KATHMANDU UNIVERSITY
End Semester Examination
August, 2018

Marks Scored:

Level : B.E.
Year : III

Course : INAN 301
Semester: II

Exam Roll No. :

Time: 30 mins.

F.M. : 20

Registration No.:

Date : AUG 27 2018

SECTION "A"
[20 Q.×1=20 marks]

Select the most appropriate answer:

1. The input transducer for atomic emission spectrometer is
   a. Filter
   b. Photomultiplier tube
   c. Monochromator
   d. Electrodes

2. Which of these statements is true?
   a. UV radiation has a longer wavelength then IR
   b. IR has a shorter wavelength than visible radiation
   c. IR has lower wavenumber than visible
   d. Microwave radiation possesses more energy than IR

3. Which of the following statements is NOT true?
   a. When gas flow rate is equal to burning velocity, there is stable flame
   b. The maximum temperature is located in the flame about 2.5 cm above the primary combustion zone
   c. Magnesium exhibits a minimum in absorbance at the middle of the flame
   d. For determination of metals forming stable oxides, a flame that contains excess of fuel is often desirable

4. In which region of the electromagnetic spectrum does an absorption at 0.76 μm come?
   a. Ultraviolet region
   b. Visible region
   c. Vacuum UV region
   d. Infrared region

5. Rank the following bonds in order of increasing stretching frequency (cm^{-1}) in IR spectrum.
   [A] O-H [B] N-H [C] C=O [D] C-C
   a. C<B<D<A b. C<B<A<D c. B<A<C<D d. D<C<B<A

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_3CH_2Br?
   a. M + 1 b. M + 2 c. M + 3 d. M + 4

8. Which one of the following vibration is IR active?
   a. C-C stretching vibration of CH_3-CH_3
   b. Symmetric stretching of CO_2
   c. Symmetric stretching of SO_2
   d. C-H 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] Phenol [B] Methyl benzoate [C] Acetone [D] Toluene
a. B,A,C,D b. C,B,A,D c. D,B,C,A, d. A,B,C,D

10. A resonance is displaced 90 Hz from TMS at a magnetic field strength of 1.41 T (60 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 blank by most appropriate VALUE or WORD.

11. _____amount of light is transmitted through the sample when it has absorbance value 2.5.

12. The equation of least square analysis of calibration data for the determination of Cu by UV visible spectroscopy is S=1.23 Cu + 0.416. For the concentration of 15 ppm Cu the value of standard deviation of measurement is 0.18. What will be the analytical sensitivity at this concentration of Cu?_____.

13. The absorption frequency in a 7.05 T magnetic field of ^{1}H is _____ (Given $\gamma=2.68 \times 10^{8} T^{-1} S^{-1}$).

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 amino acids.

16. The appearance of mass spectra for a given molecular species strongly depends on _____.

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

18. A solution containing $3.9X10^{-5}$ mol/lit $KMnO_4$ has a transmittance of 0.195 in a 1.00 cm cell at 520 nm. The value of molar absorptivity of $KMnO_4$ at 520 nm is_____.

19. A chromatogram of a mixture of species A and B provided the following data: void time is 3.1 min, retention time for A and B species is 15.8 min and 17.3 min respectively. The peak width for A and B are 1.13 and 1.22 min respectively. The column resolution will be_____.

20. The_____ is an atomization technique mostly applicable for the determination of arsenic.

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Time : 2 hrs. 30 mins.

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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 are transfer function and dynamic range? [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 data domain? How is the information encoded in an analog signal? [3]

4. What variables are likely to affect the selectivity factor α for a pair of analytes? [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. Calculate the frequency in hertz, the energy in joules and the energy in electron volts of an X-ray photon with a wave length of 6.24 A^0. [3]

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. Write the principle of flame photometry. Show the process that occurs in the flame during atomization. [1.5+3.5]

9. a. Define auxochrome. What are the effects of substituent and conjugation on chromophores? [4]
   b. What are first order spectra? [1]

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 is isocratic elution? [2]

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

12. a. What are different types of ion sources used in MS? [3]
    b. Predict the appearance of high resolution proton NMR spectra for highly purified ethanol and impure ethanol. [2]

13. a. What is the principle of nuclear magnetic resonance spectroscopy? What are the screening constant and coupling constant? [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 injectors 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 NMR and MS in structure elucidation. [4]
    b. List the difference between HPLC and GC. [3.5]

17. a. Write a short note on thin layer chromatography [3.5]
    b. Differentiate between [2+2]
    (i) Finger print region and group frequency region
    (ii) Single beam and double beam spectrophotometer