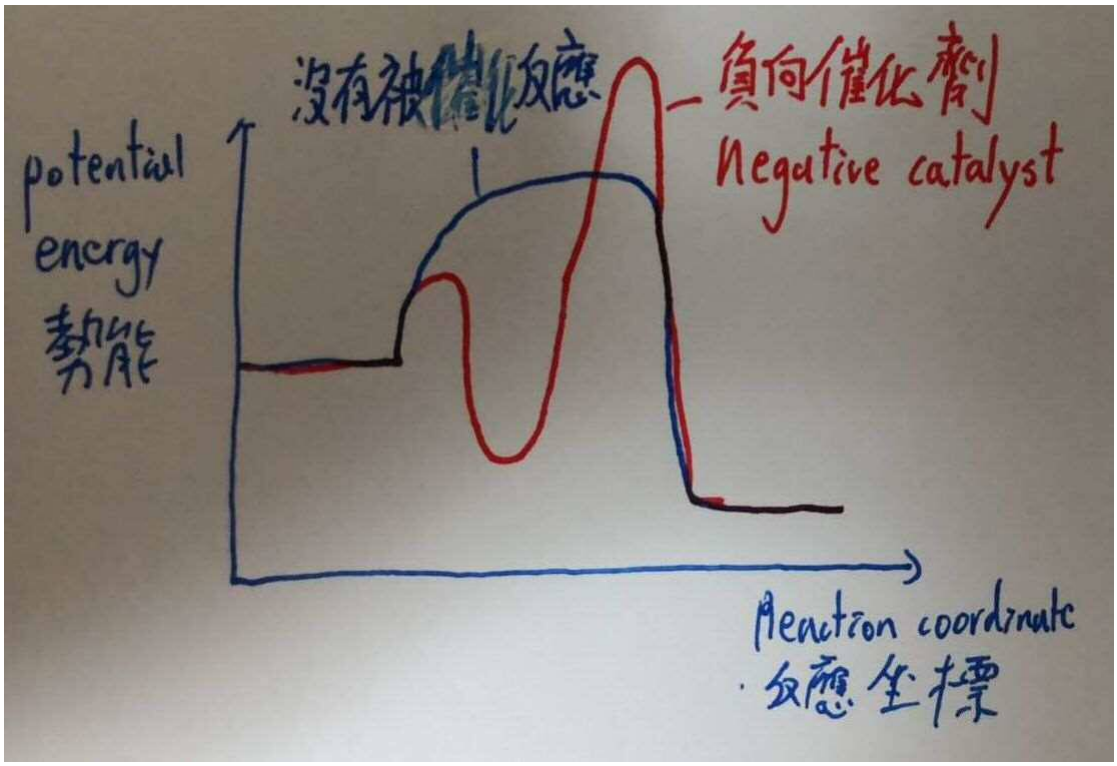
Paper 2
卷二

1(a)(i)
Toxic mercury is used(1)
使用了有毒的汞 (1)
A lot of energy is needed during operation (1)
運作過程所需的能量十分高(1)

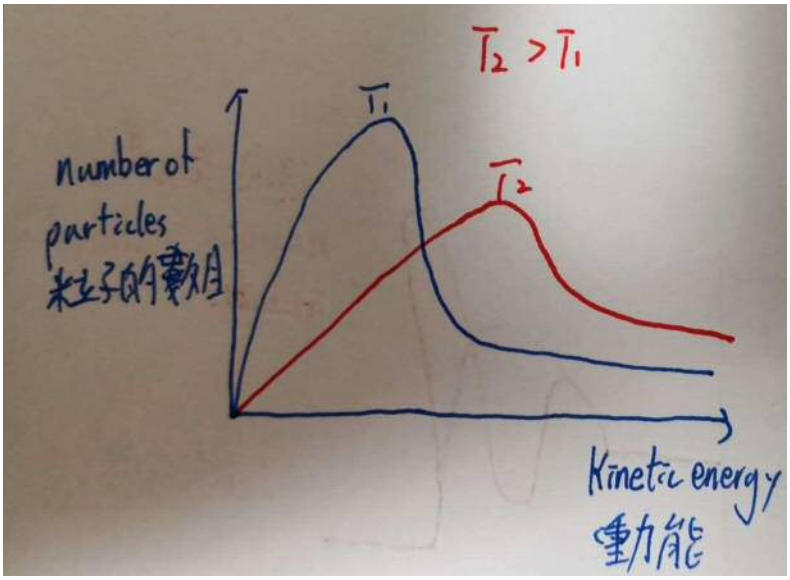
1(a)(ii)



1(a)(iii)
It is a feedstock to produce organic compounds with greater number of carbon atoms/ a wide variety of chemicals in the chemical industry.(1)or
It acts as a source of fuel.(1)or
It acts as a solvent.(1)
作為原材料以製成含有更碳原子的化合物/不同種類的化合物(1)or
作為燃料的來源(1)or
作為溶劑(1)

1(b)(i)(1)
$N_2 + 3H_2 \rightleftharpoons 2NH_3$ (1)
Finely divided iron(1)
細碎的鐵(1)

1(b)(i)(2)



(1)
As temperature increases, the average kinetic energy of the particles increases.
The number of particles having energy equal to or greater than activation energy also increases.
Consequently, the number of effective collisions per unit time increases, so the reaction rate increases.(1)
當溫度上升，粒子的平均動能上升。
擁有動能高於或相等於活化能的粒子數目上升。
因此，每時間單位的有效碰撞數目上升，所以反應速率上升。(1)

1(b)(i)(3)
No.
High temperature causes endothermic reaction has a higher rate than exothermic reaction.(1)
Under industrial process, it needs to compromise the rate of reaction. Hence, high operation doesn't mean it is an endothermic reaction.(1)
不。
高溫會令到化學平衡中吸熱反應比放熱反應的速率高。(1)
但於工業過程，需要考慮速率的因素，因此高溫操作不一定證明該反應是吸熱反應。(1)

1(b)(ii)
Nitrogen: fractional distillation of liquefied air(1)
氮: 液化空氣的分餾(1)
Hydrogen: syngas(1)
氫:合成氣(1)

1(c)(i)
Measure the oxygen gas produced per unit time
量度氣體(O_2)產生每單位時間產生的體積

1(c)(ii)
在 0^oC,
Rate = $k[H_2O_2]^n$(1)

$6.66x10^{-3} = k[0.4]^n$ ----(1)式
$5.33x10^{-3} = k[0.32]^n$ -----(2)式

(2)/(1) :

$6.66x10^{-3} / 5.33x10^{-3} = (0.4/0.32)^n$
n = 1

$6.66x10^{-3} = k[0.4]$
k= 0.01665 $cm^3min^{-1}M^{-1}$ (1)

在 25^oC,
$8.5 \times 10^{-3} = k[0.4]$
k = $0.02125cm^3min^{-1}M^{-1}$(1)

1(c)(iii)

$$\log\frac{k_2}{k_1} = \frac{-Ea}{2.3R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$ **(1)**

Log(0.02125/0.01665) = -Ea/2.3(8.31)(1/298 - 1/273)
Ea = $6589kJmol^{-1}$(1)

2(a) condensation polymerization 縮合聚合作用
diol and dioic acid
二醇 和 二酸

2(b)For thermosetting plastic there are cross linkage between different polymer chain.
就熱固性塑膠，聚合物鏈之間會有交叉鏈接。

For polyester there are dipole-dipole attraction between the polymer chain.
就聚酯，聚合物鏈之間會有偶極－偶極吸引力。

2(c) It is a good electrical insulator and a good heat insulator
極佳的電絕緣體, 極佳的耐熱物質

2(d)(i)
Using the material which is biodegradable and adding material that is biodegradable to the plastic.
使用可生物降解的物質及加入可生物降解的物料至塑膠。

2(d)(ii)
Using the material which is biodegradable: the microorganism can decompose it directly.
使用可生物降解的物質: 微生物可以直接將其分解

Adding material that is biodegradable to the plastic: after the biodegradable substance decomposed, the surface area of the other part of plastic will be increased.
加入可生物降解的物料至塑膠: 當生物可降解的物質被分解後，其他塑膠部分的表面面積會增加。

2(d)(iii)
polylactide (PLA)
聚乳酸

2(e)(i)
The unit cell is the simplest arrangement of atoms (or ions)which when repeated will reproduce the whole structure.
晶胞是能描述晶體結構的最小結構單位。把晶胞複製，並有規律地排列，可得出整個晶體。

2(e)(ii)
The coordination number is defined as the number of atoms (or ions) immediately surrounding an atom (or ion) in a crystal lattice.
配位數是指在一個晶格中包圍一個原子（或離子）的原子（或離子）的數目。

2(e)(iii)(1) 12
2(e)(iii)(2) 8
2(e)(iv) brass 黃銅

2(e)(v)
In a pure copper, all the atoms are of the same size. The layers of atoms can slide past one another easily when a force is applied. In an brass, atoms of a different size are added. This distorts the regular structure of the pure metal. The layers of atoms in the alloy are difficult to slide past one another when a force is applied. Hence brass is stronger and harder than copper.
在銅，所有原子的體積都相同。當施加力時，原子層能夠輕易滑動經過其他的原子。在黃銅，不同體積的原子加入，令到當中有規律的結構被破壞。當施加力時，原子層較難滑動經過其他的原子。因此，黃銅的硬度比銅高。

2(e)(vi)
A regularly packed solid has a higher melting point than one with a less regular structure. The structure of brass is less regular than pure copper. Hence brass has a lower melting point than the copper.
一個規則排列的固體比不規則排列的固體有更高的熔點。黃銅的結構比純銅的排列更不規則。因此黃銅比銅有更低的熔點。

3(a)(i)
adding H_2SO_4 to the sample, filter out the sample and carry out the flame test. If there are brick red flame, it indicates that there is the presence of Ca^{2+}.

加入 H_2SO_4 至樣本，過濾樣本並進行焰色測試，若有磚紅色的火焰生成，這顯示該樣本是有 Ca^{2+} 的存在。

(2)

3(a)(ii)
Add water to the sample respectively. $CaCl_2$ would be soluble but $CaSO_4$ would be insoluble (1)

將水分別地加進樣本， $CaCl_2$ 是可溶的，但 $CaSO_4$ 是不可溶的(1)

3(a)(iii)
No, the compound with the same Rf value in the same mobile phase and stationary phase is the same compound.(1)
The mobile phase of this two experiments are different. (1)

不，在同一個固定相和流動相之中擁有相同 Rf 值的化合物是同一化合物。(1)

但在兩個實驗中流動相是不相同的。(1)

3(b)(i)
$I_2 + C_6H_8O_6 \rightarrow 2I^- + C_6H_6O_6 + 2H^+$(1)
$I_2 + 2S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2I^-$(1)

3(b)(ii)
Starch solution(1), from dark blue to colorless(1)

澱粉溶液(1)，由藍黑色轉為無色(1)

3(b)(iii)
No. of mole of $S_2O_3^{2-}$ used = 17.27/1000 x 0.1 = $1.727x10^{-3}$mol
No. of mole of I_2 reacted with $S_2O_3^{2-}$ = $1.727x10^{-3}$ /2 = $8.635x10^{-4}$mol
No. of mole of I_2 added = 10/1000 x 0.2 = 2 x 10^{-3}mol
No. of mole of I_2 reacted with $C_6H_8O_6$ = 2 x 10^{-3} - $8.635x10^{-4}$ = $1.1365x10^{-3}$mol
Mass of $C_6H_8O_6$ in the sample = $1.1365x10^{-3}$ (12x 6 + 8 + 16x6) = 0.200g
Percentage by mass = 0.200/3 x100% =6.67%
(3)

使用的 $S_2O_3^{2-}$的摩爾數= 17.27/1000 x 0.1 = $1.727x10^{-3}$mol

與 $S_2O_3^{2-}$反應的 I_2 的摩爾數 = $1.727x10^{-3}$ /2 = $8.635x10^{-4}$mol

加入的 I_2 的摩爾數= 10/1000 x 0.2 = 2 x 10^{-3}mol

與 $C_6H_8O_6$ 反應的 I_2 的摩爾數= 2 x 10^{-3} - $8.635x10^{-4}$ = $1.1365x10^{-3}$mol

在樣本中 $C_6H_8O_6$ 的質量 = $1.1365x10^{-3}$ (12x 6 + 8 + 16x6) = 0.200g

質量百分比 = 0.200/3 x100% =6.67%

(3)

3(c)(i)
From characteristic (1), the compound X should have a aldehyde, primary alcohol or secondary alcohol. (1)
The spectrum does not show strong absorption at about 3230-3670 cm^{-1} ruling out the presence of a hydroxyl group.(1)
The spectrum has a strong absorption at 1700 cm^{-1} which corresponds to C=O Stretching. The compound contain C=O bond.(1)
By combine two information, the compound should be aldehyde. (1)

從特性(1), 化合物 X 應為醛，一級醇或二級醇。(1)

在光譜中 3230-3670 cm^{-1} 處沒有強吸收，可排除羥基團的存在。(1)

在光譜在 1700 cm^{-1} 處有強吸收對應於 C=O 的伸展。(1)

整合兩個資料，該化合物應為醛。(1)

3(c)(ii)
molecular formula = $(C_9H_8O_2)n$ where n is a integer.
The molecular ion peak can represent it relative molecular mass.(1)
hence,
(12x9 + 1x8 + 16x2) n = 148
n = 1

So, the molecular formula is $C_9H_8O_2$(1)

分子式 = $(C_9H_8O_2)n$, n 是一個整數

分子離子峰能夠用於反映與相對分子質量。(1)

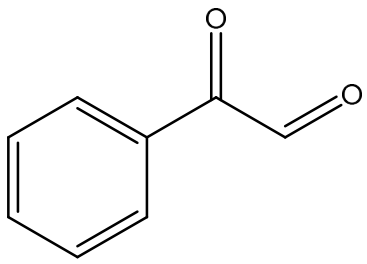
因此，

(12x9 + 1x8 + 16x2) n = 148
n = 1

所以，分子式是 $C_9H_8O_2$(1)

3(c)(iii)
The peak at m/z = 77 suggest the presence of $[C_6H_5]^+$.(1)

於 m/z=77 的峰應為$[C_6H_5]^+$.的存在(1)



(1)