M. pharm
Jan 2024
Sem - I
Semester I

Time: 3 Hours **Marks: 75**

Note:
1. **Draw neat labeled diagrams wherever necessary**
2. **Figures to the right indicate full marks**

I. Multiple choice questions **20**

1. Which of the following involves conversion from singlet excited state to triplet excited state?
   a. Vibrational relaxation
   b. Intersystem crossing
   c. Internal conversion
   d. External conversion

2. The fingerprint region in IR spectrum is
   a. 4000 to 1400 /cm
   b. 4000 to 400/ cm
   c. 1400 to 900/ cm
   d. 900 to 400/ cm

3. ____________________ is a source used in an atomic absorption spectrophotometer.
   a. Tungsten lamp
   b. Nernst Glower
   c. Deuterium lamp
   d. Hollow cathode lamp

4. In fluorescence, the emitted wavelengths are
   a. Shorter than absorbed wavelengths
   b. Always equal to absorbed wavelengths
   c. Equal to or longer than absorbed wavelengths
   d. Equal to or shorter than absorbed wavelengths

5. 'Spin-spin coupling" in proton NMR refers to?

a. The interaction of protons with an external magnetic field

b. The splitting of NMR signals due to neighboring protons

c. The conversion of spin angular momentum to kinetic energy

d. The rotation of protons around their own axis

6. What does the term "multiplicity" refer to in proton NMR?

a. The number of signals in a spectrum

b. The number of magnetic nuclei

c. The splitting pattern of a signal

d. The intensity of a peak

7. In which region of the electromagnetic spectrum does proton NMR typically operate?

a. Infrared

b. Radiofrequency

c. Ultraviolet

d. Microwave

8. ^{1}H NMR spectroscopy is used for?

a. Determining the molecular weight of a compound

b. Determining the polarity of a compound

c. Determining the carbon-hydrogen framework of a molecule

d. Determining the degree of crystallinity of a compound

9. Which component of a mass spectrometer is responsible for separation of ions?

a. Detector

b. Analyzer

c. Ion Source

d. Vacuum System

10. What is the significance of the base peak in a mass spectrum?

a. It gives the highest m/z peak

b. It indicates the charge of the ions.

c. It shows the mass of the most abundant ion.

d. It determines the magnetic field strength.

11. The acronym MS stand for in mass spectrometry?

a. Molecular Structure

b. Mass Spectrometer

c. Magnetic Separation

d. Molecular Synthesis

12. In Mass spectrometry, Ion Trap is an example of?

a. Detector

b. Ionization source

c. Data processor

d. Mass Analyzer

13. Which of the following situations in isocratic elution warrant use of gradient elution in HPLC?

a. Tailing of peaks

b. Unstable base line

c. Large difference in the retention times of first and last eluted components

d. Variable retention times

14. Which of the following gases is expensive for use as a GC carrier gas?

a. Oxygen

b. Hydrogen

c. Nitrogen

d. Helium

15. In a chromatogram, peak A starts at 3.3 minutes and ends at 3.7 minutes while peak B starts at 3.8 minutes and ends at 4.4 minutes. Assuming that the peaks are symmetric and if the dead time is 1.1 minutes, calculate the selectivity factor

a. 2

b. 1.25

c. 2.25

d. 0.75

16. A silica coated TLC plate spotted with sample, after development showed the presence of 4 spots with R_f values as Compound A: 0.6, Compound B: 0.5, Compound C: 0.4 and Compound D: 0.8.
Which one of the separated compounds is most polar?

a. A

b. B

c. C

d. D

17. X ray diffraction technique is based on____.

a. Bragg's Law

b. Beer Lamberts' Law

c. Pastures' Law

d. Kick's Law

18. What is the unit of measurement used for X-ray diffraction angles?

a. Radians

b. Nanometers

c. Meters

d. Amperes

19. In electrophoresis, if the size of the particle is increased,

a. rate of migration decreases

b. rate of migration increases

c. No change in the migration rate

d. Particle becomes immobile

20. Electrophoresis is defined as

a. The migration of a charged particles through a solution under the influence of external electrical field

b. The migration of an electrons under the influence of external electrical field

c. Electrolysis of the sample solution into positive and negative ions

d. Ionization of the sample molecule with fast moving electrons

II. Long answer questions (Answer <u>any two out of three</u>) **20**

1. a. Enlist the different ionization sources in mass spectrometry. Write a detailed note on any one

   b. Give the principles of spin-spin coupling in proton NMR. Discuss how neighboring protons influence each other's resonances, leading to the observed splitting patterns

2. a. A chromatogram shows an unretained solute eluting out at a dead time of 0.9 minutes. There are two more analyte peaks observed. Peak A starts at 3.5 minutes and ends at 3.8 minutes while peak B starts at 5.8 minutes and ends at 6.1 minutes. Assuming that peaks A and B are symmetric, calculate-
      i) Adjusted retention time for peak A
      ii) Capacity factor for peak B
      iii) Selectivity factor
      iv) Number of plates for peak B
      v) Resolution between peaks A and B
      vi) If this analysis is carried out on a reverse phase column, comment on the relative polarities of A and B.

   b. Write a note on principle and advantages of FT-NMR

3. a. Explain the terms: i. Molecular ion peak ii. Isotope peak ii. Nitrogen rule

   b. A solution of drug 'X' having a concentration of 10 ppm gave an absorbance of 0.58 in a 1 cm pathlength cell. If the molecular weight of X is 255, calculate its molar absorptivity.

III. Short answer questions (Answer <u>any seven out of nine</u>) **35**

1. Illustrate a typical chromatogram depicting dead time, retention time and adjusted retention time. Explain the terms: Number of theoretical plates and Capacity factor

2. Write a note on factors affecting molecular bond vibration frequency

3. Explain working of Rheodyne injector used in HPLC. Give one example each of the following:
   i. Method for degassing HPLC
   ii. Solute property HPLC detector.

4. Draw a neat labeled block diagram of an atomic absorption spectrophotometer and explain its working.

5. With the help of a suitable example explain Mc Lafferty rearrangement

6. What is meant by ^{13}C NMR. How is it different from ^{1}H NMR. Give one application

7. Derive the equation of Bragg's law governing diffraction pattern of crystalline material in X ray crystallography. Enlist any two applications of X ray diffraction technique.

8. What is electrophoretic mobility? How does pH of buffer, size, charge of analyte and temperature affect electrophoretic mobility?

9. Draw a block diagram of GC chromatograph. Enlist the carrier gases used in GC and explain the working of any one detector used in GC.

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