Mark Scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May, 2023

Level : B.Pharm./B. Tech.
Year : III
Course : INAN 301
Semester: I

Exam Roll No. :
Time: 30 mins.
F. M. : 20

Registration No.:
Date : 26 April-023

SECTION "A"
[20 Q. × 1 = 20 marks]

Encircle the most appropriate answer from the given choices.

1. The instrumental method, _____ is based on the scattering of radiation.
   a. Mass spectrometry
   b. Turbidimetry
   c. Flame photometer
   d. Coulometry

2. Which of these statements is **TRUE**?
   a. IR has lower energy than visible.
   b. IR has a shorter wavelength than visible radiation.
   c. UV radiation has a longer wavelength than visible.
   d. IR has higher wavenumber than visible.

3. Which of the following statements is **TRUE**?
   a. Cold vapor atomization technique is applicable for the determination of arsenic.
   b. Sputtered metal atoms do not diffuse back to the cathode surface in hollow cathode lamp.
   c. Electrothermal atomizers can never be used for the direct analysis of solid samples.
   d. The maximum temperature is located in the flame about 2.5 cm above the primary combustion zone.

4. In which region of the electromagnetic spectrum does an absorption at 380 nm come?
   a. Ultraviolet region
   b. Visible region
   c. Vacuum UV region
   d. Infrared region

5. You look at an IR spectrum and see a collection of bands at 1690-1760 cm^{-1}. What conclusion can you draw about the structure?
   a. The molecule does not contain oxygen
   b. The molecule contains a C=O bond
   c. The molecule contains O-H bond
   d. The molecule contains N-H bond

6. Which one of the following is a hard source?
   a. Electron impact source
   b. Field desorption
   c. Chemical ionization
   d. Field ionization

7. Which of the following isotopic peak is much intense for CH_3Br?
   a. M+1
   b. M+2
   c. M-1
   d. M-2

8. Which one of the following vibrations is IR active?
   a. Symmetric stretching of SO_2
   b. Symmetric stretching of CO_2
   c. C-C stretching vibration of CH_3-CH_3
   d. C-H symmetric stretching of CH_2=CH_2

9. What is the order in which following compounds would be eluted from an HPLC column containing a normal phase packing?
   [A] Toluene [B] Phenol [C] Methyl benzoate [D] Acetone
   a. B,A,C,D b. C,B,A,D c. A,C,D,B d. A,B,C,D

10. A resonance is displaced 300 Hz from TMS at a magnetic field strength of 4.69 T (200 MHz instrument). What will be the chemical shift at this magnetic strength?
   a. 1.5 b. 0.45 c. 0.66 d. 7.1

Fill in the blanks by most appropriate VALUE or WORD.

11. _____amount of light is transmitted through the sample when it has absorbance value 0.15.

12. The equation of least square analysis of calibration data for the determination of Cu by UV visible spectroscopy is S=1.49 Cu + 0.512. For the concentration of 25 ppm Cu, the value of standard deviation of measurement is 0.12. What will be the analytical sensitivity at this concentration of Cu?_____.

13. The absorption frequency in a 2.35 T magnetic field of ^1H is_____.
   (Given $\gamma=2.68X10^8T^{-1}\ S^{-1}$).

14. _____ detector which is used in GC employs a radioactive beta emitter, usually nickel-63.

15. After TLC development, _____is used for the visualization of colorless spots of lipids.

16. _____ number of peaks (signals) are present in the NMR spectra for the protons in $CH_3CH_2CH_2CH_2CH_3$.

17. _____is an example of anion exchange resin (strong).

18. A solution containing 2.3×10^{-5} mol/lit $KMnO_4$ has a transmittance of 0.125 in a 1.00 cm cell at 520 nm. The value of molar absorptivity of $KMnO_4$ at 520 nm is _____.

19. The resolution required to resolve peaks for ions having masses 284.1930 and 284.1240 will be _____.

20. GC separation where temperature remains same throughout analysis is called _____ _____.

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Time : 2 hrs. 30 mins.

Course : INAN 301
Semester: I
F.M. : 55

SECTION "B"
[5Q. × 3 = 15 marks]

Attempt *ANY FIVE* questions.

1. a. Show the basic design of an instrument used for a chemical measurement. [1.5]
   b. What do you mean by selectivity of an instrument? [1.5]

2. What do you mean by spectral interference? In a hydrogen-oxygen flame, the atomic absorption signal for calcium was found to decrease in the presence of large concentration of sulphate ions. Suggest an explanation for this observation. [1+2]

3. What is calibration of an instrument? When is standard addition method used for calibration? [3]

4. Explain why increasing the magnetic field strength results in an increased signal in NMR. [3]

5. In proton NMR spectra for $CH_3CH_2OCH_3$, calculate the number of multiplets for each band and their relative areas. [3]

6. How do the spectra for the electron impact and the chemical ionization sources differ from one another? [1.5+1.5]

7. The IR spectrum of carbonyl bond shows vibration absorption band at 1600 cm^{-1}. What is the force constant for C=O bond? (the reduced mass, μ is 1.1×10^{-26} kg) [3]

SECTION "C"
[5Q. × 5 = 25 marks]

Attempt *ANY FIVE* questions.

8. Explain (with well labeled diagram) about the specialized atomization technique used for arsenic. Why an electrothermal atomizer is more sensitive than flame atomizer? [3.5+1.5]

9. a. Define auxochrome. What are the effects of substituent and conjugation on chromophores? [3]
   b. What is an isocratic elution? [2]

10. a. Describe the differences between hydrogen and deuterium lamps as source for ultraviolet radiation and list any particular advantage possessed by one over the other. [3]
    b. What are the applications of proton NMR? [2]

11. a. In chromatography, what are the variables that lead to zone broadening? [3]
    b. What are the differences between normal phase chromatography and reversed phase chromatography? [2]

12. a. What are different types of mass analyzers used in MS? [2]
    b. What is the principle of nuclear magnetic resonance? Describe the different types of NMR spectra. [3]

13. a. What do you know about charge transfer absorption? [3]
    b. What do you know about fragmentation pattern of aromatic hydrocarbons in MS? [2]

14. Draw block diagram showing components of HPLC. Write about reciprocating pump used in HPLC. [2+3]

SECTION "D"

[2Q. × 7.5 = 15 marks]

Attempt *ANY TWO* questions.

15. a. Describe the various kinds of columns used in GC. [4]
    b. Explain UV-Visible absorption detector used in liquid chromatography. [3.5]

16. a. Write the role of different spectroscopic techniques that you studied in structure elucidation. [4.5]
    b. List the difference between atomic spectroscopy and molecular spectroscopy. [3]

17. a. Write short note on sample handling techniques in IR. [3.5]
    b. Differentiate between [2+2]
        i. Finger print region and group frequency region.
        ii. Single beam and double beam spectrophotometer.