Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
July, 2017

Level : B. Sc./B. Pharm./B. Tech. Course : INAN 301
Year : III Semester: I
Exam Roll No. : Time: 30 mins. F. M. : 20

Registration No.: Date JUL 10 2017

SECTION "A"
[20 Q. × 1 = 20 marks]

Encircle the most appropriate answer from the given choices.

1. Which of the following stretches tends to be the least intense?
[ ] C – H [ ] C = C [ ] C = O [ ] O – H (alcohol)

2. Diodes made from gallium aluminium arsenide has λ_{max}
[ ] 900 nm [ ] 650 nm [ ] 550 nm [ ] 450 nm

3. Resolution in chromatography is proportional to the
[ ] number of theoretical plates in a column
[ ] square root of the number of theoretical plates in a column
[ ] square of the number of theoretical plates in a column
[ ] cube root of the number of theoretical plates in a column

4. A hollow-cathode lamp is:
[ ] a broad-band light source [ ] a narrow-band light source
[ ] a light detector [ ] not a light source

5. High performance liquid chromatography (HPLC) cannot be used to
[ ] separate types of organic pesticides
[ ] identify the various pigments from a leaf extract.
[ ] determine the caffeine content of coffee samples
[ ] determine the mercury content of a fish sample

6. Which of the following is not a step in atomic absorption spectroscopy (AAS)?
[ ] a solution is vaporised [ ] atoms absorb light.
[ ] a calibration curve is constructed [ ] particles are adsorbed onto a stationary phase

7. Which of these effects result from slow injection of a large sample volume?
[ ] increased resolution [ ] decreased resolution
[ ] non-linear detector response [ ] constant resolution

8. Which of the following statements is FALSE about the NMR experiment.
[ ] the energy required to flip the spin of a proton is in the infrared region of the electromagnetic spectrum
[ ] the energy difference between the two spin states depends on the strength of the magnetic field
[ ] when energy absorption occurs, the nuclei are said to be in resonance with the electromagnetic radiation
[ ] when a proton is aligned with the magnetic field, its energy is lower than when it is aligned against the magnetic field

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

10. Considering high performance liquid chromatography, which one of the following statement is false
[ ] HPLC is suitable for separation and determination of the non-volatile components
[ ] the stationary phase could be a liquid or a solid
[ ] column longer than 50 meter have been used to increase the efficiency of separation
[ ] high pressure is used to decrease the retention time and improve the separation of components

Fill in the blank by most appropriate VALUE or WORD.

11. The time between a LO to HI and a HI to LO transition is called the ----------

12. The molar absorptivities for a n - π^* are ----------compared to $\pi - \pi^*$ transition.

13. In an IR spectrometer, the ----------uses prisms or diffraction grating to allow only one frequency of light to enter the detector at a line.

14. Helium rather than argon often uses as the carrier gas in GLC when TCD is used as the detector because ----------

15. Ionic fragments with different m/z charge are separated using----------

16. The number of equivalent 'NMR' protons in butanoic acid are ----------

17. The detection limit of analytical instrument is given be ----------

18. The percentage transmittance of solution containing 0.346 absorbance is ----------

19. The GC trace obtained after an experiment is called ----------

20. In mass spectroscopy desorption ion sources are used for the analysis of ---------- and ----------unstable sample.

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Level : B. Sc./B. Pharm./B. Tech.
Year : III
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. Which has a lower characteristics frequency, the C = O band or the C – O bond? Explain briefly. [1.5]
   b. What is meant by temperature programming in gas chromatography? [1.5]

2. a. How spin spin splitting lines can be differentiated from chemical shift lines [1.5]
   b. Why radiation sources are unique in AAS? [1.5]

3. a. What resolution is needed to separate $C_3H_7N_3^+$ and $C_5H_9O^+$? [1.5]
   b. When considering the van Deemeter equation, why HPLC does requires small column packing particles. [1.5]

4. a. A solution containing 5.24 mg /100 mL of X (335 g / mol) has a transmittance of 55.2% in a 1.50 cm cell at the 425 nm. Calculate the molar absorptivity of X at this wavelength. [2]
   b. How the information is encoded in an analog signal? [1]

5. a. Calculate the larmor frequency for proton in 11.7 T magnetic field. [1.5]
   b. Differentiate between hypsochromic shift and bathochromic shift. [1.5]

6. a. What are the various ways of securing a narrow wavelength electromagnetic radiation in UV-visible range? [1.5]
   b. What is MALDI? Explain with suitable example. [1.5]

7. a. How tailing and fronting observed in chromatographic peak. [1.5]
   b. Shed light on the dynamic range of an analytical instruments. [1.5]

SECTION "C"
[5Q.× 5 = 25 marks]

8. Differentiate [2 × 2.5 =5]
   (i) Standard addition method and internal standard method
   (ii) Pyroelectric transducer and photoconducting transducer.

9. a. How does the capillary column configuration achieve its advantages over the packed column in gas chromatography? [2.5]
   b. How retention factor and selectivity factors differ from each other? What are its significance in chromatography? [1.5 + 1]

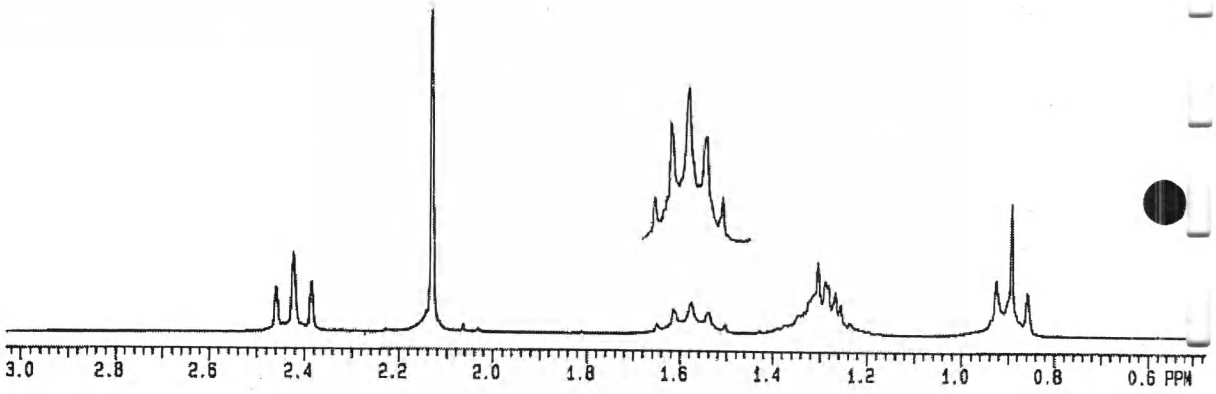
10. a. Explain the various processes occurring during atomization along with the associated chemical reactions in AAS. [2.5]

b. Describe the analytical column used in HPLC. What is the order of elution of ethyl acetate, acetic acid and dimethylamine from a normal phase packed HPLC column. [1.5+1]

11. a. Shed light on the working principle and application of flame photometry. What factors affects the intensity of flame emission? [2+1]

b. Describe a method for determining the number of plates in a column. [2]

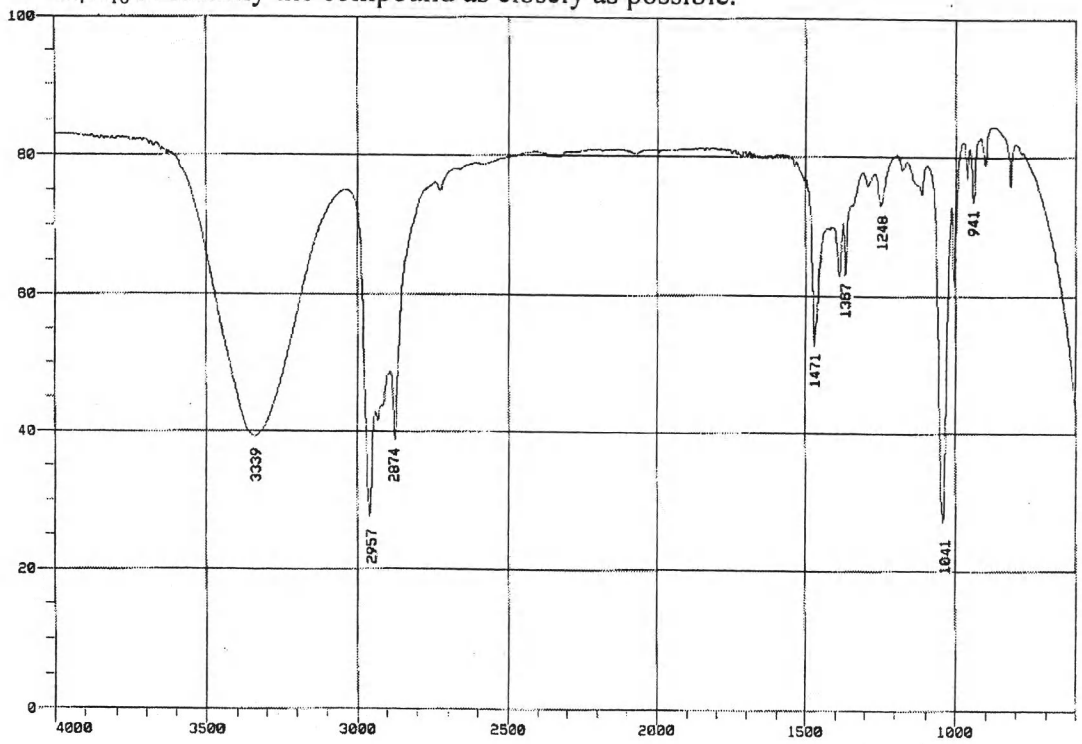
12. a. The ^{1}H-NMR spectrum in figure is for a compound having an empirical formula of $C_7H_{14}O$. Identify the compound. [3]



b. Describe the different between deuterium and tungsten filament lamp as a source for ultraviolet radiation. [2]

13. a. The accuracy and precision of spectrophotometric analysis are often limited by uncertanities or noise associated with the instrument. Give reasonable explanation. [2]

b. The spectrum in figure was obtained for the compound having empirical formula $C_4H_{10}O$. Identify the compound as closely as possible. [3]



14. Write short notes on [2 × 2.5 =5]
(i) Fourier transform – IR (FTIR)
(ii) Flame atomizer

SECTION "D"

[2Q.× 7.5 = 15 marks]

Attempt ANY *TWO* of the following questions.

15. a. List out the types of detector used in gas chromatography? Briefly explain how FID works. What types of analyte does the FID response to? [1+3+1]
b. Describe the general methods for improving the resolution in partition chromatography. [2.5]

16. a. What kinds of ion sources are used in mass spectroscopy? How electron impact, chemical ionization and field ionization spectra differ from each other? [1 +4]
b. In NMR spectroscopy, what are the advantages of using a magnet with as great a field strength as possible? Differentiate between ^{1}H –NMR differ from ^{13}C NMR? [1 +1.5]

17. a. What is pulsed flow in HPLC? Explain the term "A", "B/u" and C_u in van Deemeter equation. [1+4]
b. Discuss the difference between magnetic sector analyzer and double focusing spectrometer. [2.5]