2014

Chemistry
Paper 1

SECTION A

Question No. Part I	Key	Question No. Part II	Key
1.	C (74%)	25.	A (73%)
2.	D (75%)	26.	B (68%)
3.	A (19%)	27.	D (62%)
4.	D (62%)	28.	A (67%)
5.	C (84%)	29.	B (55%)
6.	C (64%)	30.	C (77%)
7.	B (32%)	31.	D (28%)
8.	B (78%)	32.	D (48%)
9.	A (76%)	33.	C (49%)
10.	D (70%)	34.	A (63%)
11.	C (61%)	35.	D (80%)
12.	D (48%)	36.	C (66%)
13.	C (76%)		
14.	A (68%)		
15.	B (70%)		
16.	A (88%)		
17.	A (88%)		
18.	B (66%)		
19.	D (38%)		
20.	A (63%)		
21.	D (32%)		
22.	B (62%)		
23.	B (74%)		
24.	D (51%)		

Part I

Marks

1. (a) (i) Layers of graphite are held together by van der Waals' forces / weak intermolecular forces only. 1

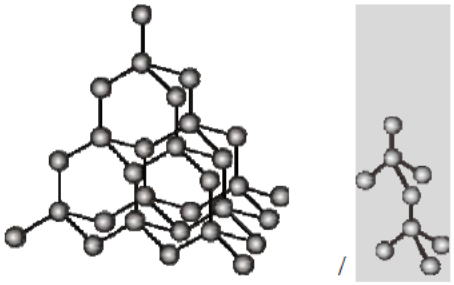
(ii) Yes, graphene has delocalised electrons / electrons in graphene are not localised / mobile electrons / electrons will flow. 1
Not accepted: No, ……
electrons / sea of electrons / free electrons

(iii)  (Accept any symbols of electrons, ignore shape) 1
Not accepted: Showing electrons in the inner shells

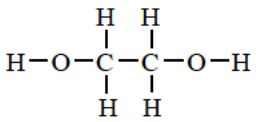
(b) No. Graphene layers are made up of a giant covalent structure. 1
A large amount of energy is needed during melting to destroy the large amount of strong covalent bonds between atoms. (1)
Not accepted: Yes, ……

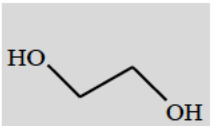
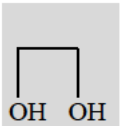
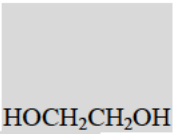
(c) z C_{60} has a spherical shape (ball) / and with strong covalent bonds between atoms. 1
z C_{60} has a simple molecular structure. 1
z The van der Waals' forces / attractive forces between C_{60} molecules are of comparable / similar strength as those in organic solvents. 1

For CS:

(c) (i)  1

(ii) Yes, diamond and graphite have the same number of electrons in the outermost shell / same electron arrangement / configuration / structure. (They are allotropes of carbon.) 1
Not accepted: No, …… They are the same element. / They are carbon.

2.  1

(Accept condensed or skeletal structural formula)

It has a small molecular size. / It is a small molecule. / It has a short carbon chain. 1
The hydroxyl groups in it can form hydrogen bonds with water. 1
Not accepted: It has a small size. / It has two hydroxyl groups.

For CS:

2. (a) HOOCCH=CHCOOH / ClOCCH=CHCOCl 1

(b) Water / H_2O / Hydrogen chloride / HCl 1

(c) z carbon-carbon double bond / C=C / -C=C- / >C=C<. Not accepted: alkene. 1
z ester group / –COO– / $–CO_2–$ 1

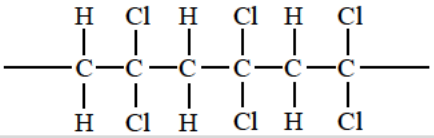
Marks

3. (a) Add in $Br_2(aq)$ or Br_2(organic solvent) / acidified $KMnO_4(aq)$ / neutral or alkaline $KMnO_4(aq)$. 1
Reddish brown or brown or orange $Br_2(aq)$ decolourised or becomes colourless (paler) 1
/ Purple $KMnO_4(aq)$ decolourised or becomes colourless (paler)
/ Purple $KMnO_4(aq)$ becomes brown
Not accepted: yellow $Br_2(aq)$, Br_2, Bromine, $Br_2(g)$, $Br_2(l)$, …

(b) (i) † 1,1-dichloroethene 1

(ii) † addition (polymerisation) 1
Not accepted: additional polymerisation

(iii) 1



(Need to show 3 or more repeating units, in the following orders: B—B—B, B—B—B, etc.)

(c) 'Saran' is more heat resistant / has a higher melting temperature / is less soluble in oil 1
because the polar attraction (force) between 'Saran' polymer chains is stronger than that 1
between PE / the molecular sizes of 'Saran' are larger, hence it has a larger dispersion force or van del Waal's forces or intermolecular forces than that in PE.

(d) Incineration of food wrap made from 'Saran' will produce toxic gases / harmful gases / 1
dioxins / hydrogen chloride / HCl / chlorine / Cl_2, while that made from PE will not.
(For CS(c))

For CS(d):
Thermoplastics become soft / deform when heated, 1
and become a solid / solidify / harden when cooled, 1
They decompose / melt at high temperatures. (1)

4. y By heating oxide of silver directly, silver can be obtained, while copper and magnesium cannot be obtained by similar method. 1
y By heating with charcoal / carbon / hydrogen/ carbon monoxide/ town gas, oxide of copper can be reduced to copper, while magnesium cannot be obtained by similar method. 1
y Magnesium can only be obtained by electrolysis of its oxide in molten state. 1
y As more stable is the metal oxide, the more reactive is the metal. So, the order of reactivity is: magnesium > copper > silver 1
y Communication mark (demonstrate the ability to deduce the answer) 1
(chemical knowledge = 0 to 2, communication mark = 0
chemical knowledge = 3 to 4, communication mark = 0 or 1
incomplete answer / difficult to understand, communication mark = 0)

5. (a) Wearing protective gloves or plastic gloves or gown or safety goggles or any suitable PPE / 1
adding concentrated acids into water when diluting the concentrated acids / use a fume cupboard. Not accepted: maintain a good ventilation.

(b) No, the strength of an acid is not related to its concentration. / Not all concentrated acids, e.g. 1
ethanoic acid, are strong acids / use a concrete example to illustrate.
Not accepted: Yes, ……

(c) Concentrated sulphuric acid reacts with copper to liberate a colourless gas / irritating gas / gas with characteristic smell / black solid (copper(II) oxide). 1

Concentrated nitric acid reacts with copper to liberate a brown gas / bluish-green or blue solution. 1

When concentrated ethanoic acid is added to copper granules, no observable changes occur / no reaction. 1

Not accepted: exothermic / bluish-green or blue solution in concentrated sulphuric acid

†: correct spelling

Marks

6. (a) (i) Components having different boiling points can be separated from each other by fractional distillation. 1
The longer the carbon chain, the higher is the boiling point . 1

(ii) Cracking of heavy oil/heavy hydrocarbons 1

(iii) The enthalpy change when one mole of a compound (/ substance / octane) burns completely under standard conditions/25°C and 1 atm. 1

$C_8H_{18}(l) + \frac{25}{2} O_2(g) \rightarrow 8CO_2(g) + 9H_2O(l)$ (The eq. should have correct state symbols) 1

(b) (i) Catalytic converter (†) 1

(ii) $\Delta H^\ominus = 2(-394) - 2(-110.5) - 2(90.3)$ 2*
(1 mark for correct coefficients, 1 mark for correct signs of the terms)
$= -747.6$ kJ mol^{-1} (the answer should have correct sign and unit) 1

7. (a) Mass of HCl present in 1000 cm^3 of the concentrated acid = 1180 x 36% = 425 g 1*
Formula mass of HCl = 36.5
Concentration = 425 / 36.5 = 11.6 mol dm^{-3} (M) (Accept 11.5 – 11.644, 12, not accept 12.0) 1
(Accept answer without unit) (NOT accept wrong unit)(accept maximum 3 decimal places)

(b) (i) z Weigh accurately the amount of sodium carbonate needed and dissolve it using deionised water / distilled water. (accept using "a known amount of sodium carbonate"; not accept if state "water" only) 1
z Transfer all the solution made to a volumetric flask, add deionised water to the graduation mark of the flask, and mix the content thoroughly. 1

(ii) No. of mole of H^+ present in the diluted acid = 1.06 x (10/1000) x 2 1*
= 0.0212
Concentration of the acid in the bottle = 0.0212 / (20.30/1000) x 10 1*
= 10.4 mol dm^{-3} (M) 1
(Accept answer without unit)(NOT accept wrong unit)
(accept maximum 3 decimal places)

(c) Some HCl escaped / vaporised from the concentrated acid as HCl(g) 1
/ (Concentrated hydrochloric acid is volatile.)

8. (a) (i) The electrode dissolves / becomes smaller / becomes thinner gradually. 1

(ii) (Colourless) bubbles / gas are given out. 1

(b) (i) $4OH^- \rightarrow 2H_2O + O_2 + 4e^-$ 1

(ii) $Ag^+ + e^- \rightarrow Ag$ 1

(c)

electrode **W**	electrode **Z**
anode	cathode

1

(d) Electrons would not flow through the electric wires / no observable changes on all electrodes / no reaction occurs because ethanol is not an electrolyte / cannot conduct electricity. 1

†: correct spelling

Marks

9. (a) (i) A blue precipitate is obtained. 1

(ii) $Cu^{2+}(aq) + 2OH^{-}(aq) \rightarrow Cu(OH)_2(s)$ / $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$ 1
(State symbols are not required)

(b) (i) Purple acidified potassium permanganate solution is decolourised / turns into colourless / turns into pale pink. 1

(ii) (1) Redox / reduction (of acidified potassium permanganate) / oxidation-reduction (†) 1

(2) $2MnO_4^{-}(aq) + 5SO_3^{2-}(aq) + 6H^{+}(aq) \rightarrow 2Mn^{2+}(aq) + 5\ SO_4^{2-}(aq) + 3H_2O(l)$ 1
(State symbols are not required)

Part II

Marks

10. y Proper way to follow the progress of the reaction (e.g. measure the volume of CO_2 evolved / measure the loss in mass of the reaction mixture over a certain time interval / measure the pressure of the CO_2 formed in a sealed reaction vessel.) (accept graphical representation) (no communication mark if no description about "time") 1

y Dilute 1M HCl to different concentrations by adding water. 1

y Repeat the experiment with the diluted HCl

y State one requirement for carrying out fair comparison (e.g $CaCO_3$ used should be of the same amount / under same experimental conditions such as same temperature or pressure) 1 1

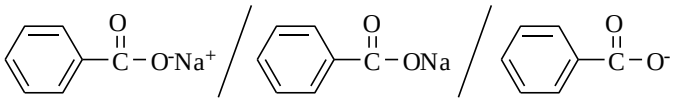
y Communication mark
(chemical knowledge = 0 to 2, communication mark = 0
chemical knowledge = 3 to 4, communication mark = 0 or 1
incomplete answer / difficult to understand, communication mark = 0) 1

11. (a) Vanadium exhibits variable oxidation numbers and its ions in aqueous solutions carry colours. 1

(b) (i) 1 (mol of) VO_2^+(aq) ions gains 2 (mol of) electrons from 1 (mol of) SO_2(g) to become 1 (mol of) V^{3+} (aq). 1
V^{3+} (aq) is green in colour. 1

(ii) $SO_2(g) + VO_2^+(aq) \rightarrow SO_4^{2-}(aq) + V^{3+}(aq)$ (State symbols are not required) 1

12. (a) (i) (alkaline) hydrolysis (†) 1

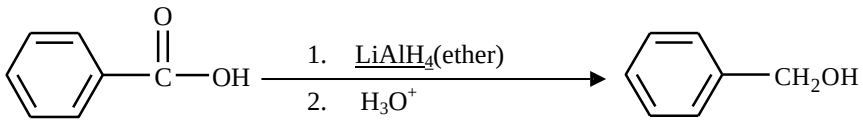
(ii)  1

(iii) HCl(aq) / H_2SO_4(aq) (accept other reasonable strong acids; not accept H^+) 1

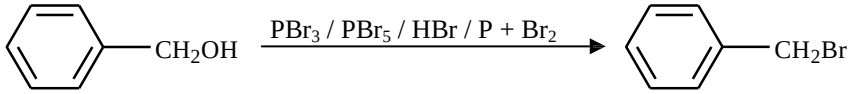
(iv) **X** (sodium benzoate) is an ionic compound which has strong(er) interactions with water ,/ Benzoic acid exists as molecules which has weak(er) intermolecular interactions with water. / 1
X is an ionic compound while benzoic acid exists as molecules.

(v) Filter the mixture to obtain the solid benzoic acid. Wash it with deionised water and then dry in oven. (not accept mixing with drying agents) (not accept evaporation or crystallisation before filtration) 1

(b)



(not accept using $LiAlH_4$ in acidic medium; not accept using $NaBH_4$ and catalytic hydrogenation)



1+1
Correct reagent for each step in the conversion
Intermediate ($C_6H_5CH_2OH$) 1

†: correct spelling

Marks

13. (a) (i)

	$2NO(g)$	+	$O_2(g)$	$\rightleftharpoons$	$2NO_2(g)$
Initial conc.:	1.02/50 = 0.0204		1.29/50 = 0.0258		0
Equil. conc.:	0.0204 x 0.39 = 0.007956		0.0258−0.006222 = 0.019578		0.0204 x 0.61 = 0.012444

1*

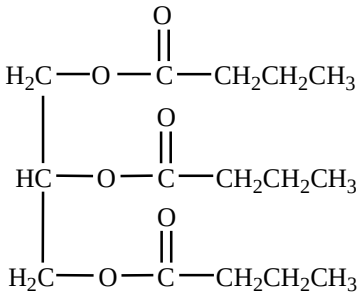
$K_c = \dfrac{(0.012444)^2}{(0.007956)^2(0.019578)}$ / $K_c = \dfrac{[NO_2]^2}{[NO]^2[O_2]}$ 1*

= 125 $dm^3\ mol^{-1}$ (accept 118-125) (answer should have correct unit; not accept M^{-1}) (accept maximum 3 decimal places) 1

(ii) No change, because K_c is independent of concentration / only depends on temperature. 1

(b) As revealed from the data, when temperature increases, K_c decreases. Therefore the forward reaction is exothermic. / 1
As higher temperature favours endothermic side of reaction, so the forward reaction is exothermic.

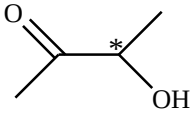
14. (a) 1



- Accept represent $-CH_2CH_2CH_3$ as $-C_3H_7$.
- Accept the answer has 1-2 $-CH_2CH_2CH_3$ carbon chains, while the other carbon chains have different chain lengths and structurally correct.

(b) methylpropanoic acid (†) (2-methylpropanoic acid) 1

(c) (i) 1



(ii) Correct chemical reagent 1
Correct observations with comparison between the tests on **Q** and **Z** 1

Possible tests and the corresponding observations:

$Cr_2O_7^{2-}$ / H^+	Observations: **Q** – no change; **Z** – from orange to green
MnO_4^- / H^+	Observations: **Q** – no change; **Z** – from purple to colourless
MnO_4^- / OH^-	Observations: **Q** – no change; **Z** – formation of brown ppt.
2,4-DNP	Observations: **Q** – no change; **Z** – formation of orange ppt.
CH_3CH_2OH / H^+ / heat	Observations: **Q**–fruity smell compound formed; **Z** – no change.
CH_3COOH / H^+ / heat	Observations: **Q**–no change; **Z**–fruity smell compound formed.
CO_3^{2-}	Observations: **Q** – formation of gas (CO_2); **Z** – no change
HCO_3^-	Observations: **Q** – formation of gas (CO_2); **Z** – no change

(also accept other reasonable chemical tests with correct observations stated. E.g. use of suitable acid-base indicators (litmus) or suitable metal (Mg))
(not accept using physical methods or using inappropriate metals (K, Na))
2,4-DNP = 2,4-dinitrophenylhydrazine

(d) (Catalytic) hydrogenation / addition of hydrogen 1

†: correct spelling

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香港考試及評核局

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

2014 年香港中學文憑

HONG KONG DIPLOMA OF SECONDARY EDUCATION 2014

化學　　試卷一　　及組合科學(化學)
乙部

評卷參考

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閱卷員需知

1. 為保持評卷的一致性，閱卷員需按照在閱卷員會議中所議決的評卷參考作為評分的準則。

2. 本評卷參考不能就各試題羅列所有可能的答案。閱卷員可根據專業判斷，接納未列於本評卷參考內其他正確和合理的答案。

3. 本評卷參考內列有以下符號：

/	顯示某個答案內可接受的不同版本或寫法
*	步 分 (涉及計算的題目)
†	需要書寫正確

4. 試題若列明要求答案的數量，而考生給予多於要 求的答案，多答的部分則不會評閱。舉例說，試題要求考生列舉兩個例子，如考生列舉了三個，閱卷員只需評閱第一和第二個答案。

5. 如考生所答的題目超出試卷要求的答題數量，閱 卷員須評閱所有答案，惟最低分的過量答案將在計算總分時被剔除。

6. 答案若自相矛盾，得零分。

7. 除於有機合成的反應 要中，所有化學方程式均須平衡。能學的化學方程式應包含所涉及化學物種的正確物態符號。

8. 在試卷中，評核考生傳意技能的題目有 * 號標記。在此等題目，考生若能提供易明的答案，便可獲得有效傳意的分數(每題 1 分)。若考生的答案含大量與題目無關的資料，及 / 或化學的概念錯誤，則不能獲得有效傳意的分數。

第一部分

分數

1. (a) (i) 石墨層間靠范德華力／弱分子間引力互相吸引。 1

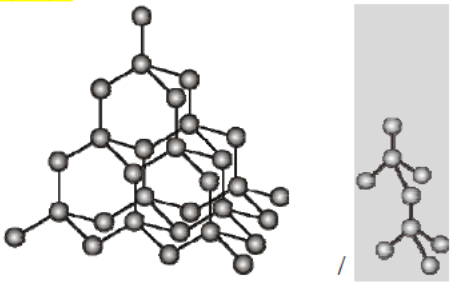
(ii) 是，石墨烯能導電因為它有離域電子／它的電子不是定域／游動電子／電子能流動。 1
不獲接受的答案：不是，……
電子／電子海／自由電子

(iii)  (接受使用不同符號代表電子，不考慮形狀) 1
不獲接受的答案：顯示了內層的電子

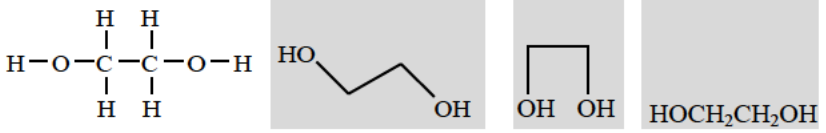
(b) 不。石墨烯層是一巨型共價結構。 1
熔解時，需大量能量才可破壞原子間大量的強共價鍵。 (1)
不獲接受的答案：是，……

(c) z C_{60} 結構如球狀／一個球／以及原子間有強共價鍵。 1
z C_{60} 有一個簡單分子結構。 1
z C_{60} 分子間的范德華力／引力的強度與有機溶劑分子間的引力相若。 1

組合科學:

(c) (i)  1

(ii) 是，金剛石與石墨具有相同的最外層電子數目／相同電子排佈（組態／結構）。（它們是碳的同素異形體）。 1
不獲接受的答案：不是，……／它們是相同的元素／它們都是碳

2.  1

它的分子體積細小／它是細小分子／它有一短碳鏈。 1
它的羥基團能與水形成氫鍵。 1
不獲接受的答案：它的體積細小／它具有兩個羥基

組合科學:

2. (a) HOOCCH=CHCOOH ／ ClOCCH=CHCOCl 1

(b) 水／H_2O ／ 氯化氫 ／ HCl 1

(c) z 碳-碳雙鍵／C=C ／ –C=C– ／ >C=C<，不獲接受的答案：烯 1
z 酯基 / –COO– / $–CO_2–$ 1

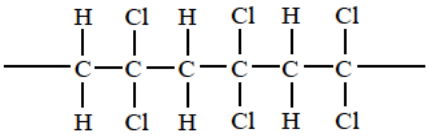
分數

3. (a) 加入 $Br_2(aq)$ 或Br_2(有機溶劑) ／酸化 $KMnO_4(aq)$ ／中性或鹼性 $KMnO_4(aq)$。 1
紅棕或棕或橙色的 $Br_2(aq)$ 脫色或變無色或變淡。 1
／紫色的 $KMnO_4(aq)$ 脫色或變無色或變淡。／紫色的 $KMnO_4(aq)$ 變棕色。
不獲接受的答案：黃色的 $Br_2(aq)$，Br_2，溴，$Br_2(g)$，$Br_2(l)$……

(b) (i) †1,1-二氯乙烯 1

(ii) †加成（聚合）／加聚 1

(iii) 1



(顯示 3 個或以上重複單位，可用以下次序：　　，　　，等)

(c) 「絲龍」的抗熱性較高／的熔解溫度較高／較不溶於油。 1
與 PE 相比，「絲龍」聚合物鏈間的極性引力較強／ 1
「絲龍」分子體積較大，故有較強的「分散力」或范德華力或分子間引力。

(d) 焚化「絲龍」製的食物保鮮紙會釋出有毒氣體／有害氣體／二噁英／氯化氫／ 1
HCl / 氯 / Cl_2，但焚化 PE 製的食物保鮮紙則否。
(組合科學 (c))

組合科學 *(d)*:
熱塑性塑膠加熱時會漸漸輭化／變形， 1
冷卻時會凝固／固化／變硬， 1
當達到高溫時它便分解／熔解。 (1)

4. y 把銀的氧化物直接加熱便可獲得銀，但銅和鎂卻不能藉類似方法獲得。 1
y 把銅的氧化物與焦炭／碳／氫／一氧化碳／煤氣共熱，可被還原為銅，但鎂卻 1
不能藉類似方法獲得。
y 把熔融狀態的鎂的氧化物電解，才可獲得鎂。 1
y 一個金屬的氧化物愈是穩定，該金屬的活潑性便愈高。因此，活潑序為： 1
鎂 > 銅 > 銀
y 傳意分數 （顯示有作出推斷的能力） 1
(化學知識 = 0 至 2 ，傳意分數 = 0
化學知識 = 3 或 4，傳意分數 = 0 或 1
若答案不完整或難以理解，傳意分數=0)

5. (a) 穿戴防護手套或膠手套或實驗袍或安全眼鏡或合適PPE／把濃酸稀釋時，須把 1
濃酸傾進水中／在煙廚內進行。不獲接受的答案：保持空氣流通。

(b) 不正確，酸的強度與它的濃度無關。／不是所有濃酸一例如乙酸一均是強酸。 1
／以實例說明。
不獲接受的答案：正確，……

(c) 濃硫酸與銅反應釋出一無色氣體／刺鼻氣體／帶特殊氣味氣體／黑色固體（氧 1
化銅(II)）。
濃硝酸與銅反應，釋出一棕色氣體／藍綠色溶液或藍色溶液。 1
把濃乙酸加進銅粒時，無可見變化／無反應。 1
不獲接受的答案：放熱，濃硫酸中出現藍綠色溶液或藍色溶液

† 需要書寫正確

分數

6. (a) (i) 分餾法可把不同沸點的成分分開。 1
碳鏈愈長，則沸點愈高。 1

(ii) 裂解重油 / 重的碳氫化合物 1

(iii) 在標準條件下/25ºC 及 1 atm 下，當一摩爾的化合物 (/ 物質 / 辛烷) 完全燃燒時的焓變。 1

$C_8H_{18}(l) + \frac{25}{2} O_2(g) \rightarrow 8CO_2(g) + 9H_2O(l)$ (方程式必須附有正確的物態符號) 1

(b) (i) 催化轉化器(†) 1

(ii) $\Delta H^o = 2(-394) - 2(-110.5) - 2(90.3)$ 2*
(1 分給予正確的計量系數；1 分給予各項中正確的正負號)
$= -747.6$ kJ mol^{-1} (答案須有正確的正負號及單位) 1

7. (a) 在 1000 cm^3 該濃酸中 HCl 的質量 = 1180 x 36% = 425 g 1*
HCl 的式量 = 36.5
濃度 = 425 / 36.5 = 11.6 mol dm^{-3} (M) (接受 11.5 – 11.644, 12; 不接受 12.0) 1
(接受沒附有單位的答案)(不接受錯誤單位)(最多接受小數點後列出三個數字)

(b) (i) z 準確地稱重所需碳酸鈉的量，並用去離子水/蒸餾水把它溶解 (接受使用 "已知分量的碳酸鈣"; 不接受只寫出 "水")。 1
z 轉移全部所得溶液至一容量瓶，加入去離子水直至到達瓶子的刻度，並把混合物搖勻。 1

(ii) 在經稀釋的酸中 H^+ 的摩爾數 = 1.06 x (10/1000) x 2 1*
= 0.0212
在瓶子中的酸的濃度 = 0.0212 / (20.30/1000) x 10 1*
= 10.4 mol dm^{-3} (M) 1
(接受沒附有單位的答案)(不接受錯誤單位)
(最多接受小數點後列出三個數字)

(c) 有些 HCl(g) 從該濃酸逸走/揮發。 1
/ (濃氫氯酸具揮發性。)

8. (a) (i) 電極逐漸變得細小 / 變幼 / 溶解 。 1

(ii) 釋出(無色)氣體 / 氣泡。 1

(b) (i) $4OH^- \rightarrow 2H_2O + O_2 + 4e^-$ 1

(ii) $Ag^+ + e^- \rightarrow Ag$ 1

(c)

電極 **W**	電極 **Z**
陽極	陰極

1

(d) 電子不會流過電線 / 在所有電極上均沒有可觀察的變化 / 沒有反應發生，因為乙醇不是電解質 / 不能導電。 1

† 需要書寫正確

分數

9. (a) (i) 得到藍色沉澱。 1

(ii) $Cu^{2+}(aq) + 2OH^-(aq) \rightarrow Cu(OH)_2(s)$ / $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$ 1
(不要求物態符號。)

(b) (i) 紫色的酸化高錳酸鉀溶液脫色 / 變為無色 / 變為淡粉紅色。 1

(ii) (1) 氧化還原 / (酸化高錳酸鉀的)還原反應(†) 1

(2) $2MnO_4^-(aq) + 5SO_3^{2-}(aq) + 6H^+(aq) \rightarrow 2Mn^{2+}(aq) + 5\ SO_4^{2-}(aq) + 3H_2O(l)$ 1
(不要求物態符號。)

第二部分

分數

10. y 正確的跟隨化學反應進度的方法 (例如：在一段時間內，量度所釋出 CO_2 的體積 / 量度反應混合物質量的下降 / 量度在一密封反應容器內所產生的 CO_2 的壓強。) (接受以繪圖表示)(若沒有關於"時間"的描述，不給予傳意分數) 1

y 用水把 1M HCl 稀釋至不同濃度。 1

y 用經稀釋的 HCl 來重做實驗 1

y 指出一項進行公平比較的條件 (例如：應使用同樣份量的 $CaCO_3$ / 在相同的實驗條件如同一溫度或壓強) 1

y 傳意分數 1

(化學知識 = 0 至 2，傳意分數 = 0
化學知識 = 3 或 4，傳意分數 = 0 或 1
若答案不完整或難以理解，傳意分數=0)

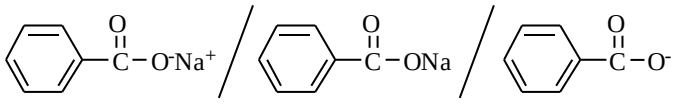
11. (a) 釩展示可變氧化數，而它的離子於水溶液中帶顏色。 1

(b) (i) 1 (mol) VO_2^+(aq) 離子從 1 (mol 的) SO_2(g)獲得 2 (mol) 電子，生成 1 (mol) V^{3+} (aq) 離子。 1

V^{3+} (aq) 離子是綠色的。 1

(ii) $SO_2(g) + VO_2^+(aq) \rightarrow SO_4^{2-}(aq) + V^{3+}(aq)$ (不要求物態符號。) 1

12. (a) (i) (加鹼) 水解(†) 1

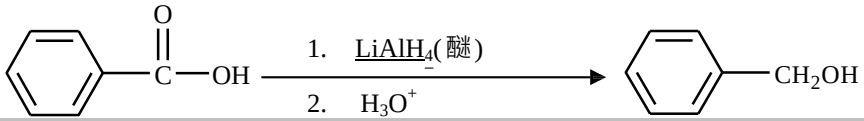
(ii)  1

(iii) HCl(aq) / H_2SO_4(aq) (接受其他合理的強酸;不接受 H^+) 1

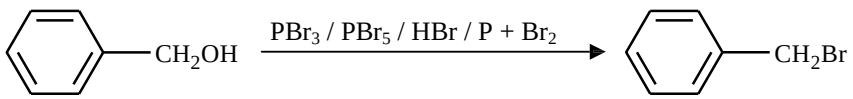
(iv) **X** (苯酸鈉) 是離子化合物，它與水的相互作用力(較)強。/
苯酸以分子形式存在，它與水的分子間引力(較)弱。/
X 是離子化合物，而苯酸以分子形式存在。 1

(v) 把混合物過濾，以獲得苯酸固體。用去離子水沖洗固體，並在烘箱內乾燥。(不接受與乾燥劑混合) (不接受在過濾前進行蒸發或結晶) 1

(b)



(不接受在酸性環境中使用 $LiAlH_4$；不接受使用 $NaBH_4$ 及催化加氫反應)



每一轉化步　中正確的試劑 1+1

中間物 ($C_6H_5CH_2OH$) 1

† 需要書寫正確

分數

13. (a) (i)

	$2NO(g)$	+	$O_2(g)$	$\rightleftharpoons$	$2NO_2(g)$
初始濃度：	1.02/50 = 0.0204		1.29/50 = 0.0258		0
平衡濃度：	0.0204 x 0.39 = 0.007956		0.0258−0.006222 = 0.019578		0.0204 x 0.61 = 0.012444

1*

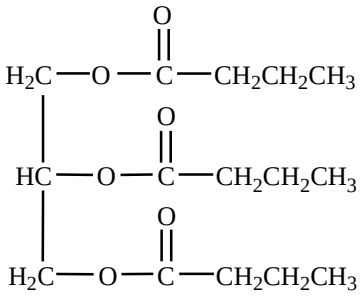
$K_c = \dfrac{(0.012444)^2}{(0.007956)^2(0.019578)}$ / $K_c = \dfrac{[NO_2]^2}{[NO]^2[O_2]}$ 1*

= 125 $dm^3\ mol^{-1}$ (接受 118-125) (須有正確的單位;不接受 M^{-1}) 1
(最多接受小數點後列出三個數字)

(ii) 沒有變化，因為 K_c 與濃度無關 / 只視乎溫度。 1

(b) 從數據顯示，溫度上升時 K_c 便下降。故正向反應為放熱。/ 1
由於高溫有利於反應中吸熱一方，故正向反應為放熱。

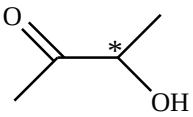
14. (a) 1



- 接受以 $-C_3H_7$ 表示 $-CH_2CH_2CH_3$
- 接受答案有 1-2 $-CH_2CH_2CH_3$ 碳鏈，而其碳鏈的長度不一樣及結構正確。

(b) 甲基丙酸 (†) (2-甲基丙酸) 1

(c) (i) 1



(ii) 正確化學試劑 1
正確比較 **Q** 和 **Z** 在測試中得出的觀察 1

可行的化學測試及對應的觀察：

$Cr_2O_7^{2-}$ / H^+	觀察:**Q** – 沒有變化; **Z** – 由橙色轉變為綠色
MnO_4^- / H^+	觀察: **Q** –沒有變化; **Z** –由紫色轉變為無色
MnO_4^- / OH^-	觀察: **Q** –沒有變化; **Z**–生出棕色沉澱物
2,4-DNP	觀察: **Q**–沒有變化; **Z** – 生出橙色沉澱物
CH_3CH_2OH / H^+ / 加熱	觀察: **Q** –生出帶芬芳氣味的化合物; **Z**–沒有變化
CH_3COOH / H^+ / 加熱	觀察: **Q** –沒有變化; **Z**–生出帶芬芳氣味的化合物
CO_3^{2-}	觀察: **Q** – 有氣體生成 (CO_2); **Z** –沒有變化
HCO_3^-	觀察: **Q** – 有氣體生成 (CO_2); **Z** –沒有變化

(亦接受其他可行的化學測試及正確的對應觀察，如使用合適的酸鹼指示劑(石蕊)或合適的金屬(鎂))
(不接受物理測試或使用不合適的金屬(如鉀、鈉))

2,4-DNP = 2,4-二硝基苯肼

(d) (催化)加氫反應 / 氫的加成 1

† 需要書寫正確

機密（只限閱卷員使用）

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香港考試及評核局

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

2014 年香港中學文憑

HONG KONG DIPLOMA OF SECONDARY EDUCATION 2014

CHEMISTRY PAPER 2

MARKING SCHEME

本評卷參考乃香港考試及評核局專為今年本科考試而編寫，供閱卷員參考 之用。本評卷參考之使用，均受制於閱卷員有關之委任條款及閱卷員指引。特別是：

- 本局擁有並保留本評卷參考的所有財產權利(包括知識產權)。在未獲本局之書面批准下，閱卷員均不得複製、發表、透露、提供、使用或經營本評卷參考之全部或其部份。在遵守上述條款之情況下，本局有限地容許閱卷員可在應屆香港中學文憑考試的考試成績公布後，將本評卷參考提供任教本科的教師參閱。

- 在任何情況下，均不得容許本評卷參考之全部或其部份落入學生手中。本局籲請各閱卷員/教師通力合作，堅守上述原則。

This marking scheme has been prepared by the Hong Kong Examinations and Assessment Authority for the reference of markers. The use of this marking scheme is subject to the relevant appointment terms and Instructions to Markers. In particular:

- The Authority retains all proprietary rights (including intellectual property rights) in this marking scheme. This marking scheme, whether in whole or in part, must not be copied, published, disclosed, made available, used or dealt in without the prior written approval of the Authority. Subject to compliance with the foregoing, a limited permission is granted to markers to share this marking scheme, after release of examination results of the current HKDSE examination, with teachers who are teaching the same subject.

- Under no circumstances should students be given access to this marking scheme or any part of it. The Authority is counting on the co-operation of markers/teachers in this regard.

INSTRUCTIONS TO MARKERS

1. In order to maintain a uniform standard in marking, markers should adhere to the marking scheme agreed at the markers' meeting.

2. The marking scheme may not exhaust all possible answers for each question. Markers should exercise their professional discretion and judgment in accepting alternative answers that are not in the marking scheme but are correct and well reasoned.

3. The following symbols are used:

/	A single slash indicates an acceptable alternative within an answer.
*	Step-mark (for questions involving calculations)
†	Correct spelling required

4. In questions asking for a specified number of reasons or examples etc. and a candidate gives more than the required number, the extra answers should not be marked. For instance, in a question asking candidates to provide two examples, and if a candidate gives three answers, only the first two should be marked.

5. In cases where a candidate answers more questions than required, the answers to all questions should be marked. However, the excess answer(s) receiving the lowest score(s) will be disregarded in the calculation of the final mark.

6. Award zero marks for answers which are contradictory.

7. Chemical equations should be balanced except those in reaction schemes for organic synthesis. For energetics, the chemical equations given should include the correct state symbols of the chemical species involved.

Marks

1. (a) (i) 'Activation energy' refers to the minimum energy possessed by the colliding reactant particles in order that a reaction can occur. 1

(ii)
- Yeast provides enzyme / catalyst. 1
- At high temperature, the enzyme (yeast) is denatured / destroyed so that it cannot function as a catalyst. 1

(iii) It is to solve the problems of inadequate or shrinking supply of vitamin C. 1

(iv) Any TWO: chlorine, hydrogen, sodium hydroxide , NaOCl, HCl, $NaClO_3$, ClO^-, ClO_3^-, bleaching solution 1

(b) (i) Initial rate is the instantaneous rate at the start of the reaction. OR rate at t = 0 1

(ii)
- Follow the colour intensity of the solution / by colorimetry 1
- The solution changes from colourless to brown/yellow. 1

OR
- Titrate with standard $Na_2S_2O_3$ solution. (1)
- Quenching. Add starch indicator. End point: blue to colourless. (1)

(iii)
- The initial rate is directly proportional to $[BrO_3^-(aq)]$. / The graph is linear / a straight line. / $rate \propto [BrO_3^-]$ 1
- Therefore, the order of reaction with respect to $BrO_3^-(aq) = 1$ 1

(iv) (1)

Rate = $k[BrO_3^-][I^-][H^+]^y$

where y is the order of the reaction with respect to H^+

$$\frac{\text{initial rate 1}}{\text{initial rate 2}} = \frac{(0.17)(0.15)}{(0.17)(0.30)}\left(\frac{0.10}{0.20}\right)^y = \frac{2.30\times10^{-3}}{1.84\times10^{-2}}$$ 1*

y = 2 1

Reaction is second order with respect to $H^+(aq)$ (1)

(Accept other explanation.)

When initial $[I^-]$ increases by a factor of 0.30 / 0.15 = 2/doubles and initial $[H^+]$ increases by a factor of 0.20 / 0.10 = 2/doubles while keeping initial $[BrO_3^-]$ constant, the initial rate increases by a factor of $1.84 \times 10^{?} / 2.30 \times 10^{-3} = 8$. Since the rate of reaction is first order with respect to I^-, the initial rate increased by four times when the initial $[H^+]$ is doubled. (1*)

(2) Rate of consumption of BrO_3^- = 1/3 × rate of formation of I_2

The initial rate with respect to $BrO_3^-(aq)$ in Trial 1

$= -2.30 \times 10^{-3} \times 1/3$

$= -7.67 \times 10^{-4}$ mol dm^{-3} s^{-1} (Accept –7.7, –7.667, –7.6667 but not –7.70) 1

(c) (i) Haber process produces ammonia which can be used to manufacture fertilizers / explosives, etc. (HNO_3, NH_4NO_3 / NO_3^-/ refrigerant) 1

(ii) Natural gas remains the more convenient / cheap way to provide hydrogen as feedstock for production of ammonia in the Haber process. 1

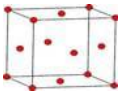
(iii) Provide a larger surface area that makes the catalyst more effective. 1

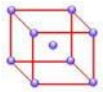
(iv)
- equilibrium position / yield 1
- reaction rate / effective collisions 1

(v) Any unreacted reactants are reused /recycled and are allowed to react again. 1
Removing ammonia / Liquefying ammonia from the product mixture so as to shift the equilibrium position to the product side /Further H_2 addition. (1)

(vi) As the demand for mining the natural nitrate to produce fertilisers drops drastically, the mining work was no longer profitable /mining work might be closed/a high unemployment rate. (Accept other reasonable answers.) 1

Marks

2. (a) (i) (1)  1

(2)  1

(ii) Any two: 1+1
- y With a fairly rigid molecular backbone containing double bonds defining the long axis of the molecule
- y many liquid-crystalline materials have benzene rings
- y rod-like or disc-like molecules
- y polar groups

(iii) Thermoplastics: polyvinyl chloride, polystyrene 1
Thermosetting plastics: urea-methanal

(b) (i) (1) Both of them have giant structures. 1

(2) Silicates are natural materials, while ceramics are synthetic materials. 1

(ii) (1) $Si_2O_5^{2-}$ 1

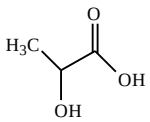
(2)
- y Talc: Sheet structure in which the sheets are held together by van der Waals' forces / weak intermolecular forces. 1
- y Quartz: Si and O atoms joined by a giant network / strong covalent bonds. 1
- y A small amount of energy can make the sheets slip over one another in talc, while a large amount of energy is needed to break the giant network in quartz. 1

(iii) High hardness 1

(c) (i) Blow moulding / Injection moulding 1

(ii)
- y low density polyethene (LDPE) and high density polyethene (HDPE) (Accept "polythene", "polyethylene") 1
- y As the bottle for cough syrup is hard, HDPE is more suitable. HDPE molecules have a linear structure that pack more closely. 1
  OR
  As the bottle for cough syrup is soft, LDPE is more suitable. LDPE molecules are highly branched that cannot pack closely.

(iii)
- y The polar PET molecules are held together by much stronger polar-polar interactions. 1
- y The non-polar PE (HDPE) molecules are held together by van der Waal's forces / weak intermolecular forces. 1

(iv) (1) 
 1

(2) PLA is made from renewable resources, while PE and PET are made from non-renewable petroleum products. 1
OR
PLA is biodegradable, while PE and PET are non-biodegradable.

(3) PLA is made from agricultural products. Massive production of PLA may affect the supply of food. 1

Marks

3. (a) (i) (1)
- Place HCl(g) near NH_3(g / conc). 1
- Dense white fume is observed. 1

OR

Dissolve HCl(g) in deionised water.
- + Na_2CO_3 (s/aq) gives a gas (1)
- + $AgNO_3/H^+$ gives a white ppt (1)

OR
- HCl + Na_2CO_3 (aq) gives a gas (1)
- HCl + $AgNO_3/H^+$ gives a white ppt (1)

(2)
- Add 2,4-dinitrophenylhydrazine. 1
- Yellow/ orange/ red precipitate is formed. 1

(ii) (anhydrous) magnesium sulphate 1

(b) (i) To ensure the reaction go to completion. / To increase the reaction rate. 1

(ii) (1) No more gas is given out. / All solids are dissolved. 1

(2) Brown precipitate formed. 1

(iii) No. of mole of CaC_2O_4 formed in step 6:
2.374 / 128.1 = 0.01853 1*
Mass of $CaCO_3$ in the limestone sample:
0.01853 x 100.1 = 1.855 g 1*
Percentage of $CaCO_3$ by mass in the limestone sample:
1.855 g / 2.025 g = 91.60 (%) [91.3 – 91.9 Accept up to 5 sig. fig. or 91/92] 1

(iv) Gravimetric analysis 1

(c) (i)
- Dissolve the sample in pentane and shake the solution with $NaHCO_3$(aq) in a separating funnel. 1
- Collect the organic layer and carry out fractional distillation / distillation. 1

[Only fractional distillation / distillation: 0 mark]

(ii) y The spectrum does not show strong absorption at about 3230-3670 cm^{-1}, ruling out the presence of a hydroxyl group (the possibility of being an alcohol) 1

The absence of absorption at 2070-2250 cm^{-1} ruled out the presence of C≡C group. (1)

The absence of absorption at 1610 - 1680 cm^{-1} ruled out the presence of C=C group. (1)

y The spectrum has a strong absorption at 1730 (one number from 1700 to 1750) cm^{-1} / (1680 to 1800 cm^{-1}), which corresponds to C=O stretching. The compound may contain an aldehyde group or a ketone group. 1

[Accept without cm^{-1}]
[if write cm^{-1} as cm or /cm^{-1}: deduct 1 mark.]

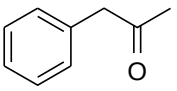
1

- The negative result in Tollens' test ruled out the presence of aldehyde group in the compound. / The compound may contain a ketone group [IR: C= O].

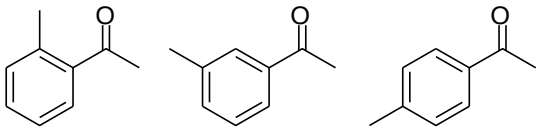
(iii) m/z = 43: $[CH_3CO]^+$ 1

m/z = 134: $[C_7H_7COCH_3]^+$ 或 $[C_6H_5C_3H_5O]^+$ 1

[Accept: ( ); without [ ]; use structures below to represent]
[If not write any numbers (43 and 134), regard the first one to appear as 43.]
[Not accept: $[C_2H_3O]^+$/ $[C_9H_{10}O]^+$.]

(iv)  1

Other possible structures:



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香港考試及評核局

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

2014 年香港中學文憑

HONG KONG DIPLOMA OF SECONDARY EDUCATION 2014

化學　　試卷二

評卷參考

本評卷參考乃香港考試及評核局專為今年本科考試而編寫，供閱卷員參考之用。本評卷參考之使用，均受制於閱卷員有關之委任條款及閱卷員指引。特別是：

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閱卷員需知

1. 為保持評卷的一致性，閱卷員需按照在閱卷員會議中所議決的評卷參考作為評分的準則。

2. 本評卷參考不能就各試題羅列所有可能的答案。閱卷員可根據專業判斷，接納未列於本評卷參考內其他正確和合理的答案。

3. 本評卷參考內列有以下符號：

/	顯示某個答案內可接受的不同版本或寫法
*	步 分 (涉及計算的題目)
†	需要書寫正確

4. 試題若列明要求答案的數量，而考生給予多於要 求的答案，多答的部分則不會評閱。舉例說，試題要求考生列舉兩個例子，如考生列舉了三個，閱卷員只需評閱第一和第二個答案。

5. 如考生所答的題目超出試卷要求的答題數量，閱 卷員須評閱所有答案，惟最低分的過量答案將在計算總分時被剔除。

6. 答案若自相矛盾，得零分。

7. 除於有機合成的反應 要中，所有化學方程式均須平衡。能學的化學方程式應包含所涉及化學物種的正確物態符號。

分數

1. (a) (i) 「活化能」是反應物粒子碰撞時擁有的最小能量，以令反應發生。 1

(ii) y 酵母提供酶/催化劑。 1
y 在高溫下，酶(酵母)會變質 / 被破壞，令它失去催化劑的功用。 1

(iii) 它可解決丙種維生素不足或供應量萎縮的問題。 1

(iv) 任何兩項： 氯、氫、氫氧化鈉, NaOCl, HCl, $NaClO_3$, ClO^-, ClO_3^-,漂白水 1

(b) (i) 初速是反應開始時的瞬間速率。或t = 0 時的速率。 1

(ii) y 用比色法 / 跟隨溶液的顏色強度。 1
y 溶液由無色變棕色/黃色。 1
或
y 與標準 $Na_2S_2O_3$ 滴定。 (1)
y 進行驟冷。加入澱粉指示劑。顏色變化:由藍色變無色。 (1)

(iii) y 初速/速率與 $[BrO_3^-(aq)]$ 成正比 / 圖象是一直線 / 速率 $\propto [BrO_3^-]$。 1
y 因此，對應於$BrO_3^-(aq)$ 的反應級數 = 1 1

(iv) (1) 速率 = $k[BrO_3^-][I^-][H^+]^y$
y 為對應於 H^+ 的反應級數

$$\frac{\text{初速 1}}{\text{初速 2}} = \frac{(0.17)(0.15)}{(0.17)(0.30)}\left(\frac{0.10}{0.20}\right)^y = \frac{2.30\times10^{-3}}{1.84\times10^{-2}}$$ 1*

$y = 2$ 1
因此，該反應對應於H^+為二級。 (1)
(接受其他解釋。)
當起始 [I⁻] 增幅為 0.30 / 0.15 = 2 倍，起始 $[H^+]$ 增幅為 0.20 / 0.10 = 2 倍，而起始的 $[BrO_3^-]$ 保持不變，初速增加了 $1.84 \times 10^{-2} / 2.30 \times 10^{-3} = 8$ 倍。由於反應的速率對 I⁻ 為一級，當起始 $[H^+]$ 倍增時，速率上升了四倍。 (1*)

(2) 消耗 BrO_3^- 的速率 = 1/3 × 生成I_2 的速率
在第 1 次實驗中，對應$BrO_3^-(aq)$ 的初速
$= -2.30 \times 10^{-3} \times 1/3$
$= -7.67 \times 10^{-4}$ mol dm^{-3} s^{-1} (接受–7.7, –7.667, –7.6667 不接受–7.70) 1

(c) (i) 哈柏法產生的氨可用來製造肥料/炸藥等。(HNO_3, NH_4NO_3 / NO_3^- / 雪種) 1

(ii) 在哈柏法製氨，天然氣仍然是提供氫作原材料的較方便/廉宜途徑。 1

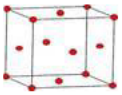
(iii) 提供較大的表面積以提升催化劑的果效。 1

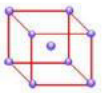
(iv) y 平衡位置 / 產率 1
y 反應速率 /有效碰撞 1

(v) 把未反應的反應物再用/再循環，使他們再反應。 1
從生成的混合物移走氨/液化氨可令平衡位置移向生成物一方。/ (1)
再增加 H_2. (1)

(vi) 由於開採天然硝酸鹽礦物以生產肥料的需求大幅下降，致令
採礦業無利可圖 1
或 採礦業需停產
或 使失業率上升
(接受其他合理答案。)

分數

2. (a) (i) (1)  1

(2)  1

(ii) 任何兩項： 1+1
- y 擁有頗為剛性的分子脊柱，其中含雙鍵以確定分子的長軸
- y 很多液晶物料含有苯環
- y 棒狀或碟狀分子
- y 極性基團

(iii) 熱塑性塑膠： 氯乙烯、 苯乙烯 1
熱固性塑膠：脲甲醛

(b) (i) (1) 兩者都有巨型結構。 1

(2) 硅酸鹽是天然物料，而陶瓷則為合成物料。 1

(ii) (1) $Si_2O_5^{2-}$ 1

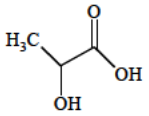
(2) y 滑石：層狀結構，其中各層由范德華力 / 弱的分子間引力彼此牽引。 1
y 石英：結構由 Si 和 O 原子以巨型網絡 / 強共價鍵牽引而成。 1
y 施加小量能便可令滑石中各層相互滑動，但要破壞石英的巨型網絡卻需大量的能。 1

(iii) 高硬度 1

(c) (i) 吹氣成型 / 吹塑法 / 注射成型 / 注模法 1

(ii) y 低密度 乙烯 (LDPE) 與高密度 乙烯 (HDPE) 1
y 由於止咳水瓶子硬，所以 HDPE 較合適。HDPE 的分子具鏈狀結構，分子可作緊密裝填。 1
或
由於止咳水瓶子軟，所以 LDPE 較合適。LDPE 分子有很多支鏈，分子不能緊密裝填。

(iii) y 極性的 PET 分子由強很多的極性-極性作用力牽引。 1
y 非極性的 PE (HDPE) 分子由范德華力 / 弱的分子間引力牽引。 1

(iv) (1)  1

(2) PLA 是從可再生原料製成，但 PE 和 PET 是從不可再生的石油產物製成。 1
或
PLA 可被生物降解，但 PE 和 PET 卻不可被生物降解。

(3) PLA 製自農業產品。大量製造 PLA 會影響食物供應。 1

分數

3. (a) (i) (1)
- 把 HCl(g) 放近 NH_3(g/濃)。 1
- 觀察到濃的白色煙霧。 1

或

溶HCl(g) 於 去離子水.

- + Na_2CO_3 有氣體釋出 (1)
- + $AgNO_3/H^+$生成白色沉澱 (1)

或

- HCl + Na_2CO_3 (aq) 有氣體釋出 (1)
- HCl + $AgNO_3/H^+$生成白色沉澱 (1)

(2)
- 加入 2,4-二硝基苯肼。 1
- 生成黃色 / 橙色 / 紅色沉澱。 1

(ii) (無水)硫酸鎂 1

(b) (i) 確保反應達致完全。/增加反應速率。 1

(ii) (1) 沒有更多氣體釋出。 / 全部固體溶解。 1

(2) 生成棕色沉澱。 1

(iii) 在步 6，生成 CaC_2O_4 的摩爾數：
2.374 / 128.1 = 0.01853 1*
在該石灰石樣本中 $CaCO_3$ 的質量：
0.01853 x 100.1 = 1.855 g 1*
在該石灰石樣本中 $CaCO_3$ 的質量百分率：
1.855 g / 2.025 g = 91.60 (%)[91.3 – 91.9 接受到五個有效數字或 91/92] 1

(iv) 重量分析 1

(c) (i)
- 把樣本溶於戊烷，並將溶液與 $NaHCO_3$(aq) 在分液漏斗中搖動。 1
- 收集有機液層，並進行分餾/蒸餾。 1

[只有分餾/蒸餾:0 分]

(ii) y 光譜中約 3230-3670 cm^{-1} 處沒有強吸收，可排除羥基團的存在 (醇的可能性) 1

在 2070-2250 cm^{-1} 不呈現吸收，可排除 C≡C 基團的存在。 (1)

在 1610 - 1680 cm^{-1} 不呈現吸收，可排除 C=C 基團的存在。 (1)

y 光譜在 1730 cm^{-1} (由 1700 至 1750 的其中一個數字) / (1680 to 1800 cm^{-1}) 處有強吸收對應於 C=O 的伸展。該化合物可能含醛基團或酮基團。 1

[接受沒有 cm^{-1}]

[如寫 cm^{-1} 為 cm 或/cm^{-1} : 扣 1 分]

y 在托倫斯試驗中呈現陰性結果，可排除該化合物中有醛基團。/ 該化合物可能含酮基團[IR: C=O]。 1

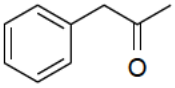
(iii) m/z = 43: $[CH_3CO]^+$ 1

m/z = 134: $[C_7H_7COCH_3]^+$ 或 $[C_6H_5C_3H_5O]^+$ 1

[接受: ( ); 沒有 [ ]; 用下列結構表示]

[如不寫任何數字(43 and 134) ，可視最先出現的為 43。]

[不接受: $[C_2H_3O]^+$/ $[C_9H_{10}O]^+$ 。]

(iv)  1

其他可能結構：