

Time : 3 Hrs


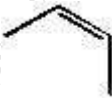
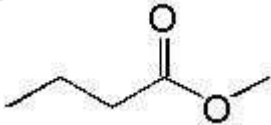
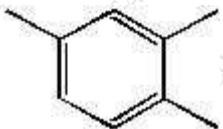
Marks : 75

**Q.1** Multiple Choice Questions

**20**

1. Which of the following is a parameter related to peak shape
  - a. Tailing factor
  - b. Number of plates
  - c. Capacity factor
  - d. Selectivity factor
2. Which of the following is a bulk property HPLC detector?
  - a. UV detector
  - b. Diode array detector
  - c. Refractive index detector
  - d. Amperometric detector
3. Which type of chiral stationary phase is also called 'brush type'
  - a. Protein based
  - b. Pirkle type
  - c. Crown ethers type
  - d. Cyclodextrin based
4. Column efficiency increases if which of the following parameters decreases
  - a. Number of theoretical plates
  - b. Capacity factor
  - c. Selectivity factor
  - d. HETP
5. Which of the following is a carrier gas used in GC?
  - a. Oxygen
  - b. Nitrogen
  - c. Carbon dioxide
  - d. Water vapour
6. Which of the following is a component of HPTLC?
  - a. Linomat
  - b. Soap bubble flow meter
  - c. Reciprocating pump
  - d. Refractive index detector
7. Electrophoretic mobility is decided by
  - a. Size alone
  - b. Charge alone
  - c. Partition coefficient
  - d. Size and charge
8. Proteins X, Y and Z have molecular sizes 69, 95 and 80 kDa respectively. Their elution order in size exclusion chromatography would be -
  - a. X followed by Y followed by Z
  - b. Z followed by Y followed by X
  - c. Y followed by Z followed by X
  - d. Y followed by X followed by Z

9. Octyl sulphate Sodium can be used as a mobile phase additive in
  - a. Ion exchange chromatography
  - b. Ion pair chromatography
  - c. Size exclusion chromatography
  - d. Chiral chromatography
10. Which of the following is a preferred mobile phase in supercritical fluid chromatography?
  - a. Nitrogen
  - b. Carbon dioxide
  - c. Hydrogen
  - d. Water
11. Protein A and protein B have pI values of 4 and 9 respectively. If a cation exchange column is used to perform chromatography, what should be the pH of mobile phase for protein B to be preferentially retained?
  - a. 3
  - b. 6
  - c. 10
  - d. 12
12. Head space analysis is a term associated with
  - a. NMR spectroscopy
  - b. IR spectroscopy
  - c. GC
  - d. HPLC
13. A commonly used reagent gas in chemical ionization in mass spectrometry is
  - a. Helium
  - b. Hydrogen
  - c. Methane
  - d. Oxygen
14. Which ion source is expected to produce most fragmentation from the list given below?
  - a. Fast atom bombardment
  - b. Matrix assisted laser desorption ionization
  - c. Electrospray ionization
  - d. Electron impact ionization
15. Glycerol or nicotinic acid is used in which of the undermentioned ion sources in a mass spectrometer
  - a. Electron impact
  - b. Chemical ionization
  - c. Fast atom bombardment
  - d. Field ionization
16. Which of the following compounds will undergo McLafferty rearrangement in mass spectrometry?
  - a. 2 – propene
  - b. Butane
  - c. 1 – Methoxypentane
  - d. Acetone

17. Which type of electromagnetic radiation is used in NMR spectroscopy?
- Infrared radiation
  - Microwave radiation
  - Radiofrequency radiation
  - Gamma radiation
18. How many peaks would be obtained in the  $^1\text{H}$  NMR spectrum of diethyl ether
- 1
  - 2
  - 3
  - 6
19. The methylene group in ethyl iodide will give a quartet in the proton magnetic spectrum. The relative intensities of the peaks in the quartet will be in the proportion
- 1:2:2:1
  - 1:1:1:1
  - 1:4:4:1
  - 1:3:3:1
20. An unknown molecule A has 4 signals in the  $^1\text{H}$  NMR spectrum. Which of the following corresponds to molecule A?
- 
  - 
  - 
  - 

**Q.2.** Answer the following (Any two)

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- Give two points of difference between  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectroscopy. Define chemical shift. Enlist factors affecting chemical shift.
  - Give two important points of difference between HPLC and UPLC. Draw a neat labelled diagram of HPLC instrument and enlist the various types of pumps and detectors used in HPLC.
- What is affinity chromatography? Draw a neat labelled diagram of GC instrument and write a note on any one detector used in GC.
  - Write a note on principle and instrumentation of supercritical fluid chromatography.

3. Enlist ion sources used in mass spectrometry. Describe any one interface used in LC-MS. What are isotope ions and meta-stable ions in mass spectrometry? Depict retro Diels Alder fragmentation.

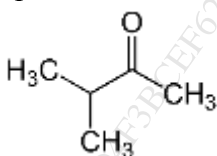
**Q.3.** Answer the following (Any 7)

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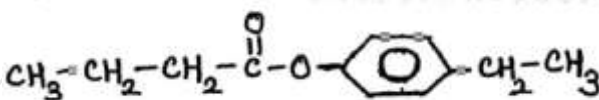
- 1 Give reasons for the following problems in HPLC and suggest ways of overcoming them-

- i. Bubbles in the HPLC system
- ii. Peak splitting

- 2 Give the number of signals and multiplicity in the  $^1\text{H}$  NMR spectrum of



- 3 Suggest two fragmentation pathways in MS of



- 4 What is gradient elution? Under which circumstances is gradient elution performed? What is nano liquid chromatography?
- 5 Write a note on columns used in GC.
- 6 Write a note on principle involved in ion pair chromatography.
- 7 What is the principle involved in capillary electrophoresis? Write in brief about the use of crown ethers as buffer additives in capillary electrophoresis.
- 8 Enlist mass analyzers and describe the working of MALDI – TOF mass spectrometer.
- 9 What are 2D NMR techniques? Discuss any one 2D NMR technique.

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