DATE: 06TH NOVEMBER 2024 **TIME: 9.30 A.M. - 12.30 P.M.**

Part B- Short Answer Questions (20 Marks)

1.

1.1 List three (3) major components in the mass spectrometer. (03 marks)

I.....

II.....

III.....

1.2 What is the isocratic mode of elution? (02 marks)

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1.3 What will be the elution order of Toluene and the Benzoic acid in reverse phase chromatography (RPC) mode? (01 mark)

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1.4 What is the major role of the Guard column in HPLC? (02 marks)

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1.5 What is the purpose of the derivatization in Gas Chromatographic analysis? (02 marks)

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Index No. .....

2.

2.1 Name three (03) types of information that can be obtained from a chromatogram.

(03 marks)

I.....

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II.....

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III.....

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2.2 What is the basic principle of Atomic Absorption Spectroscopy (AAS)? (03 marks)

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2.3 What material is used to make the cathode in a hollow cathode lamp in AAS? (02 marks)

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2.4 What is the function of the Flame or Emission system in AAS? (02 marks)

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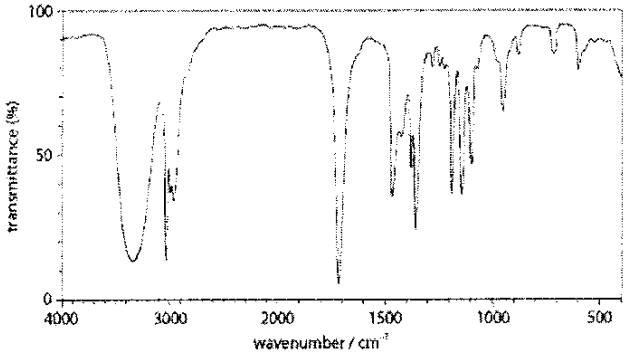
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Part C- Structured Essay Question (60 Marks)

1. An attempt was made to prepare 3-methylbutan-2-one by oxidizing 3-methylbutan-2-ol with an excessive amount of potassium dichromate (v) in an acidic medium. After 30 minutes, the reaction mixture was separated and dried. The infrared spectrum (IR) of the dried sample was recorded as shown below.



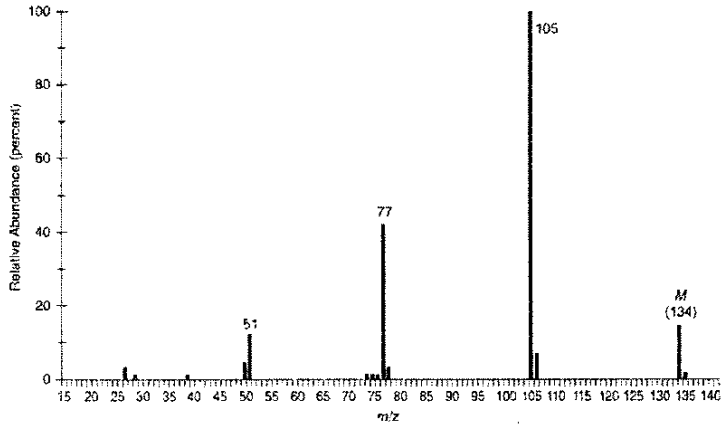
1.1 Has the reaction reach completion? Explain your answer providing reasons. (05 marks)

1.2 Predict any changes you would see in the IR spectrum if the reaction has gone to the completion. Justify your answer. (04 marks)

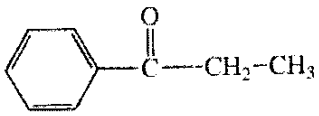
1.3 Generally, carbonyl C=O stretch appears in the range of 1740-1720 cm^{-1} for esters. However, IR spectrum of methyl salicylate shows a peak at 1680 cm^{-1} for the C=O stretching. Explain this observation. (06 marks)

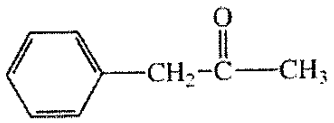
2.

2.1 Electron Ionization (EI) mass spectrum of a monosubstituted aromatic compound is shown below. Deduce the structure of the compound providing reasons. (06 marks)



2.2 How could the following pair of isomeric compounds be differentiated by mass spectrometry? (05 marks)

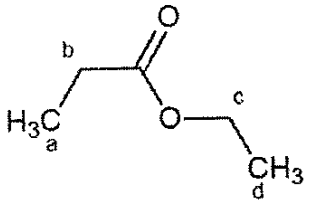
a) 

b) 

2.3What are the masses of charged fragment ions produced by alpha-cleavage and the McLafferty rearrangement of 4-methyl-2-pentanone? Provide reasonable mechanisms. (04 marks)

3.

3.1. Predict the ^{1}H NMR and ^{13}C NMR spectra of the following compound. Your answer must include the splitting patterns, labeling of the carbon atoms, and approximate/relative positions of each peak. δ values are not necessary. (10 marks)



3.2 Propose the most suitable structure for the formula $C_4H_8Br_2O$ which shows only two triplets in its ^{1}H NMR. (05 marks)

4.

4.1 Define the Beer-Lambert law. (02 marks)

4.2 A solution was made by dissolving 0.0515 g of Benzonitrile in 1L of water. The UV spectrum of this solution was recorded, and a primary absorption band was observed at 224 nm. The measured absorbance value for the solution at 224 nm was 0.90. Calculate the molar absorptivity of this absorption band if the cell length is 1 cm. (05 marks)

4.3 Explain why the choice of the solvent to be used in ultraviolet spectroscopy is important. (04 marks)

4.4 Which of the following shows absorbance at a higher wavelength? Benzene, Aniline. Explain your answer. (04 marks)