Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 03**

Total No. of Questions : 11

M.Sc.(Chemistry) (2018 Batch)   (Sem.–1)
SPECTROSCOPY - I
Subject Code : CHL404-18
Paper ID : [75116]

**Time : 3 Hrs.**   **Max. Marks : 70**

INSTRUCTION TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains EIGHT questions carrying FIVE marks each and students have to attempt any SIX questions.**
3. **SECTION-C will comprise of two compulsory questions with internal choice in both these questions. Each question carries TEN marks.**

SECTION-A

Q1   Answer briefly :   **(10×2=20)**

a) What do you understand by Frank-Condon principle?

b) When p-nitrophenol is dissolved in water, the colour is yellow, but when NaOH is added, the colour deepens in intensity and moves to longer wavelength. Explain.

c) Determine the index of hydrogen deficiency for $C_{21}H_{22}N_2O_2$.

d) Primary alcohols have a strong peak at m/z = 31. What fragment is responsible for this peak?

e) Write the McLafferty rearrangement in butyraldehyde along with m/z values.

f) Write mass fragments in case of 2-Chloropropane at 80, 78, 65, 63, 43 (Base peak).

g) λ_{max} for trans-stilbene is _____ than cis-stilbene. Explain.

h) List three factors that influence the intensity of an IR absorption band.

i) Which will occur at a higher frequency: the C-N stretch of an amine or the C-N stretch of an amide?

j) Predict the appearance of proton-decoupled ^{13}C NMR spectra for the following compounds.
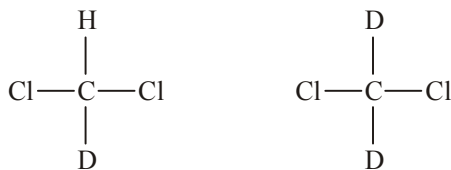
$J_{CD} \cong 20 - 30$ Hz (one bond)

SECTION-B

Q2-Q4 Give the mass fragmentation pattern along with m/z values for the following :

Q2 $CH_3CH_2\overset{|}{C}HBr$ **(5)**
$\qquad\quad \overset{|}{C}H_3$

Q3 **(5)**

Q4 **(5)**

Q5 Explain the ^{1}H NMR patterns and intensities of the isopropyl group in isopropyl iodide. **(5)**

Q6 Explain proton decoupling in ^{13}C NMR. **(5)**

Q7 The hydrogen halides have the following stretching wavenumbers: 4148.3 cm^{-1} (HF); 2988.9 cm^{-1} (HCl); 2649.7 cm^{-1} (HBr). Use Hooke's law to calculate the force constants for hydrogen-halogen bonds. **(5)**

Q8-9 Calculate λ_{max} for the following in hexane (specify each assignment) :

Q8(a)   **Q8(b)** **(5)**

Q9(a)   **Q9(b)** **(5)**
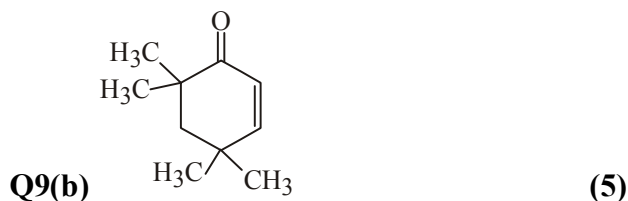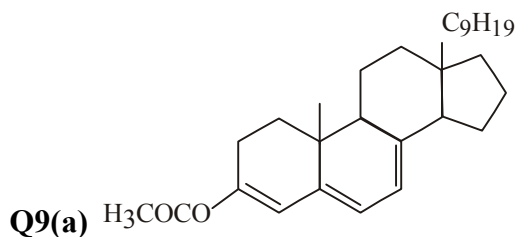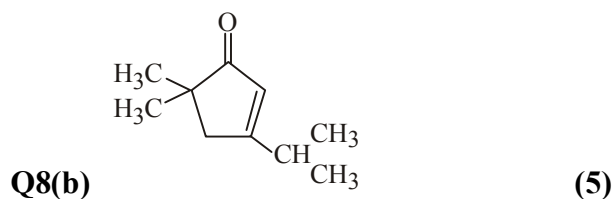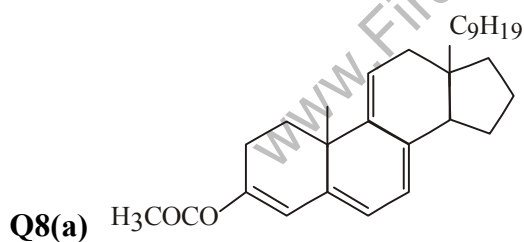
SECTION-C

Q10   a) Give the structure(s) consistent with each of the following sets of NMR data :   **(10)**

i) $C_{10}H_{14}$

a doublet	δ 0.88, 6H
b multiplet	δ 1.86,1H
c doublet	δ 2.45,2H
d singlet	δ 7.12,5H

ii) $C_{10}H_{12}$

a multiplet	δ 0.65,2H
b multiplet	δ 0.81,2H
c singlet	δ 1.37, 3H
d singlet	δ 7.17, 5H

iii) C_9H_{10}

a quintet	δ 2.04,2H
b triplet	δ 2.91,4H
c singlet	δ 7.17,4H

iv) $C_{10}H_{13}Cl$

a singlet	δ 1.57,6H
b singlet	δ 3.07,2H
c singlet	δ 7.27,5H

or

b) Discuss fragmentation pattern for amides, nitriles and carboxylic acids.   **(10)**

Q11 a) Explain the principle of electronic spectroscopy.   **(10)**

or

b) How chemical ionization differs from electron impact phenomenon? How it helps in determining the accurate molecular ion peak? Explain.   **(10)**