成的產物是鹽而非二酸。(1)

12(c) (難度: Lv4)



(2)

13(a)(i) (難度: Lv4)
Average rate of the reaction.(1)
反應的平均速率(1)

13(a)(ii) (難度: Lv4)
As the concentration of the HCl will change during the reaction. (1)
The average rate cannot show the rate corresponding to the concentration. (1)
Initial rate should be used.(1)
因為 HCl 的濃度會隨反應而改變。(1)
平均速率不能顯示對應的濃度的速率。(1)
需要用到初速。(1)

13(b) (難度: Lv3)
The concentration of the reactants decreased. (1)
The less collision will be occurred. Less effective collision will cause the rate of the reaction decreased.(1)
反應物的濃度會下降。(1)
會進行更少的碰撞。因此會有較少的有效碰撞。 (1)

14(a)(i) (難度: Lv4)
z: SiO_2(1)

14(a)(ii) (難度: Lv2)
$SiO_2 + 2NaOH \rightarrow Na_2SiO_3 + H_2O$(1)

14(b) (難度: Lv3)
X:Al_2O_3(1)
ZnO(1)

14(c)(i) (難度: Lv2)
Na_2O(1)

14(c)(ii) (難度: Lv4)
Add the substance to H_2O than adding to $Al(NO_3)_3$ until excess, if there are white precipitate formed then redissolve, it should be the oxide of sodium amount period three.
加入至水並加至 $Al(NO_3)_3$ 直至過量，若當中有白色沉澱物生成並重溶，它應是在第三週期的鈉氧化物。
$Na_2O + H_2O \rightarrow 2NaOH$