

Name of the Student: _____

Max. Marks : 26 Marks

Time : 26 Minutes

Q1.

- (a) Propanoic acid can be made from propan-1-ol by oxidation using acidified potassium dichromate(VI). Propanal is formed as an intermediate during this oxidation.

- (i) State the colour of the chromium species after the potassium dichromate(VI) has reacted.

(1)

- (ii) Describe the experimental conditions and the practical method used to ensure that the acid is obtained in a high yield. Draw a diagram of the assembled apparatus you would use.

Conditions _____

Apparatus

(4)

- (iii) Describe the different experimental conditions necessary to produce propanal in high yield rather than propanoic acid.

(2)

- (b) Propan-1-ol is a volatile, flammable liquid.

Give **one** safety precaution that should be used during the reaction to minimise this hazard.

(1)

- (c) A student followed the progress of the oxidation of propan-1-ol to propanoic acid by extracting the organic compounds from one sample of reaction mixture.

- (i) Give a chemical reagent which would enable the student to confirm the presence of propanal in the extracted compounds.
State what you would observe when propanal reacts with this reagent.

Reagent _____

Observation _____

(2)

- (ii) Give a chemical reagent that would enable the student to confirm the presence of propanoic acid in the extracted compounds.
State what you would observe when propanoic acid reacts with this reagent.

Reagent _____

Observation _____

(2)

- (d) Predict which **one** of the compounds, propan-1-ol, propanal and propanoic acid will have the highest boiling point. Explain your answer.

Prediction _____

Explanation _____

(3)

(Total 15 marks)

Q2.

A student read the following passage on the Internet.

Haloalkanes contain a polar covalent bond. The carbon atom of the polar covalent bond can be attacked by nucleophiles. Nucleophilic attack enables haloalkanes to undergo substitution reactions. A nucleophilic substitution reaction occurs when a haloalkane undergoes hydrolysis; the rate of hydrolysis of the haloalkane is influenced by the carbon–halogen bond enthalpy.

(a) Explain the meaning of each of the following terms in the information given above.

(i) *nucleophile*

(1)

(ii) *substitution*, as applied to nucleophilic substitution in a haloalkane

(1)

(iii) *hydrolysis*

(1)

(iv) *bond enthalpy*, as applied to a carbon–halogen bond.

(1)

(b) Outline a mechanism for the nucleophilic substitution reaction in which 2-bromopropane ($\text{CH}_3\text{CHBrCH}_3$) reacts with potassium hydroxide to form propan-2-ol.

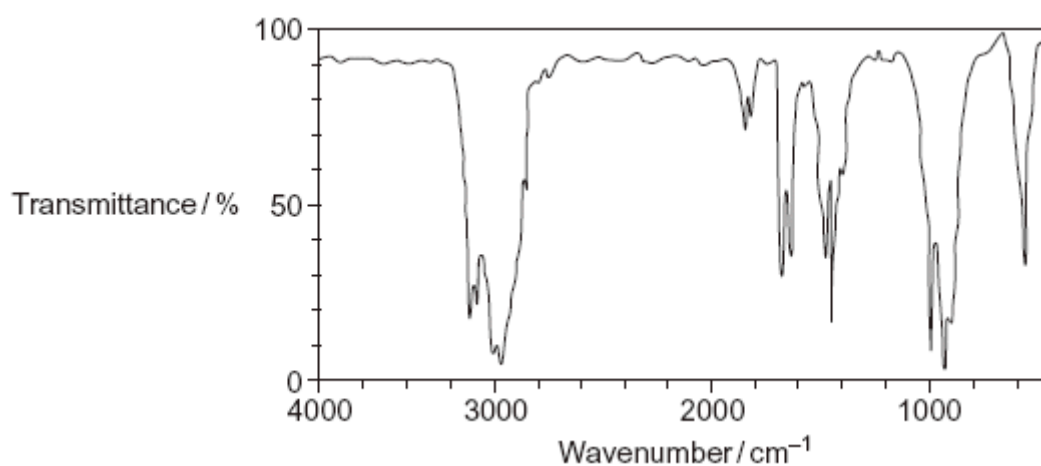
(2)

(c) Haloalkanes also undergo elimination reactions to produce alkenes.

- (i) Outline a mechanism for the elimination reaction in which 2-bromopropane reacts with potassium hydroxide to form propene.

(3)

- (ii) A student obtained the following infrared spectrum for the product from this elimination reaction.



Use information from the infrared spectrum to state and explain how the student deduced that the product was an alkene.

You may find it helpful to refer to **Table 1** on the Data Sheet.

(2)

(Total 11 marks)