751301

Jan. 2022
M.Sc. (CHEM) IIIrd SEMESTER
Spectroscopy-I (CH-301A)

Time : 90 Minutes] [Max. Marks : 25

Instructions :

1. *It is compulsory to answer all the questions (1 mark each) of Part-A in short.*
2. *Answer any three questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART - A

1. (a) How many Hertz does 1 ppm correspond to for an PMR spectrometer operating at a radio frequency of 60 MHz and 100 MHz? (1)

   (b) What is the natural abundance of ^{13}C? (1)

   (c) How many signals does the aldehyde $(CH_3)_3CCH_2CHO$ have in ^1H NMR and ^{13}C NMR spectra? (1)

   (d) What are shift reagents in NMR spectroscopy? (1)

(e) What is the ^{13}C resonance frequency on a 600 MHz NMR spectrometer? (1)

(f) What are the units for gyro magnetic ratio? (1)

(g) 2.5×10^{-4} M solution of a substance in a 1 cm length cell at λ_{max} 245 nm has absorbance 1.17. Calculate ebsillion max for this transition. (1)

(h) Calculate the absorption maximum in nm for the given compound. (1)
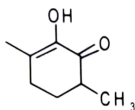
(i) What is the value of $^{3}J_{HH}$ coupling constants in Hz? (1)

(j) What is IR absorption value for carbonyl group in acetophenone? (1)

PART - B

2. (a) Calculate the absorption maximum in nm for the compound A and B.
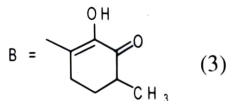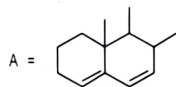
(b) 2.5×10^{-4} M solution of a substance in a 1 cm length cell at λ_{max} 245 nm has absorbance 1.17. Calculate ebsillion max for this transition. (2)

3. (a) Explain the terms :
   (i) Fermi Resonance;
   (ii) Overtone. (2)

   (b) Write a note on stretching frequencies of Carbonyl compounds. (3)

4. A compound X exhibit molecular ion at m/z 58. It shows a strong absorption at about 1720 cm^{-1} in its IR spectrum and responds to iodoform test. The NMR spectrum shows only one sharp signal at δ 2.0 ppm. Treatment of X with Lithium aluminium hydride affords another compound Y which shows the following characteristics: MS: M+, m/z 60, IR : 3400 cm^{-1}, NMR δ 1.2 (d, 6H), δ 3.9 (septet, 1H) and 4.7 (s, 1H). The last signal disappears on shaking with D$_2$O. Characterize X and Y and write mechanistic sequence for the conversion of A to B. (5)

5. (a) What are the applications of NMR spectroscopy? (4)
   (b) What is Pople notation? (1)

6. (a) Write a brief note on the applications of IR spectroscopy. (4)
   (b) What is effect of solvents on vibrational frequencies? (1)