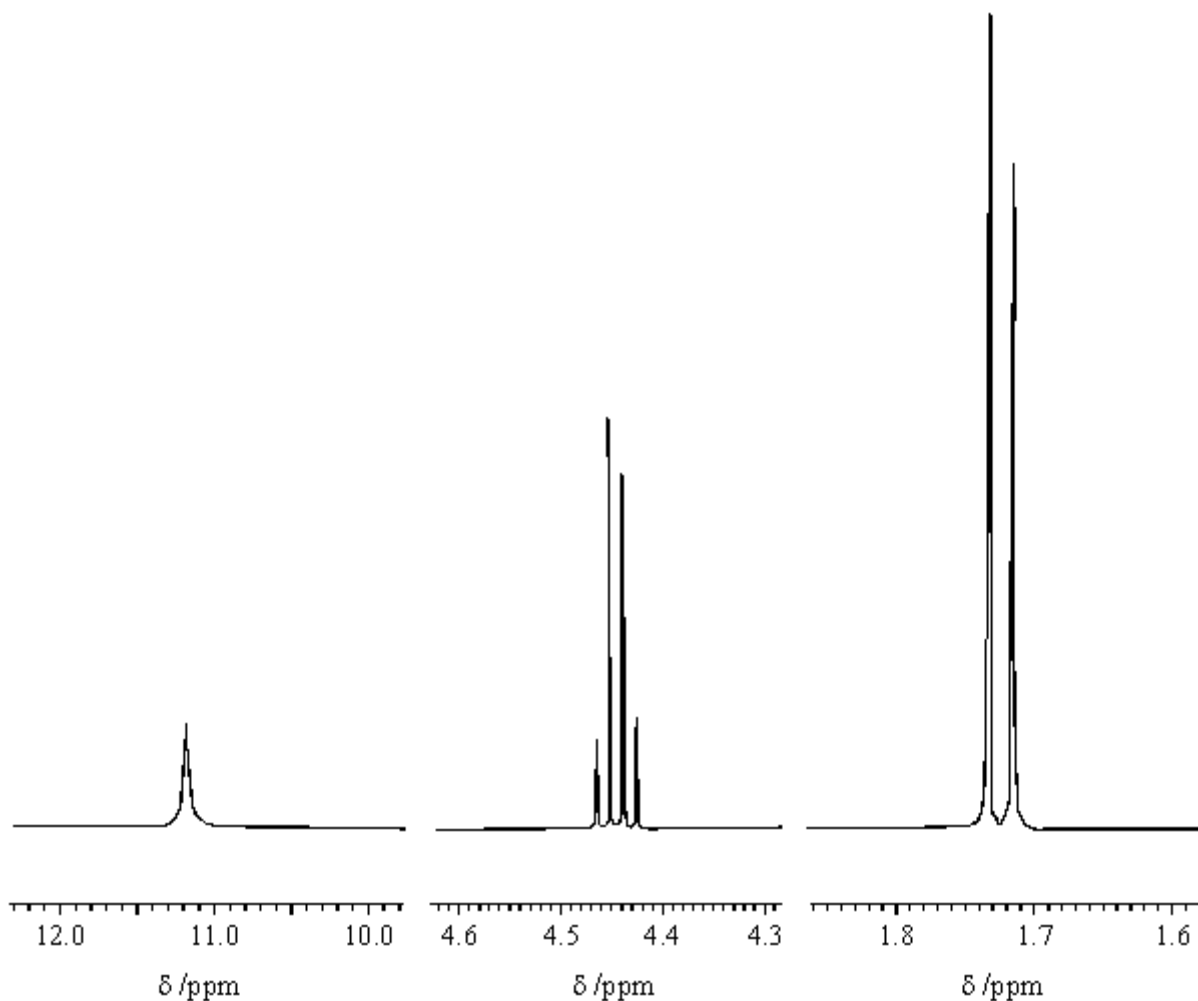


Name of the Student: _____

Max. Marks : 22 Marks

Time : 22 Minutes

Q1.

Three sections of the proton n.m.r. spectrum of $\text{CH}_3\text{CHClCOOH}$ are shown below.(a) Name the compound $\text{CH}_3\text{CHClCOOH}$

(1)

(b) Explain the splitting patterns in the peaks at δ 1.72 and δ 4.44

(2)

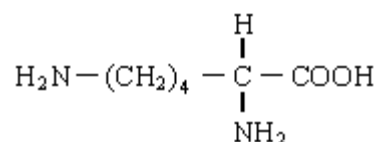
- (c) Predict the splitting pattern that would be seen in the proton n.m.r. spectrum of the isomeric compound $\text{ClCH}_2\text{CH}_2\text{COOH}$

(1)

- (d) The amino acid *alanine* is formed by the reaction of $\text{CH}_3\text{CHClCOOH}$ with an excess of ammonia. The mechanism is nucleophilic substitution. Outline this mechanism, showing clearly the structure of *alanine*.

(5)

- (e) The amino acid *lysine* has the structure



Draw structures to show the product formed in each case when lysine reacts with

- (i) an excess of aqueous HCl ,

- (ii) an excess of aqueous NaOH ,

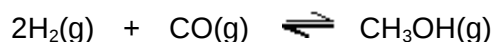
- (iii) another molecule of lysine.

(3)

(Total 12 marks)

Q2.

Hydrogen and carbon monoxide were mixed in a 2:1 mole ratio. The mixture was allowed to reach equilibrium according to the following equation at a fixed temperature and a total pressure of 1.75×10^4 kPa.



(a) The equilibrium mixture contained 0.430 mol of carbon monoxide and 0.0850 mol of methanol.

(i) Calculate the number of moles of hydrogen present in the equilibrium mixture.

(ii) Hence calculate the mole fraction of hydrogen in the equilibrium mixture.

(iii) Calculate the partial pressure of hydrogen in the equilibrium mixture.

(5)

(b) In a different mixture of the three gases at equilibrium, the partial pressure of carbon monoxide was 7550 kPa, the partial pressure of hydrogen was 12300 kPa and the partial pressure of methanol was 2710 kPa.

(i) Write an expression for the equilibrium constant, K_p , for this reaction.

(ii) Calculate the value of the equilibrium constant, K_p , for the reaction under these conditions and state its units.

K_p _____

Units _____

(3)

(c) Two isomeric esters **E** and **F** formed from methanol have the molecular formula $\text{C}_6\text{H}_{12}\text{O}_2$

Isomer **E** has only 2 singlet peaks in its proton n.m.r. spectrum.

Isomer **F** is optically active.

Draw the structures of these two isomers.

Isomer **E**

Isomer F

(2)

(Total 10 marks)