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

Total No. of Questions : 11

M.Sc.(Chemistry) (2018 & onwards) (Sem.–1)

SPECTROSCOPY - I

Subject Code : CHL404-18

M.Code : 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

1. Answer briefly :

a) Explain blue and red shift in UV-visible spectroscopy.

b) "*Electronic absorption bands are generally broad as compared to Infrared*". Explain.

c) How we can differentiate between CH_3CHO and CH_3COCl on the basis of the IR spectroscopy ?

d) How many fundamental modes of vibrations are possible for :-

i) $CHCl_3$,

ii) SO_2

iii) Benzene

iv) CO_2.

e) "^{13}C *is NMR active while* ^{12}C *is not NMR active*". Explain.

f) The chemical shift of acetylenic protons are δ 2-3ppm while for ethylenic protons is δ 4.5-6.0ppm, although the former is attached to a more electronegative sp-hybrid carbon. Explain.

g) The ^{1}H-NMR spectrum of dimethyl formamide (Me_2N-CHO) shows two signals at δ = 2.84 and 3.0 ppm for methyl protons at room temperature but only a single sharp singlet is observed for these two methyl groups at 165 °C. Explain.

h) What is the most characteristic features of the mass spectra of compounds containing one bromine atom?

i) Define Base Peak and molecular ion peak in Mass spectrometry.

j) Explain Nitrogen rule.

SECTION-B

2. Discuss the effect of increase in polarity of solvent on $\prod \rightarrow \prod^*$ and $\eta \rightarrow \prod^*$ transitions.

3. Which of the following molecules will absorb at longer wavelength (λmax) in UV region and why? Justify your answer.

   a) *cis*-Stilbene or *trans*-Stilbene

   b) Anthracene or Naphthalene

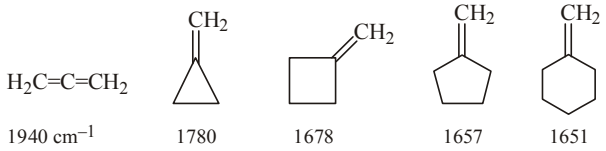
   c) CH_3-(CH=CH)$_2$-CHO or CH_3-(CH=CH)$_3$-CHO

   d) Cyclohexatriene or 1,3-cyclohexadiene

   e) Aniline or *p*-nitroaniline

4. Why a broad band is observed in IR spectrum of alcohols? Can IR spectroscopy be used for differentiation of 1°, 2° and 3° alcohols?

5. Explain the order of following observed v C=C stretching frequencies for external double bond :



6. Define chemical shift? Why aromatic, alkenic and aldehydic protons have high value of chemical shift.

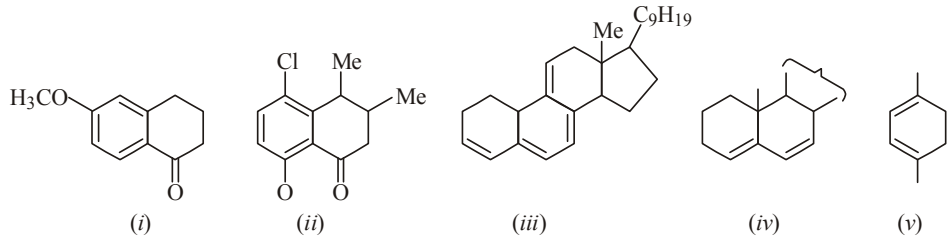
7. Define spin-spin splitting and cause of splitting. Show the splitting pattern when CH_3 is present adjacent to CH in NMR spectroscopy.

8. Explain Even-electron rule and Nitrogen rule with examples in mass spectrometry.

9. Explain the Chemical Ionisation method for generation of positively charges ions in Mass spectrometry.

SECTION-C

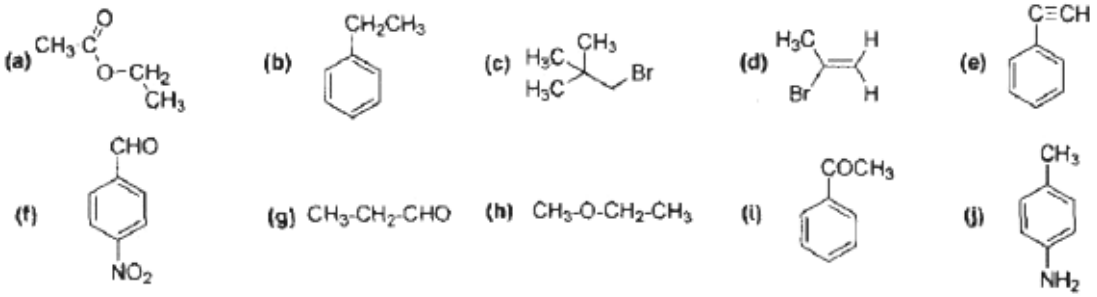
10. Applying Woodward-Fischer rules, calculate the value of absorption maxima (λ_{max}) for the following unsaturated hydrocarbons :



(*i*) (*ii*) (*iii*) (*iv*) (*v*)

OR

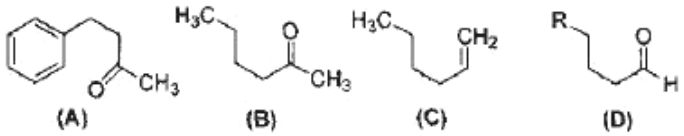
How many PMR signals would following compound will show? In case of compounds where splitting is possible indicate the multiplicity of various signals. Justify your answer.



11. Explain the Fast Atom Bombardment (FAB) in Mass spectrometry with its advantages over other methods.

OR

State McLafferty rearrangement and show the splitting pattern of following molecules :



NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.