STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

(For candidates admitted from the academic year 2015-16& thereafter)

SUBJECT CODE: 15CH/MC/SP64

B.Sc. DEGREE EXAMINATION, APRIL 2021
BRANCH IV – CHEMISTRY
SIXTH SEMESTER

COURSE: MAJOR CORE
PAPER: SPECTROSCOPY
TIME: 90 MINUTES **MAX.MARKS: 50**

SECTION –A

Answer all the questions **(15 x 1 =15 Marks)**

I. Choose the correct answers

1. If the wavelength of a radiation is 2.85 μ , then the corresponding wave number is _____
a) 350.8 cm^{-1} b) 3508 cm^{-1} c) 402 cm^{-1} d) 4028 cm^{-1}

2. The number of signals observed in ^{13}C NMR decoupled spectrum of acetaldehyde is _____
a) 2 b) 5 c) 1 d) 3

3. In mass spectrometer the energy required for the electron bombardment is in the range of ____ eV
a) 1 – 5 b) 20 – 30 c) 10 – 15 d) 50 – 60

4. The solvent used in NMR technique is _____
a) hexachloroacetone b) ethanol c) toluene d) tetramethylsilane

5. The selection rule for rotational – vibrational Raman spectra is _____
a) $\Delta V = \pm 1$ and $\Delta J = 0$ b) $\Delta V = \pm 2$ and $\Delta J = 0, \pm 1$
c) $\Delta V = \pm 1$ and $\Delta J = 0, \pm 1$ d) $\Delta V = \pm 1$ and $\Delta J = \pm 1$

II. Fill in the blanks:

6. The number of waves which can pass through a point in one second is called _____

7. The C-O stretching frequency is _____ for tertiary than primary alcohol

8. The zero point energy in vibrational spectroscopy is _____

9. The increase in λ_{max} values is called as _____ shift

10. Karplus equation for $\phi = 0°$ to $90°$ is _____

III. Answer in one or two lines:

11. What is NMR transition?

12. Define Nitrogen rule.

13. What is isosbestic point?

14. What is fermi resonance?

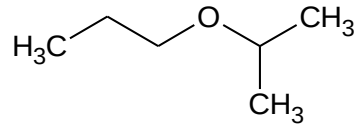
15. What is time-of-flight analyser?

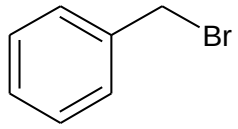
SECTION - B

Answer any three of the following: **(3 x 5 = 15 Marks)**

16. Discuss the fragmentation pattern and draw the mass spectrum for :

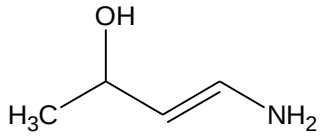
(2 x 2 ½ = 5 Marks)

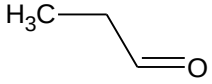
(i) 

(ii) 

17. Explain Franck - Condon principle.

18. Identify the chemical shift values and spin-spin coupling for the following compounds in ^{1}H NMR . **(2 x 2 ½ = 5 Marks)**

(i) 

(ii) 

19a. Calculate the bond length of CO molecule, if it's first rotation spectrum line appears at 3.84×10^{2} m^{-1} (Atomic weight of C = 12 a.m.u & O = 16 a.m.u) **(3 Marks)**

b. Compare the relative IR stretching frequencies for C-C, C=C and C≡C bonds. **(2 Marks)**

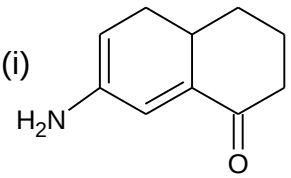
20. Explain the solvent and conjugation effects in UV-visible absorption bands.

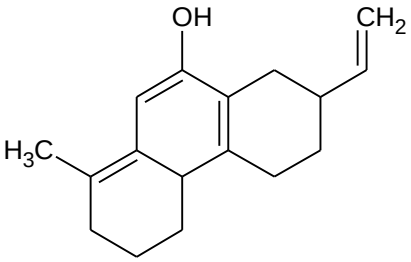
SECTION - C

Answer any TWO of the following: **(2 x 10 = 20 Marks)**

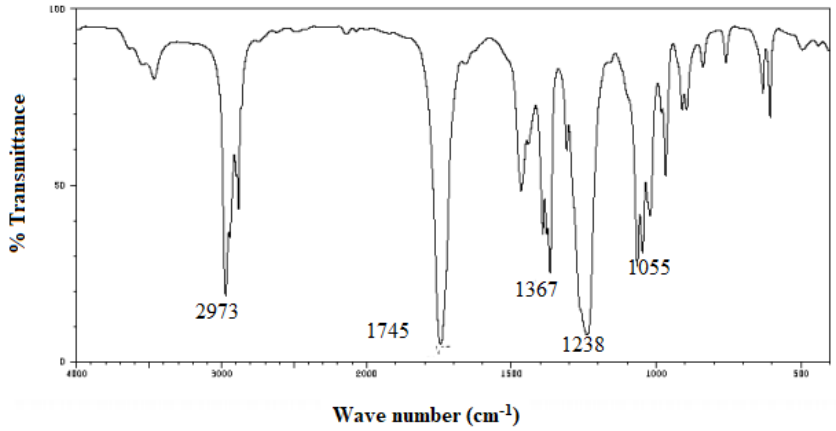
21a. Discuss the principle, instrumentation, sampling and solvents/ standards used in FTIR technique. **(7 Marks)**

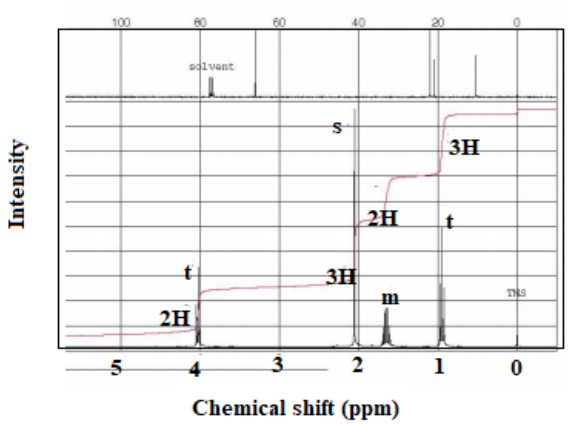
b. Determine the λ_{max} values using Woodward-Fieser rule for the following :**(2 x 1 ½ = 3 Marks)**

(i) 

(ii) 

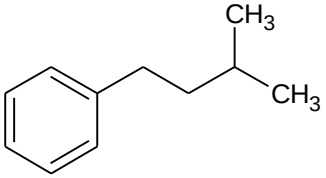
22a.The IR and ^{1}H NMR spectra of a compound with the molecular formula $C_5H_{10}O_2$ are provided below. Major mass spectra fragment peaks are also observed at m/z = 43, 60, and 73. Calculate the m/z for the molecular ion. Deduce the structure of the compound? **(2+2+2+1= 7 Marks)**





b. What is coupling constant? Give its significance. **(3 Marks)**

23a. Discuss Mclafferty rearrangement for the given compound: **(2 Marks)**



b.What are Stokes and Antistokes lines. Explain. **(5 Marks)**

c.The C-H stretching frequency is observed at 3000 cm^{-1}. Calculate the force constant of C-H bond. The atomic mass of C is 12.000 a.m.u and H is 1.008 a.m.u. **(3 Marks)**

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