SERANGOON JUNIOR COLLEGE
General Certificate of Education Advanced Level
Higher 1

CHEMISTRY 8872/02

Preliminary Examination **Paper 2** **SOLUTIONS**

1 Iron tablets containing iron (II) sulphate can be used to supplement the daily iron intake in diet. The Health Sciences Authority had regulated that all commercially available iron tablets must contain 15 to 18% by mass of iron.

(a) Acidified potassium manganate (VII), $KMnO_4$, which oxidises iron (II) sulphate, is used to estimate the amount of iron (II) ions, Fe^{2+}, present in Brand **A** iron tablet. 2.00 g of the iron tablet was dissolved in dilute acid and the volume of the solution was made up to 100 cm^3 in a volumetric flask. A 10.0 cm^3 portion of this solution was titrated against 2.50 x 10^{-4} mol dm^{-3} of potassium manganate (VII) solution. 13.50 cm^3 of the manganate (VII) solution was required to completely oxidise the Fe^{2+} present.

(i) Write the overall equation of the reaction between MnO_4^- and Fe^{2+}.

Oxidation: $Fe^{2+} \longrightarrow Fe^{3+} + e$
Reduction: $MnO_4^- + 8H^+ + 5e \longrightarrow Mn^{2+} + 4H_2O$

$5Fe^{2+}(aq) + MnO_4^-(aq) + 8H^+(aq) \rightarrow 5Fe^{3+}(aq) + Mn^{2+}(aq) + 4H_2O\ (l)$

(ii) Calculate the concentration of Fe^{2+} in the 100 cm^3 solution.

amount of MnO_4^- in 13.50 cm^3 = $\frac{13.5}{1000} \times 2.5 \times 10^{-4}$ = 3.370 x 10^{-6} mol

from (3) mole ratio: $5Fe^{2+} \equiv MnO_4^-$

amount of Fe^{2+} in 10 cm^3 = 3.37 x 10^{-6} x 5 = 1.6875 x 10^{-5} mol

amount of Fe^{2+} in 100 cm^3 = 1.6875 x 10^{-5} x 10 = 1.6875 x 10^{-4} mol

concentration of Fe^{2+} in 100 cm^3 solution = 1.6875 x 10^{-4} / 0.1
= 1.69 x 10^{-3} mol dm^{-3}

(iii) Hence, state with **reasoning** if the Brand **A** iron tablet meets the regulation stated by the Health Sciences Authority.

Mass of Fe^{2+} present in 2g of tablet **A** = 1.6875 x 10^{-4} x 55.8
= 9.4163 x 10^{-3} g

Percentage of Fe present in tablet **A** = (9.4163 x 10^{-3} / 2) x 100 %
= 0.471 %

No , the iron tablet does no meet the requirement of HSA as its iron content is not within the range 15 to 18% by mass.

(b) Write the electronic configurations of Fe and Fe^{2+} ion.

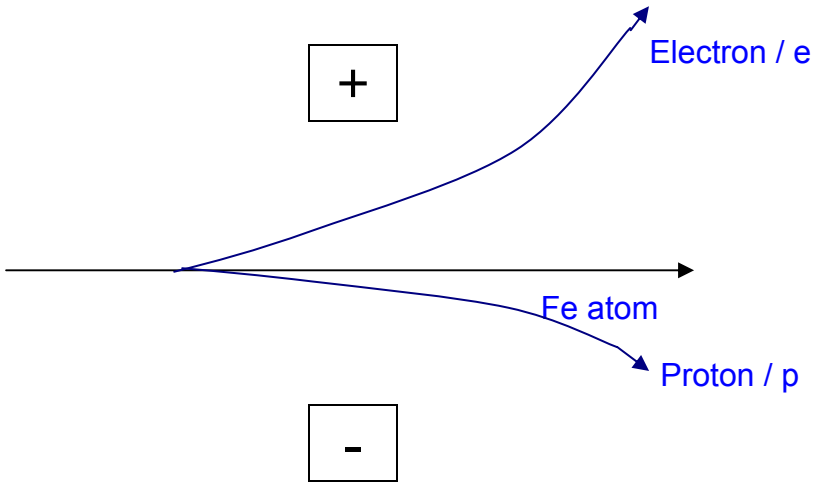
Fe atom: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$

Fe^{2+} ion: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$

(c) On the diagram below, show and label clearly how the beams of the following particles are deflected when subjected to an ***electric*** field.

(i) electron
(ii) proton
(iii) Fe atom

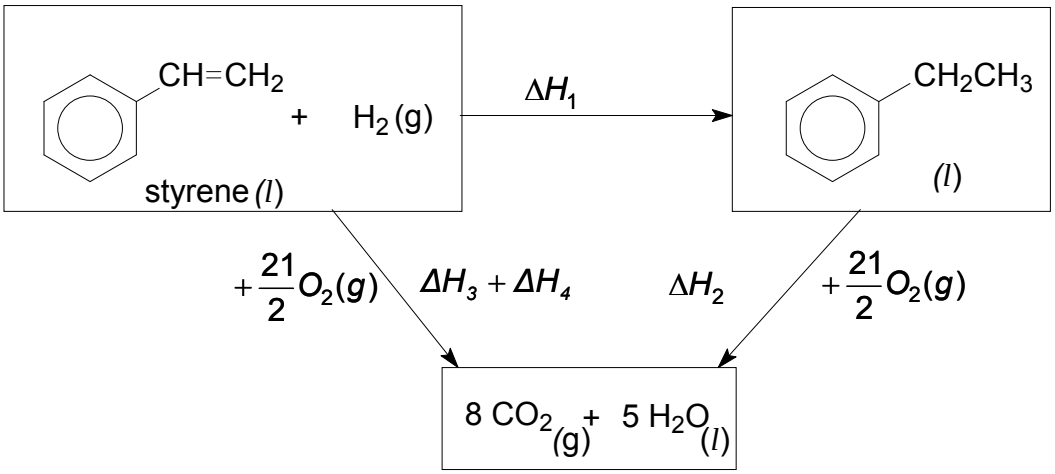
You should relate clearly the magnitude and the direction of deflection of each beam to the other. (Any pencil markings will NOT be graded.)



[Total: 8 m]

2 Styrene is an aromatic hydrocarbon that is a precursor to polystyrene, an important synthetic material that is used in the making of many substances such as plastic, rubber, insulation and fiberglass.

The diagram below shows an energy cycle involving the compound styrene.



(a) **(i)** Use the following data to calculate the standard enthalpy change of hydrogenation of styrene.

$\Delta H_C^{\ominus}$ hydrogen	=	–286 kJ mol^{-1}
$\Delta H_C^{\ominus}$ styrene	=	–4393 kJ mol^{-1}
$\Delta H_C^{\ominus}$ ethylbenzene	=	–4562 kJ mol^{-1}

ΔH_1 = $\Delta H_C^{\ominus}$ (styrene) + $\Delta H_C^{\ominus}$ (H_2) – $\Delta H_C^{\ominus}$ (ethylbenzene)
= (–4393) + (–286) – (–4562)
= **–117 kJ mol^{-1}**

(ii) Calculate the amount of heat evolved when 1.000 g of styrene was burnt completely to heat up 200 cm^3 of water by 45.0 °C. Assume that the specific heat capacities of all solutions are 4.18 J g^{-1} K^{-1}, and that all solutions have a density of 1.0 g cm^{-3}.

Heat evolved, Q = m c ΔT
= (200) (4.18) (45)
= **37600 J** **(accept 37620)**

(iii) Using the answer in **(ii)**, calculate the enthalpy change of combustion of styrene.

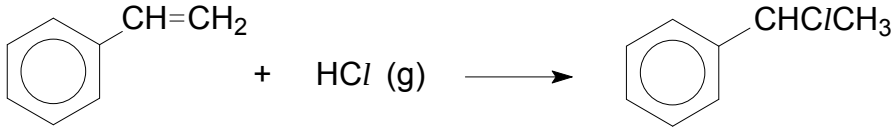
$$\Delta H_C^{\ominus} = -\frac{37620}{1/104}$$

= **–3910 kJ mol^{-1}** **(accept -3912)**

(iv) Comment on the difference in values of standard enthalpy change of combustion of styrene in (i) and (iii)

Heat has been lost to the surroundings/ poor insulation.

(b) Give the following information,



styrene

ΔH_f^o styrene = +104 kJ mol^{-1}

ΔH_f^o hydrogen chloride = –92 kJ mol^{-1}

ΔH_f^o (2-chloroethyl)benzene = –58 kJ mol^{-1}

(i) calculate the enthalpy change for the following reaction.

$\Delta H_{rxn} = \Delta H_f^o(C_8H_9Cl) - [\Delta H_f^o (C_8H_8) + \Delta H_f^o (HCl)]$

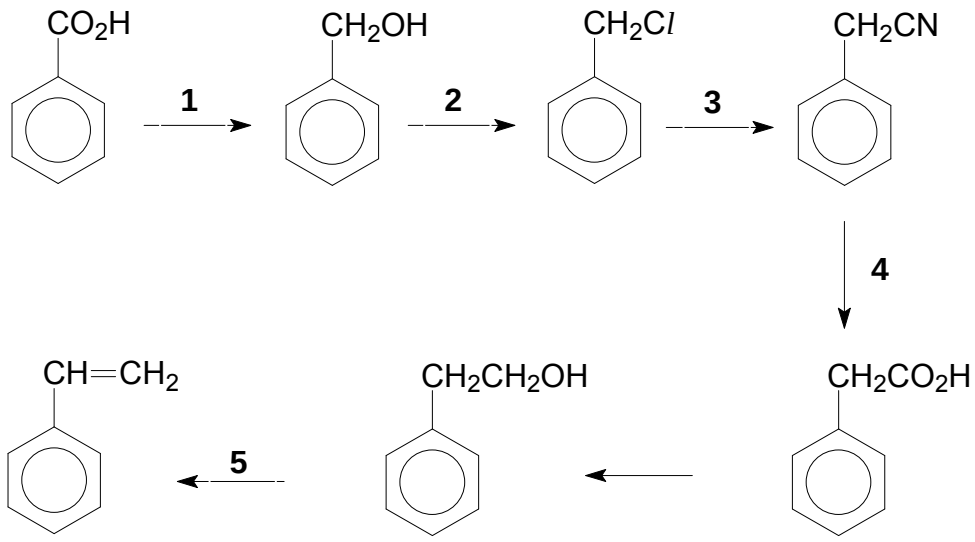
= - 58 - [104 + (-92)]

= **- 70 kJ mol^{-1}**

(ii) The reaction above can be performed when ethylbenzene is treated with a small quantity of chlorine in the presence of ultraviolet light. Both (1-chloroethyl)benzene and (2-chloroethyl)benzene are produced. Predict the approximate ratio in which they are formed.

(1-chloroethyl)benzene : (2-chloroethyl)benzene = 2 : 3

(iii) A student has accidentally poured some hot acidified potassium manganate (VII) into a bottle of styrene, forming benzoic acid. In order to salvage the styrene, he decided to adopt the following synthetic route.



Suggest the correct reagents and conditions for the synthetic steps **1** to **5**.

For (1)
Reagents: LiA/H_4,
Condition: dry ether, room temperature

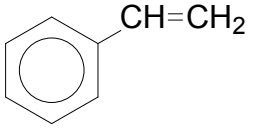
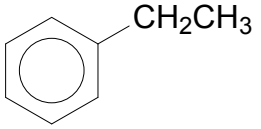
For (2)
Reagents: PC*l*$_5$ / $SOCl_2$, PCl_3
Condition: room temperature

For (3)
Reagents: KCN, NaCN
Condition: ethanol, reflux/heat

For (4)
Reagents: H_2SO_4 (aqueous)
Condition: heat

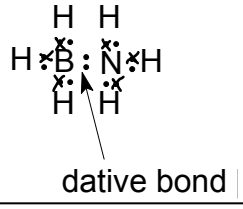
For (5)
Reagents: concentrated H_2SO_4
Condition: 170 ^{0}C

(iv) Complete the following table below:

Compound	Number of carbon atom(s)		
	sp	sp^2	sp^3
	**0**	**8**	**0**
	**0**	**6**	**2**

[Total: 12 m]

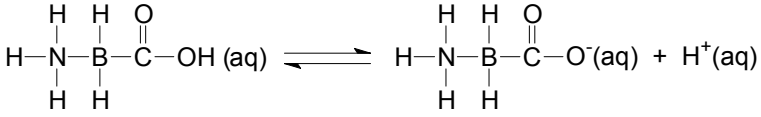
3(a) Draw the dot-n-cross diagram of BH_3NH_3 and state the type of bond between boron and nitrogen.



(b) By referring to the intermolecular interaction involved, explain the difference in boiling points between ethane and its amino-borane analogue.

- Ethane molecules are non-polar molecules, which are held together by weak induced dipole-dipole interaction.
- NH_3BH_3 molecules are polar, which are held together by stronger permanent dipole-dipole interaction.
- More energy is needed to overcome the stronger pd-pd interaction, the BH_3NH_3 has higher boiling point.

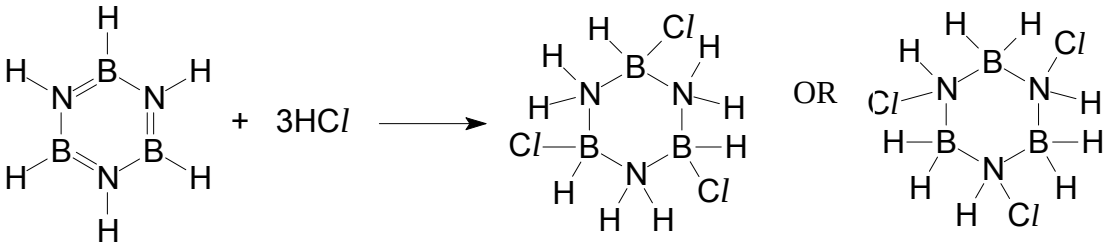
(c) Write an equation to illustrate the acidic nature of ammonia carboxyborane



(d) Suggest a name of the carbon analogue of ammonia carboxyborane. **[1]**

Propanoic acid

(e) Construct a balanced equation for the reaction between borazine and hydrogen chloride. Calculate the volume of HC*l* (measured at room temperature and pressure) needed to react completely with 16.08g of borazine.



Amount of borazine = $\frac{16.08}{(3\times10.8+3\times14.0+6\times1.0)}$ = 0.200 mol

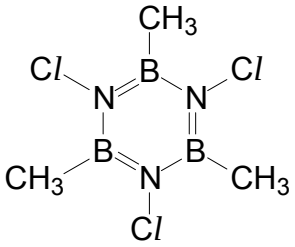
1 mol borazine ≡ 3 mol HCl

Amount of HCl needed = 0.600 mol

Volume of HCl at rtp = 0.600 × 24.0 = 14.4 dm^{-3}

(f) Suggest the reagents for the synthesis of *B*-trimethyl-*N*-trichloroborazine. Draw the displayed formula of this product.

$B(CH_3)_3$ and $ClNH_3Cl$



[Total: 10m]

4 (a)(i) Explain, using a relevant equation, how the H_2CO_3/HCO_3^- buffer responds to prevent acidosis from occurring.

When pH drops, there is **additional H_3O^+:**

Eqn: HCO_3^- (aq) + H^+ (aq) → H_2CO_3 (aq)

The added H_3O^+ is **removed** by the conjugate base as **H_2CO_3**.

Hence pH **remains fairly constant**.

(i) Using *Le Chatelier's Principle*, suggest how excess amount of H_2CO_3 is removed by the lungs.

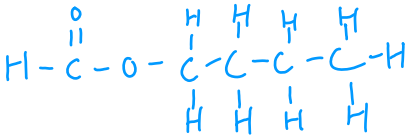
When $[H_2CO_3]$ increases, the **equilibrium position** will **shift** to the **right** to **decrease $[H_2CO_3]$**.

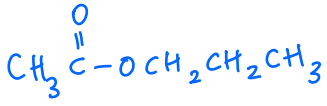
(ii) Hence, suggest a reason for the heavy breathing after strenuous exercise.

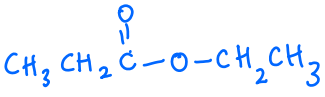
After exercise, the process of maintaining pH results in production of H_2CO_3 and removal of H_2CO_3 causes **more CO_2** to be formed. The heavy breathing could be due to an **attempt to expel CO_2** from the body.

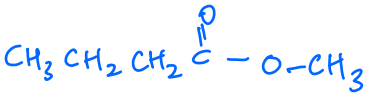
(g) Esters are a class of chemical compounds and functional groups. Esters consist of an inorganic or organic acid in which at least one -OH (hydroxyl) group is replaced by an -O-alkyl (alkoxy) group.

(i) In the boxes below, draw the structural formulae of any three **straight-chained** esters with the molecular formula $C_5H_{10}O_2$.





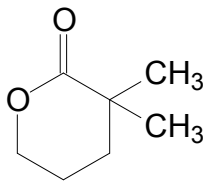




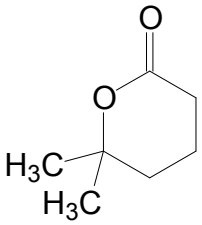
(ii) Write an equation for the basic hydrolysis of **one** of these esters.

$CH_3CH_2CH_2C(=O)-O-CH_3 + NaOH \rightarrow CH_3CH_2CH_2C(=O)-O^-Na^+ + CH_3OH$

(iii) Suggest a chemical test to distinguish between the two cyclic esters.



A



B

Test: Add aqueous NaOH, reflux, followed by dilute H_2SO_4 and $KMnO_4$

Observation: Purple $KMnO_4$ decolourised for A
Purple $KMnO_4$ remains unchanged for B

[Total: 10m]

Section B

5(a) This question is on the oxides of nitrogen.

At 1280°C, nitrogen monoxide and hydrogen react as follows:

$$2NO(g) + 2H_2(g) \rightarrow N_2(g) + 2H_2O(g)$$

The results of some investigations of the rate of this reaction are shown below.

Experiment	[NO] / mol dm^{-3}	[H_2] / mol dm^{-3}	Initial rate / mol dm^{-3} s^{-1}
1	0.005	0.002	1.3×10^{-5}
2	0.010	0.002	5.0×10^{-5}
3	0.010	0.004	10.0×10^{-5}

(i) Use the data above to determine the order of the reaction with respect to
I nitrogen monoxide
II hydrogen

Comparing **expt 1 & 2** at constant [H_2],
when [NO] is doubled, rate is increased by 4 times,
hence **2nd order wrt NO**

Comparing **expt 2 & 3** at constant [NO]
when [H_2] is doubled, rate is also doubled,
hence **1st order wrt H_2**

(ii) Hence, write a rate equation for the reaction and determine a value for k, stating the units.

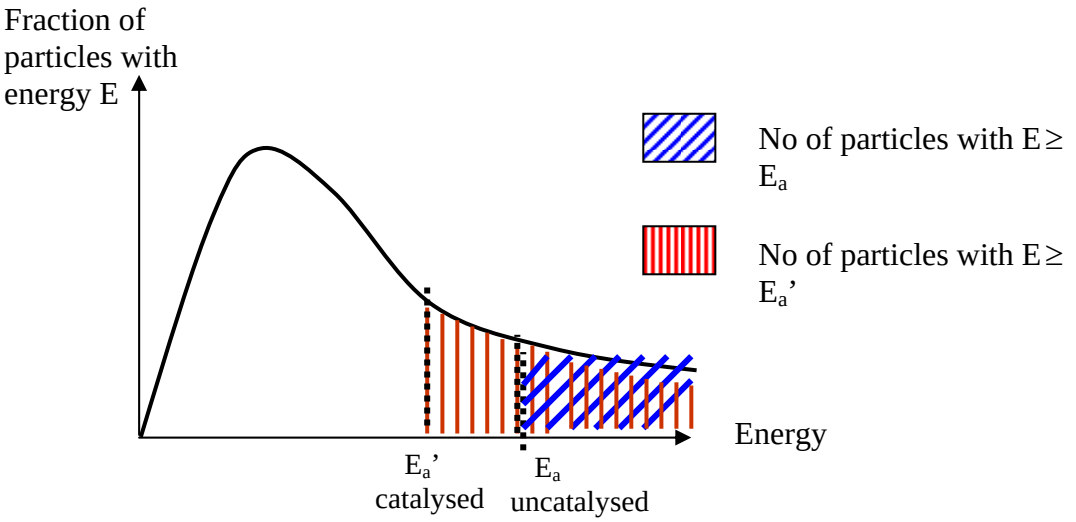
Rate = k[NO]^2[H_2]

Using Expt 1,
$1.3 \times 10^{-5} = k[0.005]^2[0.002]$
k = 260 mol^{-2} dm^6 s^{-1}

(iii) Discuss the effect on the rate of this reaction when the concentration of NO is halved and the concentration of H_2 is tripled simultaneously.

$$\frac{\text{new rate}}{\text{old rate}} = \frac{k(\frac{1}{2}[NO])^2(3[H_2])}{k[NO]^2[H_2]} \Rightarrow \text{new rate} = \text{¾ old rate}$$

(iv) With the aid of the Boltzmann distribution, explain how the presence of a catalyst increases the rate of the above chemical reaction.



Catalyst **lowers activation energy.**
Since **shaded area** with catalyst present is **larger**,
Number of reactant particles with at least activation energy, E_a increases. .
Number of effective collisions taking place in the reaction **increases**.

(b) Another oxide of nitrogen, dinitrogen pentoxide, N_2O_5, decomposes to nitrogen dioxide, NO_2, and nitrogen trioxide, NO_3, as follows:

$$N_2O_5\,(g) \rightarrow NO_2\,(g) + NO_3\,(g)$$

The activation energy of the reaction is 154 kJ mol^{-1} and the enthalpy change of the reaction is +136 kJ mol^{-1}.

(i) Define the term *activation energy*.

Activation energy is the minimum amount of energy that reactant particles must posses in order to react.

(ii) Determine the activation energy for the reverse reaction.

E_a of reverse reaction = 154 – 136 = <u>18.0 kJ mol^{-1}</u>

(c) Two of the oxides of nitrogen can co-exist in the equilibrium

$$\underset{\text{colourless}}{N_2O_4(g)} \rightleftharpoons \underset{\text{brown}}{2NO_2(g)}$$

(i) Write an expression for K_c, indicating the units.

$K_c = \dfrac{[NO]^2}{[N_2O_4]}$ Units: **<u>mol dm^{-3}</u>**

(ii) 1 mol of dinitrogen tetraoxide, N_2O_4, was introduced into a vessel of volume 10.0 dm^3 at a temperature of 70°C. At equilibrium, 50% of N_2O_4 had dissociated. Calculate K_c.

Step 1:	N_2O_4 (g) $\rightleftharpoons$	$2NO_2$
<u>I</u>nitial no. of mole (mol)	1	0
<u>C</u>hange in no. of mole (mol)	- 0.5	+ 1
No. of mole at **<u>E</u>**q$^{\underline{m}}$ (mol)	0.5	1

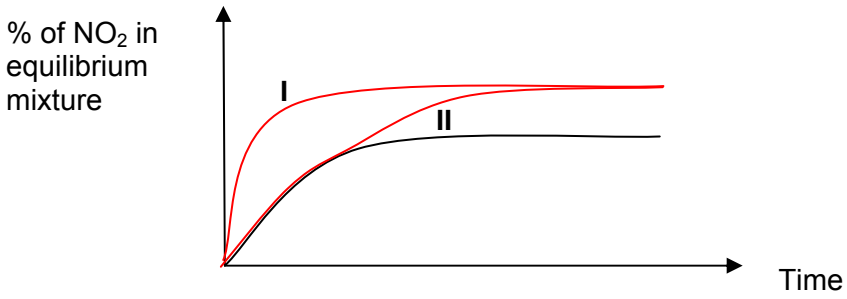
$K_c = \dfrac{[NO]^2}{[N_2O_4]} = \dfrac{(1/10)^2}{0.5/10}$ = **<u>0.2 mol dm^{-3}</u>**

(iii) The graph below shows 1 mol of N_2O_4 in a vessel of volume 10.0 dm^3. Copy the graph and sketch on the same axes as shown below, the new graph that would be obtained if the experiment in **(c)(ii)** was carried out using

I 2 mol of N_2O_4 in a vessel of volume 10.0 dm^3

II 2 mol of N_2O_4 in a vessel of volume 20.0 dm^3

Label each graph clearly on your sketch.



(iv) Use the following data to calculate the enthalpy change of the forward reaction.

Compound	ΔH_f^θ / kJ mol^{-1}
N_2O_4	+9.70
NO_2	+33.9

ΔH_{rxn}^θ = ΔH_f^θ (products) - ΔH_f^θ (reactants)

= 2(+33.9) – 9.70

= **+58.1 kJ mol^{-1}**

(v) Using *Le Chatelier's Principle*, predict and explain the observations when the equilibrium mixture in **(c)(ii)** is cooled.

By Le Chatelier's Principle,
When the equilibrium mixture is cooled, the system will increase the temperature.
Equilibrium position will **shift left** favouring the **exothermic reaction to increase the temperature.**
The mixture will appear **colourless/lighter brown**.

(vi) Suggest why the reaction below is not a very useful method of making NO_2.

$$N_2(g) + 2O_2(g) \rightarrow 2NO_2(g)$$

The reaction will be **very slow** even at high temperatures. This is because of the **very large E_a due to very high bond energies of N_2**.

[Total: 20 m]

6(a) Describe qualitatively the variation in atomic radius from sodium to chlorine.

Across the period:
- **Nuclear charge increases**,
- **Increase in screening effect is negligible**
- **Increase in nuclear charge outweigh negligible increase in screening effect**
- **Effective nuclear charge increase**
- **Electrostatic forces of attraction** between nucleus and valence electrons **increases**
- **Atomic radius decreases** from sodium to chlorine.

(b) (i) Write equations to illustrate the reaction of oxides of magnesium and phosphorus with water and indicate the pH of the resultant solution.

$MgO + H_2O \rightarrow Mg(OH)_2$ pH = 8 or 9

$P_4O_6 + 6H_2O \rightarrow 4H_3PO_3$ pH = 1 or 2

(ii) Using sodium hydroxide and hydrochloric acid as example, write equations to illustrate the amphoteric behaviour of aluminium oxide.

Al_2O_3 (s) + 2 NaOH (aq) + 3 H_2O (l) $\rightarrow$ 2 $Na[Al(OH)_4]$ (aq)

Al_2O_3 (s) + 6 HCl (aq) $\rightarrow$ 2 $AlCl_3$ (aq) + 3 H_2O (l)

(c) The table below illustrates the pH value of some the chloride after it was dissolved in water.

Chlorides	pH
Sodium chloride	7
Magnesium chloride	6
Aluminium chloride	3
Phosphorus trichloride	1

Using your *Data Booklet*, explain the variation of pH for magnesium chloride and aluminium chloride. Include equations in your answer.

Ionic radius of Al^{3+} < ionic radius of Mg^{2+}
Charge of Al^{3+} > Charge of Mg^{2+}
Charge density of Al^{3+} >> Charge density of Mg^{2+}
Polarising power of Al^{3+}>> Mg^{2+}

Water molecules is polarised to a greater extent by Al^{3+} than Mg^{2+}
H^+ released more readily for Al^{3+} than Mg^{2+}

$MgCl_2 + 6H_2O \rightarrow [Mg(H_2O)_6]^{2+} + 2Cl^-$
$[Mg(H_2O)_6]^{2+} \rightleftharpoons [Mg(H_2O)_5(OH)]^+ + H^+$

$AlCl_3 + 6H_2O \rightarrow [Al(H_2O)_6]^{3+} + 3Cl^-$
$[Al(H_2O)_6]^{3+} \rightarrow [Al(H_2O)_5(OH)]^{2+} + H^+$

(d) Ethanol is a central nervous system depressant and has significant psychoactive effects in sub-lethal doses. Based on its abilities to change the human consciousness, ethanol is considered a drug.

The amount of ethanol in the body is typically quantified by blood alcohol content (BAC). BAC is usually measured as mass per volume. For example, a BAC of 0.02% means 0.002 grams of alcohol per 10 grams of individual's blood. The table below summarises the symptoms associated with ethanol consumption.

BAC %	**Symptoms**
0.050	Euphoria, talkativeness, relaxation
0.10	Central nervous system depression, impaired motor and sensory function, impaired cognition
0.14	Decreased blood flow to brain
0.30	Stupefaction, possible unconsciousness
> 0.40	death

Ethanol $\xrightarrow{\mathbf{1}}$ Ethanal $\xrightarrow{\mathbf{2}}$ Ethanoic acid

Ethanol within the human body is converted into ethanal by the enzyme alcohol dehydrogenase in step **1** and then into ethanoic acid by the enzyme acetaldehyde dehydrogenase in step **2**.

.

(i) State the reagents and conditions that can be used to replace alcohol dehydrogenase and acetaldehyde dehydrogenase in the laboratory.

alcohol dehydrogenase: $K_2Cr_2O_7$ in dilute H_2SO_4, distillation

acetaldehyde dehydrogenase: $K_2Cr_2O_7$ in diluite H_2SO_4, reflux

(ii) Write the acid dissociation expression for ethanoic acid.

$$K_a = \frac{[CH_3COO^-][H^+]}{[CH_3COOH]}$$

(iii) Account for the difference in acidity between ethanoic acid and propanoic acid.

- Both ethanoic acid and propanoic acid contain electron donating alkyl group
- Alkyl group in propanoic acid is bulkier as compared with ethanoic acid
- Conjugate base of propanoic acid is less stable as compared with conjugate base of ethanoic acid
- Less H^+ will be released for propanoic acid thus propanoic acid is a weaker acid

A forensic technician from the Traffic Police titrated 25.0 cm^3 of 0.0300 mol dm^{-3} ethanoic acid with 25.0 cm^3 of 0.0300 mol dm^{-3} sodium hydroxide. The ethanoic acid used for the titration was metabolised from an ethanol containing blood sample which weighs 10 g.

(iv) Write an equation of the above titration and identify the Brønsted acid and Brønsted base, and their conjugate base and conjugate acid.

$CH_3COOH + NaOH \rightarrow CH_3COO^-Na^+ + H_2O$

Brønsted acid: CH_3COOH **Conjugate base: CH_3COO^-**
Brønsted base: NaOH **Conjugate acid: Na^+**

(v) From the information pertaining to BAC%, determine the symptom shown by the drunk driver.

Amount of ethanoic acid present = $\frac{25}{1000} \times 0..03$ = **7.5 x 10^{-4} mol**

Amount of ethanol = **7.5 x 10^{-4} mol**

Mass of ethanol = 46 x 7.5 x 10^{-4} = **0.0345 g**

Since 10 g of blood sample contains 0.0345 g of ethanol
➔ BAC % =**0.345**

➔ **Patient will suffer stupefaction, possible unconsciousness**

(vi) Given the pH of the equivalent point to be 8. Choose suitable indicator(s) from the list below and provide a reason for your choice of indicator(s)

Indicator	Low pH colour	Transition pH range	High pH colour
Phenol Red	red	6.8-8.4	purple
Bromothymol blue	yellow	6.0-7.6	blue
Naphtholphthalein	colourless	7.3-8.7	greenish blue
Thymolphthalein	colourless	9.3-10.5	blue
Alizarine Yellow R	yellow	10.2-12.0	red

Phenol Red and Naphtholphthalein

pH transition range of indicators lies within rapid pH change over the equivalence point.

[Total: 20 m]

7(a) 0.066 g of hydrocarbon **P** when vapourised, was found to occupy 12 cm^3 at room temperature and pressure. This volume of gaseous hydrocarbon **P** was completely burnt with 200 cm^3 of oxygen which is in excess. On cooling to room temperature, the residual gases occupied a volume of 164 cm^3. Upon passing the residual gas through potassium hydroxide, this volume decreased to 44 cm^3.
When treated with cold dilute alkaline potassium manganate (VII), **P** forms compound **Q**.

However, on heating **P** with acidified potassium manganate (VII), 2 products, compound **R**, C_8H_8O and compound **S** are formed. **S** has the following composition by mass: C, 40.0%; H, 6.7%; O, 53.3%.

When **R** was warmed with 2,4-dinitrophenylhydrazine, an orange precipitate, **T** was obtained.

On refluxing **Q** with ethanoic acid in the presence of concentrated sulphuric acid, compound **U**, $C_{14}H_{18}O_4$ is obtained.

(i) Determine the formula of hydrocarbon **P**.

Let the formula of hydrocarbon **P** be C_xH_y.

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

Volume of residual gas = Volume of CO_2 and excess O_2 = 164 cm^3
Volume of excess O_2 = 44 cm^3
Volume of CO_2 = 164 – 44 = 120 cm^3
Volume of O_2 used in combustion = 200 – 44 = 156 cm^3
Using mole ratio = volume ratio,

$$\frac{x}{1} = \frac{120}{12} \rightarrow x = 10$$

$$\frac{x + \frac{y}{4}}{1} = \frac{156}{12} \rightarrow y = 12$$

Formula of **P** is **$C_{10}H_{12}$**

(ii) Calculate the empirical formula of compound **S** and hence determine its molecular formula, given the M_r of compound **S** is 60.0.

	C	H	O
% mass	40.0	6.7	53.3
Amount in mol	3.333	6.7	3.331
Divide by smallest mol	1	2.011	1
Simplest ratio	1	2	1

Empirical formula of **S** is **CH_2O**
Let the molecular formula of **S** be $(CH_2O)_n$
$n[12.0 + 2(1.0) + 16.0] = 60.0 \rightarrow n = 2$
Molecular formula of **S** is **$C_2H_4O_2$**

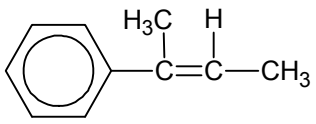
(iii)	Deduce, with reasoning, the structures of **P**, **Q**, **R**, **S**, **T** and **U**. Chemical equations are not required.

(i) **P** undergoes (**mild) oxidation** to form **Q**.
⇒ **P** contains **C=C**
⇒ **Q** contains **diol / alcohol**

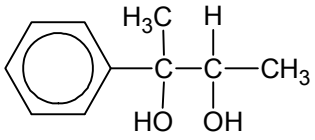
P undergoes **oxidation** to form compounds **R** and **S**.
⇒ **P** contains **C=C**
⇒ **R** is a **ketone**
⇒ **S** is a **carboxylic acid**

R undergoes **condensation** to form compound **T**.
⇒ **R** is a **ketone**
⇒ **T** is a **hydrazone**

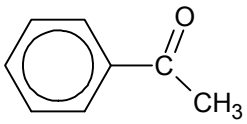
Q undergoes **esterification/ nucleophilic substitution** to form compound **U**.
⇒ **Q** contains **diol**
⇒ **U** is a **diester**



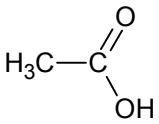
P



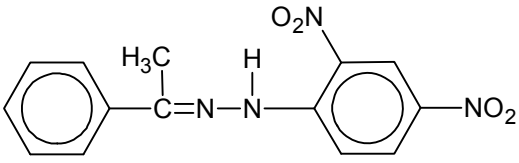
Q



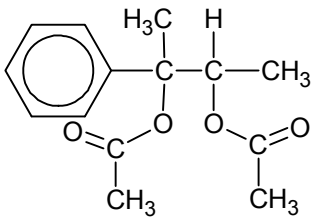
R



S



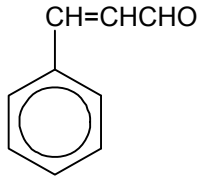
T



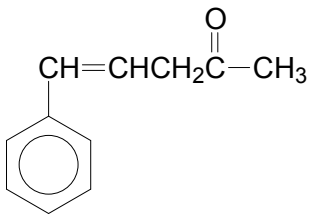
U

(b) Recent research has suggested that cinnamon could be an effective pesticide against the larvae of mosquitoes, thus helping in the fight against malaria.

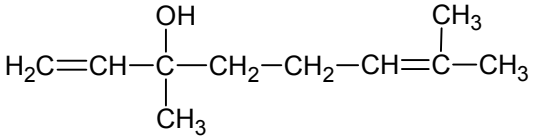
Each of the following three compounds, which are present in cinnamon, appears to be effective as a pesticide.



A



B



C

For each of the compounds **A** to **C**, state the reagents and conditions which would distinguish it from the other two and describe the observations that would be seen.

Compound	**Test and Observation**
A	**Test:** Add **Tollens' reagent** to the 3 samples separately and **warm** **Observation: Silver mirror** formed **Alt. test: Fehling's reagent; warm**
B	**Test: alkaline aqueous iodine, warm** **Observation: Yellow ppt of CHI_3 was observed , brown iodine decolourised**
C	**Test:** Add **PCl_5** to the 3 samples separately at **r.t.p** **Observation: White fumes** formed. **Alt. test: $SOCl_2$; r.t.p**

[Total: 20 m]