KATHMANDU UNIVERSITY
End Semester Examination
February/March 2018

Marks Scored :

Level : B.Sc./B.Pharm./B.Tech.
Year : III

Course : INAN 301
Semester: I

Exam. Roll No.:

Time : 30 mins.

F. M. : 20

Registration No.:

Date : FEB 26 2018

SECTION "A"
[20 Q.×1=20]

Tick the most appropriate answer from the given choices

1. The basic principle of IR for analysis of compound is
   [ ] movement of electrons between different atomic energy levels
   [ ] movement of electrons between different molecular levels
   [ ] absorption of radiation by nuclei placed in a magnetic field
   [ ] bending and stretching of covalent bonds in molecule

2. Wavelength of the photon that has three times as much energy as that of a photon whose wavelength is 779 nm is
   [ ] 240 nm [ ] 250 nm [ ] 260 nm [ ] 270 nm

3. Where does a carbonyl (C=O) stretch appear in an IR spectrum?
   [ ] 740 – 720 cm^{-1} [ ] 650 – 600 cm^{-1} [ ] 1160 – 1030cm^{-1} [ ] 1870 – 1650 cm^{-1}

4. How many signals does the aldehyde $(CH_3)_3CCH_2CHO$ have in ^1H NMR and ^{13}C NMR spectra?
   [ ] five 1H signals and six 13C signals [ ] three 1H signals and four 13C signals
   [ ] five 1H signals and four 13C signals [ ] three 1H signals and six 13C signals

5. What useful information can be found from a Van Deemter plot?
   [ ] the selectivity factor [ ] optimum mobile phase flow rate
   [ ] optimum column temperature [ ] the capacity factor

6. In GC, retention depends upon the
   [ ] vapor pressure and polarity of the solute [ ] size and charge of the solute
   [ ] the method of sample introduction [ ] the type of detector used

7. A diode array detector (DAD) coupled with UV detection is advantageous because:
   [ ] it allows a single wavelength of detection to be more precisely chosen
   [ ] it speeds up the detection at a single wavelength
   [ ] it covers a range of wavelengths
   [ ] it allows lower concentrations of analyte to be detected

8. Which of the following transitions is the highest energy transition?
   [ ] n to σ* [ ] n to π* [ ] σ to σ * [ ] π to π

9. Peak broadening is greatly contributed by
   [ ] mobile phase flow rate/visocity [ ] stagnant mobile phase in column
   [ ] detector sensitivities [ ] stationary phase nature

10. Which compound has a molecular ion at m/z = 58, an infra-red absorption at 1650cm^{-1} and just one singlet in its ^{1}H-NMR spectrum?
[ ] $CH_3CH_2CH_2CH_3$ [ ] CH_3COCH_3 [ ] CH_3CH_2CHO [ ] $CH_3CH(CH_3)_2$

Fill in the blank by most appropriate VALUE or WORD

11. Quartz crystal microbalance (QCM) is based on _____ characteristics of quartz.

12. If the gas flow rate does not exceed the _____, the flame propagates itself back in to the burner, giving flashback.

13. In a triplet, the relative peak areas are in the ratio _____.

14. Some elements such as _____, gives better result with electrode discharge lamp than using hollow cathode lamp in AAS.

15. The time between successive LO to HI transition is called _____, and the time between LO to HI and a HI to LO transition is called the _____.

16. C18 HPLC column consist of _____ in conjunction with a polar mobile phase such as water, methanol or acetonitrile.

17. In support-coated open tubular columns, the inner surface of the capillary is lined _____ of a support material, such as _____.

18. The magnetic coupling of nuclei that is transmitted by bonding electrons is often referred to as - _____.

19. In MALDI-TOF sample is prepared by mixing analyte and matrix in a ratio of _____.

20. _____from Beer's law arise when an analyte dissociates, associates, or reacts with a solvent to produce a product with a different absorption spectrum than the analyte.

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FEB 2 6 2018

Level : B.Sc./B.Pharm./B.Tech.
Year : III
Time : 2 hrs. 30 mins.

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

SECTION "B"

[5 Q.×3=15 marks]

Attempt any *FIVE* questions.

1.a. Differentiate between detector, transducer and sensor. [2]
b. What are the main reasons of peak tailing in liquid chromatography? [1]

2.a. How would you measure the column resolution in chromatography? Explain with suitable example. [1.5]
b. Describe with suitable example hypsochromic shift and bathochromic shift. [1.5]

3.a. Gaseous HCl exhibit an IR absorption at 2890 cm^{-1} due to hydrogen–chloride stretching vibration. Calculate the force constant for the bond. [1.5]
b. Explain the significance of the slit width of a monochromator. List out advantages and disadvantages of making slit width smaller. [1.5]

4.a. What are shielded and deshielded protons? Explain with suitable example. [1.5]
b. How would you measure the detection limit of an analytical instruments? [1.5]

5. What are the support materials used in an open tubular column and a packed column. Also shed light on the efficiency of these columns. [3]

6.a. In which technique, atomic absorption or emission is the flame temperature stability more critical? Why? [1]
b. A resonance is displayed 90 Hz from TMS at magnetic field strength of 1.41 T. What will be the difference at 4.69 T, 7.05 T and 18.8 T? What will be the chemical shift δ at these same magnetic field strengths? [2]

7. A 2.50 mL aliquot of a solution that contain 7.9 ppm iron (III) is treated with an appropriate excess of KSCN to form $Fe(SCN)^{2+}$ complex and diluted to 50 mL. What is the absorbance of resulting solution at 580 nm in a 2.5 cm cell? (Molar absorptivity coefficient = 7 × 103 L cm^{-1} mol^{-1}) [3]

SECTION "C"

[5 Q.×5=25 marks]

Attempt any *FIVE* questions.

8.a. Briefly explain the sources of radiation used in UV-visible spectrophotometer? [3]
b. How many vibrational modes does sulfur dioxide have? How many IR absorption bands would sulfur dioxide be expected to have? [2]

9.a. Differentiate between ion pair chromatography and size exclusion chromatography. [3]
b. Predict the spin-spin splitting pattern of ethylbenzene in high resolution proton NMR. [2]

10.a. Differentiate between selectivity factor and retention factor. [2]

b. Compare the operating principle of magnetic sector analyzer and TOF analyzer [3]

11.a. Write down the working principle of field ionization detector (FID), thermal ionization detector (TCD) and electron captured detector (ECD). [3.5]

b. How to choose between gradient elution and isocratic elution? Explain with suitable examples. [1.5]

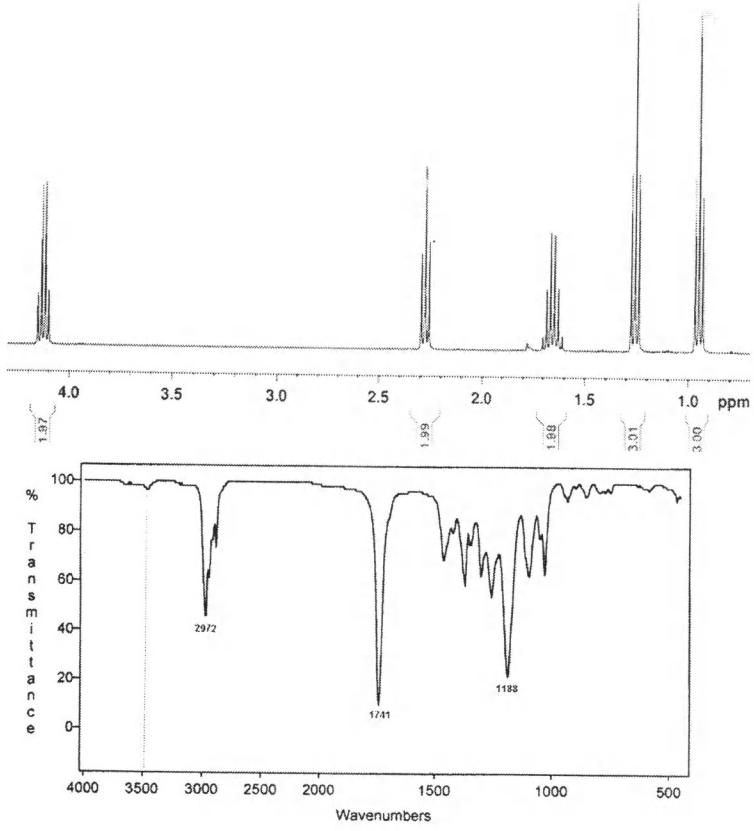
12.a. Write down the types of radiation observed in the electromagnetic spectrum going from high to low energy. Also include what types of processes occurs in atoms or molecules for each type of radiation. [1+1]

b. What is coupling constant? How many carbon resonance would you expect for p-ethyoxy benzaldehyde in ^{13}C NMR? [1+2]

13.a. Explain the working principle of a PDA detector and what are the advantages in comparison to UV-visible detector? [3]

b. How would you measure the performance characteristics of an analytical instruments? [2]

14. The ^{1}H-NMR and IR spectrum in figure is for a compound having an empirical formula of $C_6H_{12}O_2$. Identify the compound. [5]



SECTION "D"

[2 Q.×7.5=15 marks]

Attempt any *TWO* questions.

15.a. What is the working principle of mass spectroscopy? Explain in detail the ion sources used for the analysis of different molecules in mass spectrometer. [1+5]

b. What are the characteristics features of HPLC column? [1.5]

16.a. In the analysis of groundwater sample by AAS for Ba in the presence of high amount of Ca, what possible interference would you encounter and how you eliminate such interferences. [2]

b. What is the relationship between plate height and column variables? Explain its terms. What are the conclusion that can be drawn from the equation? [4.5+1]

17. Write short notes on [3×2.5=7.5]

(i) Hallow cathode lamp
(ii) Standard addition method
(iii) Flame atomizer