

Name of the Student: _____

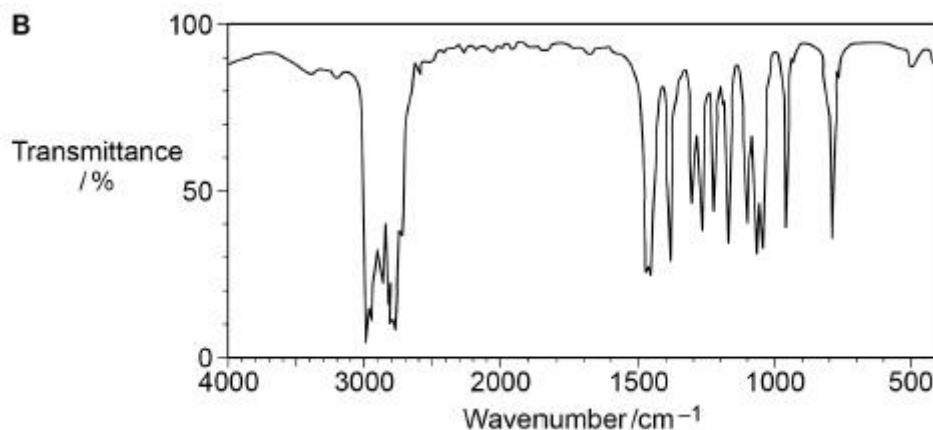
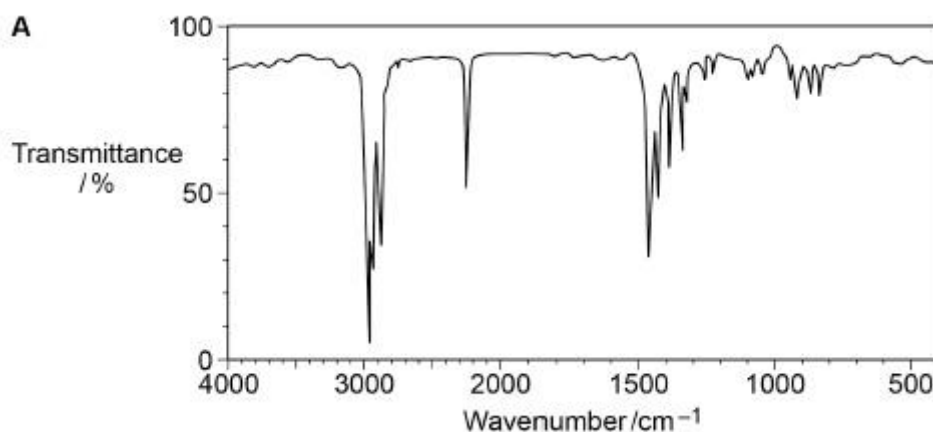
Max. Marks : 24 Marks

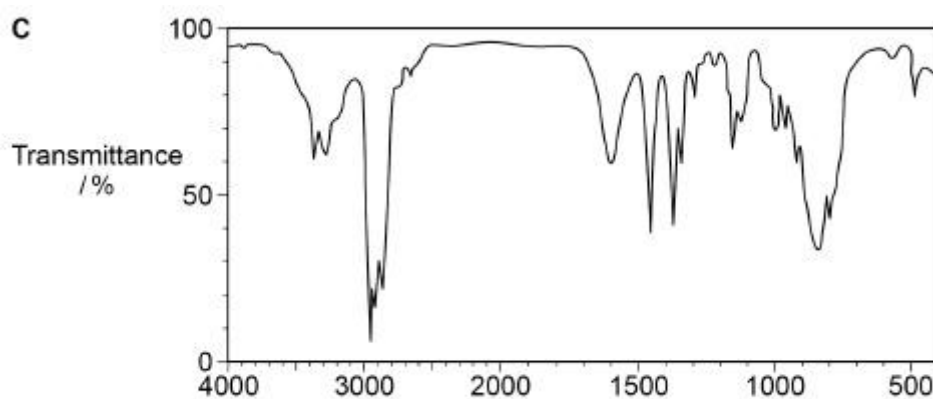
Time : 24 Minutes

Q1.

This question is about amines.

- (a) The infrared spectra **A**, **B** and **C** are those of a primary amine, a tertiary amine and a nitrile, but not necessarily in that order.





Give the letter of each compound in the correct box.

primary amine	tertiary amine	nitrile

(1)

- (b) There are **three** secondary amines that contain four carbon atoms per molecule.

Draw the skeletal formulas of these **three** secondary amines.

(2)

- (c) Primary amines can be prepared by the reaction of halogenoalkanes with ammonia or by the reduction of nitriles.

Justify the statement that it is better to prepare primary amines from nitriles rather than from halogenoalkanes.

(2)

- (d) Draw the structure of a primary amine with four carbon atoms that **cannot** be formed from a nitrile.

(1)

- (e) A student dissolves a few drops of propylamine in 1 cm^3 of water in a test tube.

Give an equation for the reaction that occurs.

Describe what is observed when Universal Indicator is added to this solution.

Equation _____

Observation _____

(2)

- (f) Phenylamine can be prepared by a process involving the reduction of nitrobenzene using tin and an excess of hydrochloric acid.

Give an equation for the reduction of nitrobenzene to form phenylamine. Use [H] to represent the reducing agent.

Explain why an aqueous solution is obtained in this reduction even though phenylamine is insoluble in water.

Equation _____

Explanation _____

(2)

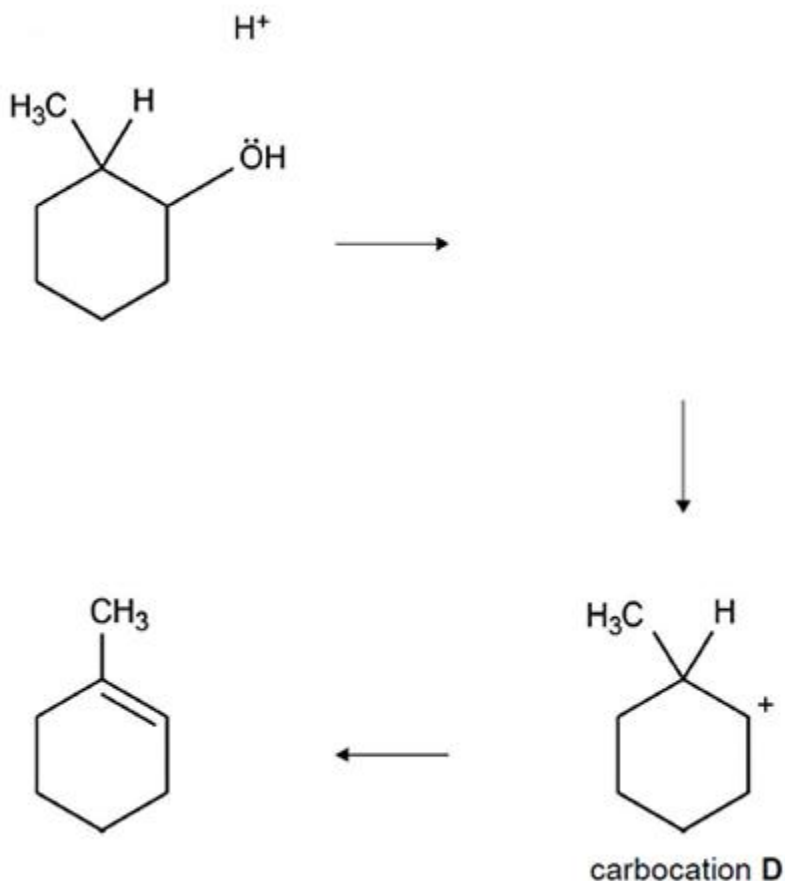
(Total 10 marks)

Q2.

Alcohols undergo dehydration in the presence of concentrated phosphoric acid, via a carbocation intermediate, to form alkenes.

(a) Complete the mechanism for the conversion of 2-methylcyclohexanol into 1-methylcyclohexene via carbocation **D** by drawing

- the structure of the missing intermediate
- all necessary curly arrows.

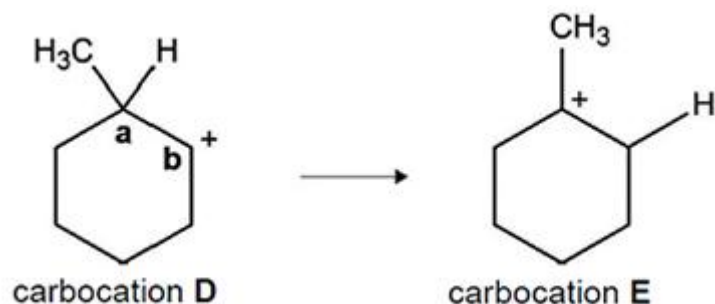


(4)

(b) Draw the structure of a different cyclic alkene formed from carbocation **D**.

(1)

(c) Carbocation **D** can undergo a type of reaction called a rearrangement to form carbocation **E**. In this reaction, a hydrogen atom and its bonding pair of electrons move from carbon **a** to carbon **b** as shown in the diagram below.



Use your knowledge of carbocations to explain why this rearrangement takes place.

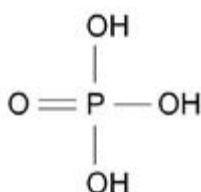
(2)

- (d) As a result of the rearrangement in part (c), a third alkene is formed in this reaction.

Draw the structure of this third alkene.

(1)

- (e) Cyclohexene is prepared by the dehydration of cyclohexanol using concentrated phosphoric acid as a catalyst. The structure of concentrated phosphoric acid is shown.



Identify the factors that influence the boiling points of each of the compounds in this reaction mixture. State how and explain why cyclohexene can be separated from the reaction mixture.

(6)
(Total 14 marks)