



Catholic Junior College

JC2 Preliminary Examinations

Higher 1

CANDIDATE
NAME

CLASS

CHEMISTRY

Paper 2

8872/02

Friday 18 August 2017

2 hours

Candidates answer Section A on the Question Paper.

Additional Materials: Data Booklet
Answer paper

READ THESE INSTRUCTIONS FIRST

Write your name and class on all the work you hand in.

Write in dark blue or black pen

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Section A – Answer **all** the questions.

Section B – Answer **two** questions on separate answer paper.

The use of an approved scientific calculator is expected where appropriate.

You are reminded of the need for good English and clear presentation in your answers.

At the end of the examination, fasten all your answer scripts securely together.

The number of marks is given in brackets [] at the end of each question or part of the question.

Answer Scheme

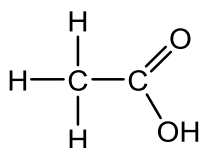
	For Examiner's Use		
Section A	Q1	9	40
	Q2	12	
	Q3	7	
	Q4	6	
	Q5	6	
Section B	Q6	20	40
	Q7	20	
	Q8	20	
Total			80

This document consists of **19** printed pages and 1 blank page

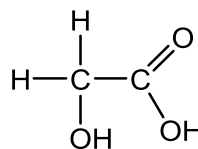
Section A

Answer **all** the questions in this section in the spaces provided.

- 1 Ethanoic acid and 2-hydroxyethanoic acid are weak acids containing two carbons each.



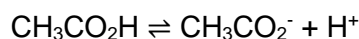
ethanoic acid



2-hydroxyethanoic acid

Ethanoic acid is a component in antiseptic that can be used to treat skin infections, whereas 2-hydroxyethanoic acid is commonly used in skincare products.

- (a) Ethanoic acid dissociates according to the following equation:



Write an expression for the acid dissociation constant, K_a , of ethanoic acid.

$$K_a = \frac{[\text{CH}_3\text{CO}_2^-][\text{H}^+]}{[\text{CH}_3\text{CO}_2\text{H}]}$$

[1]

- (b) The K_a of ethanoic acid is $1.74 \times 10^{-5} \text{ mol dm}^{-3}$.

Given that the $[\text{H}^+] = [\text{conjugate base}]$, calculate the $[\text{H}^+]$ and hence the pH of $0.100 \text{ mol dm}^{-3}$ of ethanoic acid.

$$K_a = \frac{[\text{CH}_3\text{CO}_2^-][\text{H}^+]}{[\text{CH}_3\text{CO}_2\text{H}]}$$

$$1.74 \times 10^{-5} = \frac{[\text{H}^+]^2}{(0.100)}$$

$$[\text{H}^+] = 1.32 \times 10^{-3} \text{ mol dm}^{-3}$$

$$\text{pH} = -\lg (1.32 \times 10^{-3}) = 2.88$$

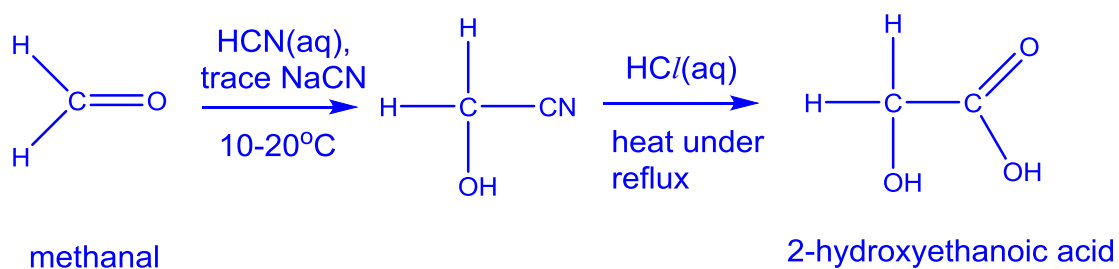
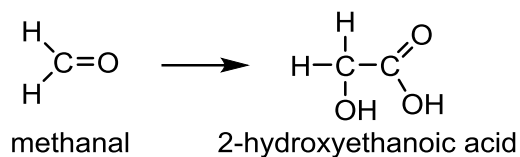
[2]

- (c) The K_a of 2-hydroxyethanoic acid is $1.48 \times 10^{-4} \text{ mol dm}^{-3}$.

Explain why 2-hydroxyethanoic acid has a higher K_a value than ethanoic acid.

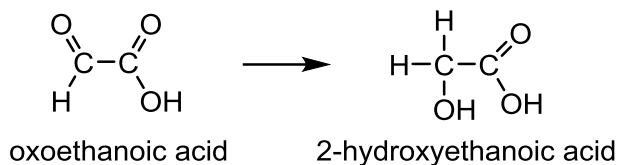
The -OH group (on the α -carbon) is electron withdrawing. This stabilises the conjugate base by dispersing the negative charge on O, decreasing the tendency to recombine with H^+ OR weakens the O-H bond of the $-\text{CO}_2\text{H}$ group allowing for greater ease of dissociation of H^+ . Hence, 2-hydroxyethanoic acid is a stronger acid, resulting in a higher K_a value. [2]

- (d) Propose a simple reaction scheme to obtain 2-hydroxyethanoic acid from methanal.



[3]

- (e) 2-hydroxyethanoic acid can also be obtained from oxoethanoic acid in a one-step reaction. State the reagents and conditions for this conversion.

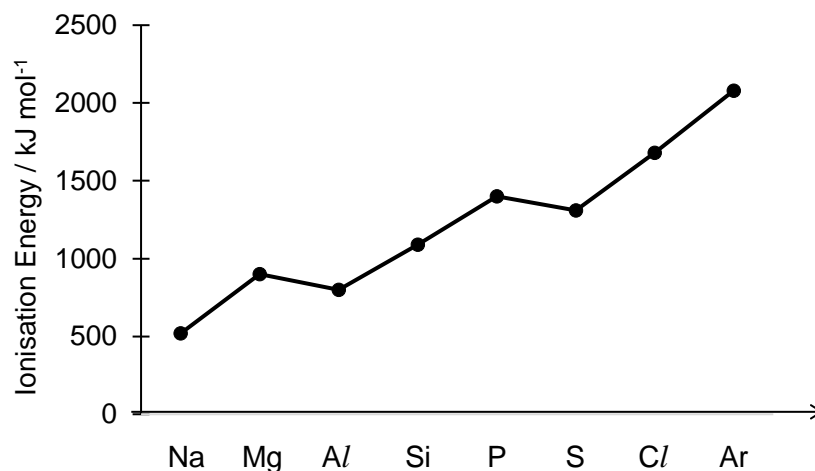


Reagents and conditions:

NaBH₄ in methanol [1]

Note: LiAlH₄ in dry ether cannot be used as this will reduce the carboxylic acid group as well. [Total: 9]

- 2 (a) The diagram below shows the first ionisation energies of the Period 3 elements from Na to Ar.



- (i) Write an equation to represent the *first ionisation energy* of S.



- (ii) Explain why the first ionisation energy generally increases across Period 3.

The nuclear charge increases (due to the increase in number of protons).
 The atomic radius decreases (thus the outermost electron is nearer to the nucleus).
 The screening/shielding effect remains almost the same (as the electron is "added" to the same outermost electron shell).

Therefore, the outermost electron becomes more strongly attracted by the positive nucleus and thus, more energy is required to remove the electron.

- (iii) With the aid of electronic configurations, predict whether the **second** ionisation energy of Si will be higher or lower than the second ionisation of Al. Give your reasoning.



The second I.E. of Si will be lower than the second I.E. of Al.

Less energy is required to remove a 3p electron in Si⁺ than a 3s electron in Al⁺ since the 3p subshell has a higher energy than the 3s subshell.

.....[2]

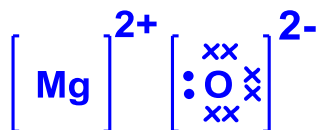
- (b) Sodium and magnesium are elements from Period 3 of the Periodic Table.
- (i) State and explain two reasons why the melting point of magnesium is higher than that of sodium.

Mg has stronger metallic bond strength compared to Na as Mg has a greater number of valence electrons contributed to the 'sea' of delocalised electrons, than Na. As more energy is required to overcome the stronger metallic bonds in Mg, Mg has a higher melting point. Mg^{2+} has a larger ionic charge and smaller cationic size than Na. This results in higher charge density of Mg^{2+} and stronger metallic bond strength.

[2]

Magnesium can react with oxygen gas to form magnesium oxide, MgO , which is often used as a refractory material in the lining of furnaces.

- (ii) Draw a dot-and-cross diagram to show the bonding in MgO .



[1]

- (iii) Explain why the lattice energy of MgO is less exothermic than that of Mg_3N_2 .

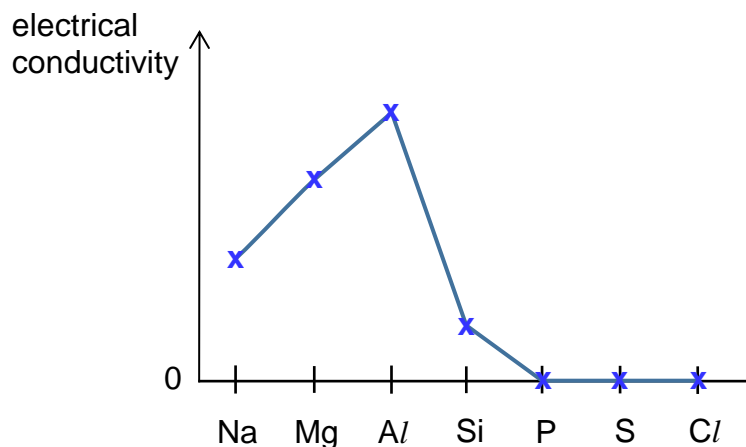
Both MgO and Mg_3N_2 contain the same cation, Mg^{2+} . Although O^{2-} has a smaller ionic radius than N^{3-} , O^{2-} has a smaller ionic charge than N^{3-} .

$$\Delta H_{\text{latt}} \propto \frac{q_+ q_-}{r_+ + r_-}$$

, as charge is more dominant than radius in affecting lattice energy, lattice energy of MgO is less exothermic than Mg_3N_2 .

[3]

- (c) Using the axes below, sketch the graph to show the electrical conductivity of the Period 3 elements from Na to Cl.

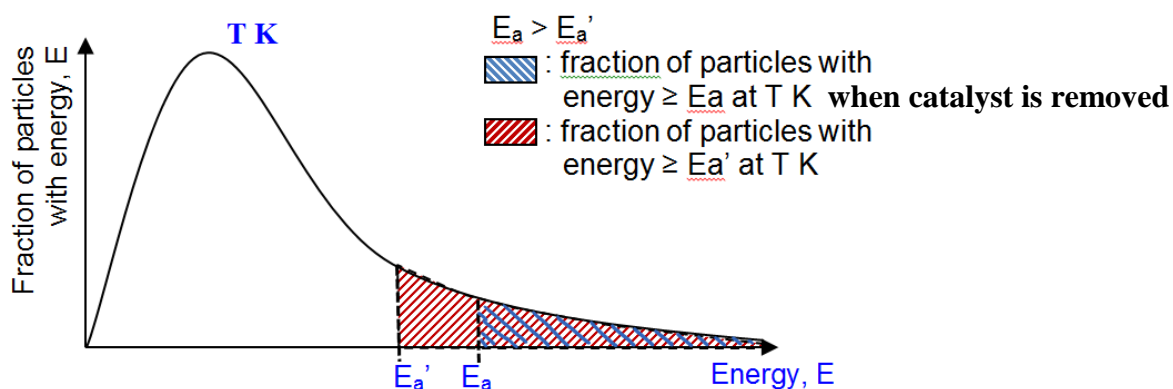


[1]

[Total: 12]

- 3 An aromatic ester with the molecular formula $C_8H_8O_2$ was synthesised in the laboratory using suitable reactants and heated under reflux with concentrated sulfuric acid catalyst for about 6 hours.
- The enthalpy change for this esterification reaction can be regarded as 0 kJ mol^{-1} .

- (a) Draw a Boltzmann distribution curve for the reactants at this temperature and use it to explain why the reaction is significantly slower when the catalyst is removed.



The catalyst speeds up the rate of reaction by lowering the activation energy of the reaction by providing an alternative reaction pathway with lower activation energy.

When a catalyst is removed, as shown by the Boltzmann distribution, there is a lower fraction of molecules with energy \geq activation energy, this also reduces the frequency of effective collisions between molecules, and the rate of reaction falls.

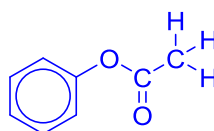
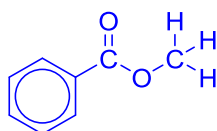
[3]

- (b) The esterification reaction is reversible and hence has an equilibrium constant, K_c . Explain briefly how the equilibrium position and K_c are expected to change when the temperature is increased.

As the enthalpy change is 0 kJ mol^{-1} , a temperature increase will not have any effect on the equilibrium position and the K_c will not change.

[2]

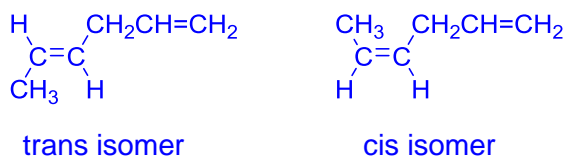
- (c) When the aromatic ester is hydrolysed with $\text{H}_2\text{SO}_4(\text{aq})$, methanoic acid, HCO_2H , is not among the products.
Suggest two possible structural formulae for the ester.



[2]

[Total: 7]

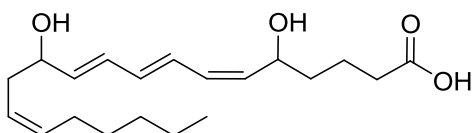
- 4 (a) Hexa-1,4-diene, $\text{CH}_2\text{CHCH}_2\text{CHCHCH}_3$, has geometrical isomers.
- (i) Draw the structural formula of each of the isomers so as to identify this isomerism and label each structure. [2]



- (ii) Explain how this isomerism arises.

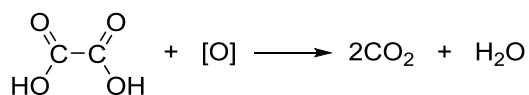
Geometric isomerism arises in alkenes due to the restricted rotation about π bond in the $\text{C}=\text{C}$ and each carbon in the $\text{C}=\text{C}$ have 2 different groups attached to it. [1]

- (b) Leukotriene B4 is a biomolecule in the human body.

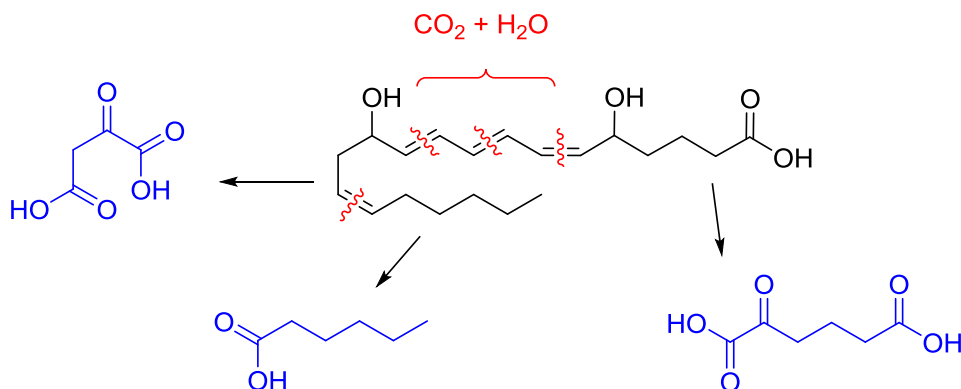


Leukotriene B4

Draw **all possible organic products** formed when leukotriene B4 is subjected to heating under reflux in the presence of acidified $\text{KMnO}_4(\text{aq})$. Note that any ethanedioic acid formed is further oxidised according to the following equation.



[3]



[Total: 6]

- 5 In March 2017, residents in a small town in Alberta, Canada, received a shock when pink coloured water flowed from their taps. The colour was due to potassium manganate(VII), KMnO_4 , used in the early stages of water treatment to remove pathogens and metal ions such as iron and manganese ions. KMnO_4 should have been removed before the treated water reached the homes of the consumers, but a water treatment valve malfunctioned which caused the incident to happen.

KMnO_4 has a relative formula mass of 158 and it exists as black crystals at room condition. When dissolved in water, small quantities of the solid are sufficient to give very intense shades of pink and purple solutions.

- (a) Define the term *relative formula mass*.

It is the ratio of the average mass of one formula unit of the compound to $\frac{1}{12}$ the mass of an atom of ^{12}C isotope, expressed on the ^{12}C scale. [1]

KMnO_4 is used to remove Mn^{2+} present in water. KMnO_4 will oxidise Mn^{2+} to MnO_2 precipitate which can easily be filtered from the water.

The half equation that shows the reduction of MnO_4^- under the treatment conditions is:



- (b) With reference to the *Data Booklet*, write down the oxidation half equation.

$\text{Mn}^{2+} + 2\text{H}_2\text{O} \rightarrow \text{MnO}_2 + 4\text{H}^+ + 2\text{e}^-$ [1]

- (c) Hence, give the overall equation that shows the removal of Mn^{2+} during the treatment of water.

$3\text{Mn}^{2+} + 2\text{H}_2\text{O} + 2\text{MnO}_4^- \rightarrow 5\text{MnO}_2 + 4\text{H}^+$ [1]

- (d) During treatment, the concentration of KMnO_4 used is 1 mg dm^{-3} . Convert this concentration value into mol dm^{-3} and hence calculate the maximum mass of MnO_2 that can be precipitated per cubic metre of water.

(1 g = 1000 mg; 1 cubic metre = 1000 dm^3)

$$\text{Concentration of } \text{KMnO}_4 \text{ in } \text{mol dm}^{-3} = \frac{1 \times 10^{-3}}{158} = 6.329 \times 10^{-6}$$

$$\begin{aligned} \text{Maximum amount of solid } \text{MnO}_2 \text{ that forms in } 1 \text{ dm}^3 &= \frac{5}{2} \times (6.329 \times 10^{-6}) \\ &= 1.582 \times 10^{-5} \end{aligned}$$

$$\begin{aligned} \text{Mass of } \text{MnO}_2 \text{ formed in } 1 \text{ dm}^3 &= (1.582 \times 10^{-5})(54.9 + 2(16.0)) \\ &= 1.375 \times 10^{-3} \text{g} \end{aligned}$$

$$\begin{aligned} \text{Mass of } \text{MnO}_2 \text{ formed per cubic metre of water} &= 1.375 \times 10^{-3} \times 1000 \\ &= 1.375 \text{g} \end{aligned}$$

[3]

[Total: 6]

Section B

Answer **two** questions from this section on separate answer paper.

- 6 Hydrogen peroxide and acidified potassium iodide can react according to the equation below.



The rate of reaction can be followed by measuring the amount of iodine produced after various times, from which the concentration of H_2O_2 remaining can be calculated.

In one such study, the following reaction mixture was prepared.

$$\text{initial } [\text{H}^+] = 0.200 \text{ mol dm}^{-3}$$

$$\text{initial } [\text{I}^-] = 0.200 \text{ mol dm}^{-3}$$

$$\text{initial } [\text{H}_2\text{O}_2] = 0.0200 \text{ mol dm}^{-3}$$

The table below shows $[\text{H}_2\text{O}_2]$ at various times.

time / s	$[\text{H}_2\text{O}_2] \times 10^{-3} / \text{mol dm}^{-3}$
0	20.0
80	16.7
183	13.5
315	10.3
490	7.10
760	3.90

- (a) (i) Explain the term *rate of reaction*. [1]

The rate of reaction is defined as the change in the concentration of reactants or products per unit time.

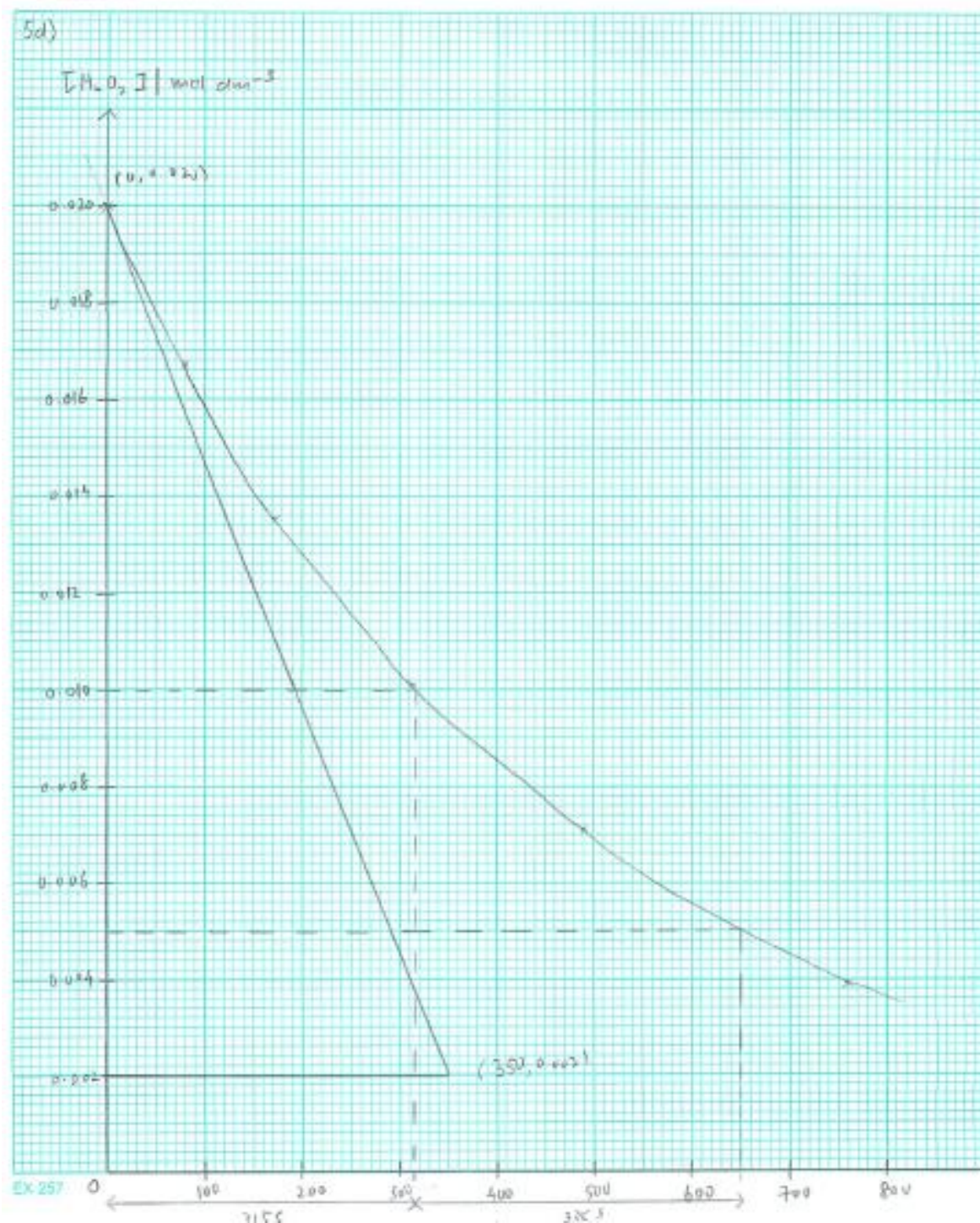
- (ii) Explain why the initial concentration of H_2O_2 used is much lower than the concentrations of H^+ and I^- used. [1]

This is to ensure that concentrations of H^+ and I^- are effectively constant and only the concentration of H_2O_2 varies with time.

OR

This is to ensure that the order of reaction with respect to H^+ and I^- is pseudo-zero order.

- (iii) Plot a graph of the above results. [2]



(iv) Use your graph to determine:

I the order of reaction with respect to $[H_2O_2]$,

Using half-life,

1st half-life = 315 s

2nd half-life = 335 s

Since both half-lives are fairly constant, the order of reaction with respect to $[H_2O_2]$ is 1.

II the initial rate, in $\text{mol dm}^{-3} \text{s}^{-1}$.

From the graph,

$$\text{Initial rate} = \frac{0.02 - 0.002}{350} = 5.14 \times 10^{-5} \text{ mol dm}^{-3} \text{s}^{-1}$$

Show all working and construction lines clearly on your graph. [4]

- (v) Further experiments were carried out by changing $[\text{H}^+]$ and $[\text{I}^-]$, but keeping the initial $[\text{H}_2\text{O}_2]$ constant. The following results were obtained.

Experiment	initial $[\text{H}^+]$ / mol dm^{-3}	initial $[\text{I}^-]$ / mol dm^{-3}	initial rate / $\text{mol dm}^{-3} \text{s}^{-1}$
1	0.400	0.200	1.0×10^{-4}
2	0.200	0.100	2.5×10^{-5}
3	0.100	0.200	2.5×10^{-5}

Determine the orders with respect to $[\text{H}^+]$ and $[\text{I}^-]$. Explain your reasoning. [2]

By inspection, using experiments 1 and 3, when $[\text{I}^-]$ is constant at $0.200 \text{ mol dm}^{-3}$, and $[\text{H}^+]$ is decreased by 4 times, the reaction rate also decreased by 4 times. Therefore, the order of reaction with respect to $[\text{H}^+]$ is 1.

Using experiments 1 and 2, when $[\text{I}^-]$ is halved and $[\text{H}^+]$ is also halved, the reaction rate decreased by 4 times. Since the order with respect to $[\text{H}^+]$ is 1, by inspection, the order of reaction with respect to $[\text{I}^-]$ is 1.

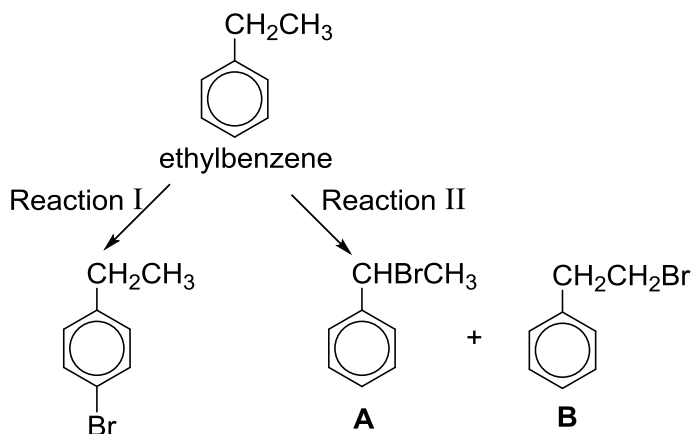
- (b) Describe the reactions, if any, of the oxides P_4O_{10} and SiO_2 with water. State the approximate pH values of the resulting solutions and explain your answer with the aid of relevant equations for any reactions that occur. [3]



P_4O_{10} completely hydrolyses in water to give a strongly acidic solution of $\text{pH} = 2$

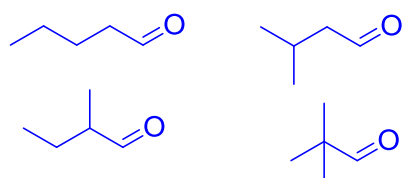
SiO_2 does not dissolve in water due to strong covalent bonds between atoms, thus the solution remains at $\text{pH} = 7$

- (c) Ethylbenzene can undergo substitution reactions to give three different products as shown in the scheme below.

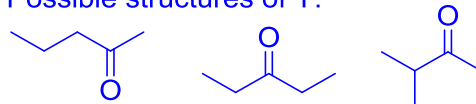


- (i) Explain why ethylbenzene does not undergo addition reactions readily. [1]
Ethylbenzene does not undergo addition reactions readily but undergoes substitution reactions so as to retain the stable ring structure.
- (ii) State the reagents and conditions for reactions I and II. [2]
Reaction I: Br_2 , anhydrous FeBr_3 catalyst or Br_2 , Fe catalyst
Reaction II: limited Br_2 , *uv* light
- (iii) Suggest the ratio in which **A** and **B** might be formed, assuming that the ease of substitution of H is the same for the formation of both compounds. [1]
A : B = 2 : 3
- (d) An alkaline solution of $\text{Cu}^{2+}(\text{aq})$ is used in organic chemistry to test for a particular functional group.
- (i) Describe the appearance of a positive result of this test. [1]
Red precipitate of Cu_2O seen
- (ii) Compounds **X** and **Y** both have the molecular formula $\text{C}_5\text{H}_{10}\text{O}$ and give an orange precipitate with 2,4-dinitrophenylhydrazine. However, compound **X** shows a positive result in the test in (d)(i) while compound **Y** does not. Suggest a possible structure for compound **X** and for compound **Y**, showing the skeletal formula in your answers. [2]

Possible structures of X:

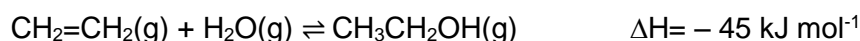


Possible structures of Y:

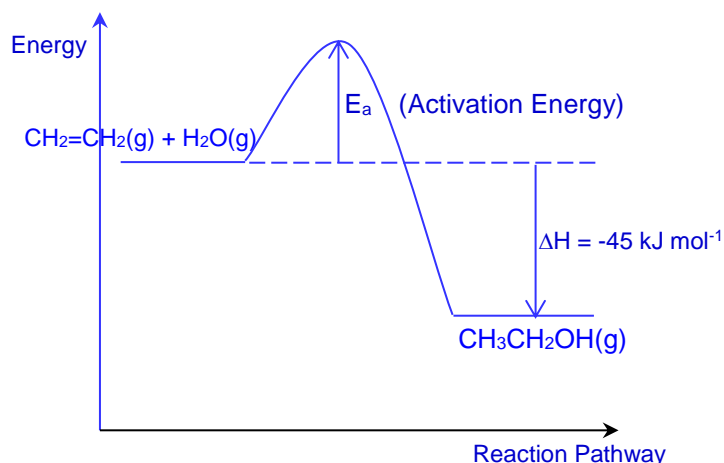


[Total: 20]

- 7 (a) Ethanol, $\text{CH}_3\text{CH}_2\text{OH}$, is manufactured in the industry by reacting ethene with steam in the presence of a catalyst. The reaction is reversible and the equation is as follows:

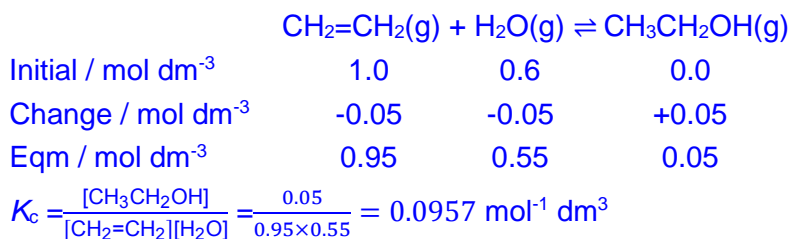


- (i) Draw a labelled reaction pathway diagram for this reaction. [2]



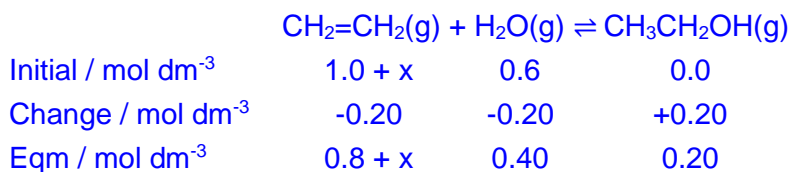
For every 1.0 mol dm^{-3} of ethene and 0.6 mol dm^{-3} of steam reacted and allowed to reach equilibrium, only 5% of the ethene is converted into ethanol at each pass through the reactor. To increase the overall yield of ethanol, ethanol is regularly removed from the equilibrium mixture as it is formed, and more ethene is added into the reaction mixture.

- (ii) Using the information given above, calculate K_c (including units) at this temperature. [2]



- (iii) Calculate the amount, in moles, of ethene (in every dm^3) that must be added to increase the equilibrium concentration of ethanol to 0.20 mol dm^{-3} . [2]

Let the amount of ethene to be added be x .



$$K_c = \frac{0.20}{(0.80+x) \times 0.40} = 0.0957; x = 4.42 \text{ moles}$$

- (iv) State the catalyst used for the reaction. [1]

Concentrated H_3PO_4

- (v) Apart from the methods mentioned above, suggest one other method which will result in an increase in the conversion of ethene into ethanol without changing the temperature and without adding more steam. Explain your answer briefly. [2]

Increasing the pressure will shift equilibrium to favour the production of fewer number of moles of gas molecules. Hence the equilibrium shifts forward and more ethanol is produced.

- (b) Ethanol is one of several compounds used as an 'anti-knock' agent that is added to unleaded petrol to prevent damage to car engines. Prior to the use of ethanol as an anti-knocking agent, a compound called tetraethyl lead was used.

To prevent accumulation of lead deposits in the engines, a small quantity of 1,2-dichloroethane was added to the gasoline to form PbCl_2 that can be flushed from the engine and into the air, but the compound quickly solidifies at atmospheric temperature. The accumulation of toxic lead compounds in the environment quickly resulted in a worldwide ban of leaded petrol.

- (i) Catalytic converters were fitted in cars to minimise the emissions of undesirable exhaust gases emitted such as carbon monoxide, oxides of nitrogen and unburnt hydrocarbons. State the environmental damage of one of the gases listed. [1]

Carbon monoxide: toxic gas that binds to human haemoglobin to inhibit the transport of oxygen

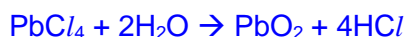
Oxides of nitrogen: Contributes to acid rain

Unburnt hydrocarbons: cause the environmental damage of photochemical smog.

- (ii) The oxidation state of Pb in PbCl_2 is +2. What is the maximum oxidation state Pb is able to obtain and explain why this is so. [1]

+4. This corresponds to the maximum number of valence electrons Pb has / used for bonding.

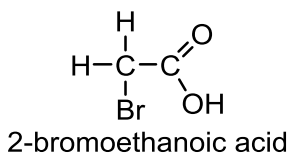
- (iii) Write an equation to show how the chloride of lead (where lead is at its maximum oxidation state) reacts with water. [1]



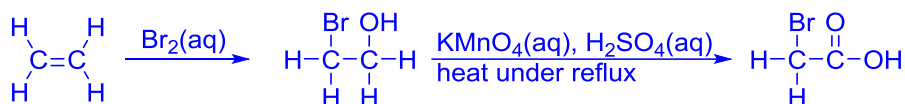
- (iv) Explain why the reaction stated in (b)(iii) proceeds with greater ease than a similar reaction involving the chloride of silicon. [1]

Pb is a larger atom than Si hence the Pb-Cl covalent bond is longer and weaker than the Si-Cl bond.

- (c) Ethene can be used as a starting material to synthesise 2-bromoethanoic acid.



- (i) Propose a reaction scheme that will convert ethene to 2-bromoethanoic acid, bearing in mind that each step should result in a fairly good yield of products. [3]



- (ii) State the functional groups present in 2-bromoethanoic acid. [2]

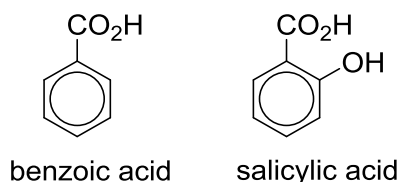
Primary bromoalkane and carboxylic acid

- (iii) Describe a simple chemical test to show the presence of bromine in 2-bromoethanoic acid. [2]

To a sample of 2-bromoethanoic acid, add aqueous NaOH and heat. Allow to cool and add dilute nitric acid, followed by aqueous AgNO₃. Cream ppt of AgBr formed confirms the presence of bromine.

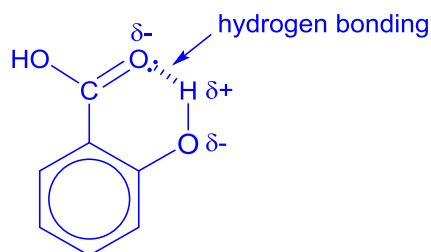
[Total: 20]

- 8 (a) Benzoic acid and salicylic acid are both important precursors for the industrial synthesis of many other organic substances.

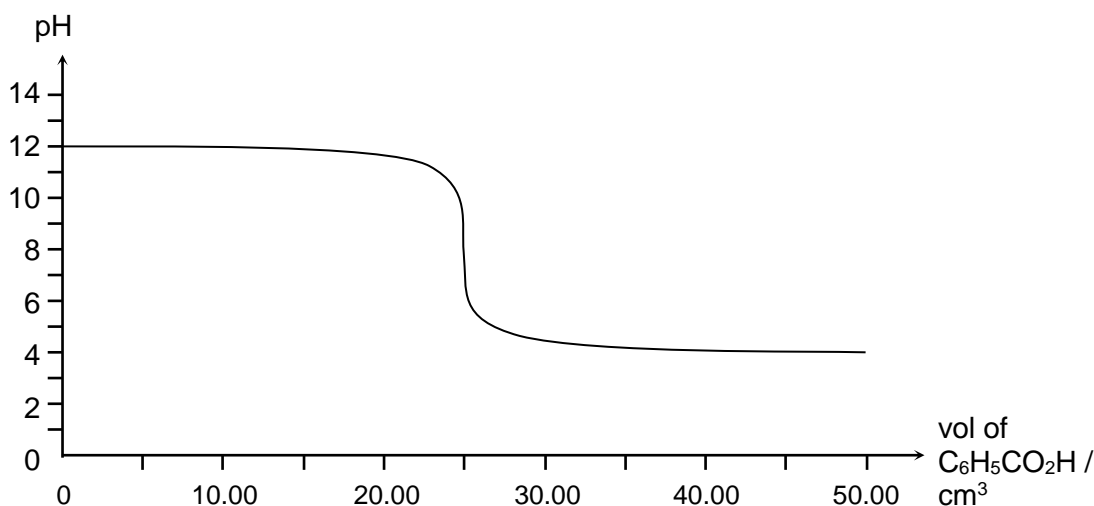


It was observed that salicylic acid has a lower solubility in water compared to benzoic acid in water. This is due to salicylic acid forming less extensive hydrogen bonding with water molecules. With the aid of a labelled diagram, suggest a reason for this observation. [2]

Salicylic acid forms intramolecular hydrogen bonding, reducing the extensiveness of intermolecular hydrogen bonding. Thus, salicylic acid is less soluble in water than benzoic acid.



- (b) In a titration carried out under standard conditions, a solution of benzoic acid is added to 20.00 cm³ of aqueous sodium hydroxide. The change in pH was measured and the following titration curve was obtained.



- (i) Using the titration curve, calculate the concentration of OH⁻ at the beginning of the reaction. [1]

Since pH = 12, pOH = 14 - 2 = 2

[OH⁻] = 10⁻² = 0.0100 mol dm⁻³

- (ii) Suggest a suitable indicator for the above reaction, stating the expected colour change. [2]

Phenolphthalein, pink to colourless

- (iii) Explain your choice of indicator. [1]

The pH range for colour change that lies within the pH range of rapid change of the titration.

- (iv) Using the answer in (b)(i), calculate the concentration of the solution of benzoic acid. [2]

Amt of NaOH used = 0.01 × $\frac{20.00}{1000}$ = 0.000200 mol

Thus amt of benzoic acid reacted = 0.000200 mol

$$[\text{benzoic acid}] = \frac{0.002}{25} \times 1000 = 0.00800 \text{ mol dm}^{-3}$$

- (c) *Use of Data Booklet is relevant to this question.*

In another experiment, 60.00 cm³ of 0.600 mol dm⁻³ benzoic acid is added to 40.00 cm³ of 0.800 mol dm⁻³ aqueous sodium hydroxide and the increase in temperature is measured.

Given that the enthalpy change of this reaction is -56.9 kJ mol⁻¹, calculate the increase in temperature. [3]

$$\text{Amt of NaOH used} = 0.8 \times \frac{40.00}{1000} = 0.0320 \text{ mol}$$

$$\text{Amt of benzoic acid used} = 0.6 \times \frac{60.00}{1000} = 0.0360 \text{ mol}$$

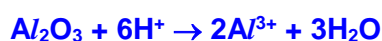
$$\text{Thus amt of water produced} = 0.0320 \text{ mol}$$

$$\text{Thus heat released} = 56.9 \times 1000 \times 0.0320 = 1821 \text{ J (4.s.f.)}$$

$$\text{Thus increase in T} = \frac{1821}{100 \times 4.18} = 4.36 \text{ K}$$

- (d) In the 1940s, it was difficult to oxidise methylbenzene to benzoic acid using the oxygen present in air. Many methods resulted in incomplete oxidation or produced low yields of benzoic acid. It was later discovered that aluminium oxide is able to support controlled oxidation of methylbenzene to benzoic acid in the presence of air.

Aluminium oxide is amphoteric. Write balanced equations to illustrate this fact. [2]



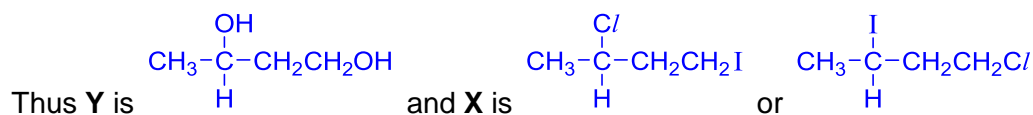
- (e) Compound **X** is a four carbon organic molecule. Upon addition of aqueous silver nitrate, a yellow precipitate was observed almost immediately. The yellow precipitate was then filtered off and the solution was left to stand. After a period of time, white precipitate was observed in the filtrate.

In a separate experiment, compound **X** was heated under reflux with aqueous sodium hydroxide to give compound **Y**. When compound **Y** was reacted with phosphorus(V) chloride, steamy fumes were observed. When one mole of compound **Y** was reacted with alkaline aqueous iodine, only one mole of yellow precipitate **Z** was produced.

Using the information given, deduce the structures of **X**, **Y** and **Z**. In your answer, state clearly the types of reactions that occurred. [7]

Clues / observations	Type of reaction	Deduction
X , a four carbon organic	Substitution /	Since X has only 4 C and two

molecule, was reacted with $\text{AgNO}_3(\text{aq})$ and yellow precipitate was observed almost immediately. After a period of time, white precipitate was observed	hydrolysis	different silver halides are precipitated, X contains an <u>iodobutane</u> . X also contains a <u>chlorobutane</u>
X is heated under reflux with aqueous sodium hydroxide to give compound Y	(nucleophilic) substitution	Y has two <u>-OH groups</u> / Y is a <u>diol</u>
Y is reacted with PCl_5 , steamy fumes are observed	(nucleophilic) substitution	
1 mole of Y is reacted with alkaline $\text{I}_2(\text{aq})$ to give 1 mole of yellow precipitate Z	Triiodomethane test or mild oxidation	Z is <u>CHI_3</u> . <div style="text-align: center;"> $\begin{array}{c} \text{CH}_3 \\ \\ \text{---C---OH} \\ \\ \text{H} \end{array}$ </div> Thus Y has <u>1</u> <u>group</u> .



[Total: 20]