

2023

Time - 3 hours

Full Marks - 60

Answer all groups as per instructions.

Figures in the right hand margin indicate marks.

GROUP - A

1. Fill in the blanks. (all)

[1 × 8

- (a) Hypsochromic shift is also called _____ shift.
- (b) A group which itself cannot impart colour but can deepen a colour is called _____.
- (c) Which type of inductive effect raises the wave number of IR absorption ?
- (d) The number of vibrational degrees of freedom of CO₂ molecule is _____.
- (e) Shielding shifts the NMR signal _____ field.
- (f) The most intense mass spectrum peak of a compound is called _____ peak.
- (g) In chromatography, the stationary phase is also called _____ phase.

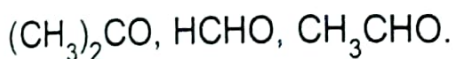
[2]

- (h) The process of removing each component from the chromatographic column and collecting them one by one is called _____.

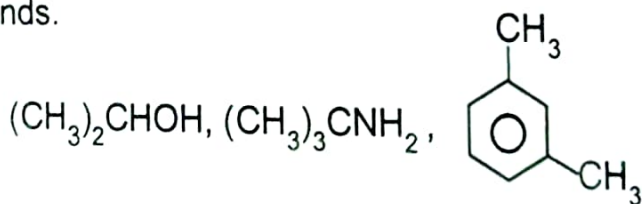
GROUP - B

2. Answer any eight of the following questions within two to three sentences each. [1½ × 8]

- (a) What are chromophores ? Give examples.
- (b) What are various types of electronic transition ? Arrange them in order of their decreasing energy.
- (c) Name two types of electronic transitions observed in carbonyl compounds. Which is more informative ?
- (d) Define stretching vibration and give its classification.
- (e) Arrange the following in increasing order of their wave numbers in IR spectra :



- (f) Predict the number of NMR spectra signals in following compounds.



- (g) Indicate the multiplicity of NMR spectra signals of the following compound : $\text{CH}_3\text{-CH(Br)-CHBr}_2$.

[3]

- (h) Name different types of mass spectra peaks.
- (i) Explain the principle of column chromatography.
- (j) Name three factors which brings success in column chromatography.

GROUP – C

3. Answer any eight of the following questions within 75 words each.

[2 × 8

- (a) Define and give examples of homoannular and hetero annular dienes.
- (b) Between cis and trans isomers of stilbene which has higher λ_{max} and why ?
- (c) State Lambert-Beer's laws.
- (d) Explain different types of bending vibrations.
- (e) Explain the effect of intramolecular and inter-molecular hydrogen bonding on IR spectra.
- (f) Calculate the wave number in cm^{-1} if wavelength of radiation is 2.5μ .
- (g) What are shielded and deshielded NMR signals ?
- (h) Why is TMS used as a common reference standard in the study of NMR spectra ?

P.T.O.

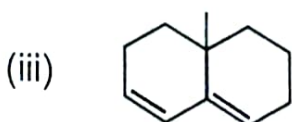
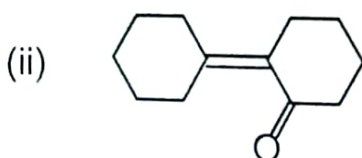
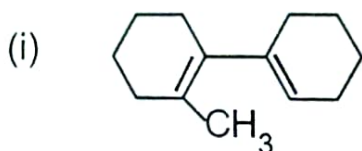
[4]

- (i) Show the fragmentation pattern for mass spectra of neo-pentane.
- (j) Explain ' R_F ' value in chromatographic study.

GROUP – D

Answer *all* questions .

4. How can λ_{\max} be calculated for the following compounds by use of Woodward-Fieser rules. [2 + 2 + 2]



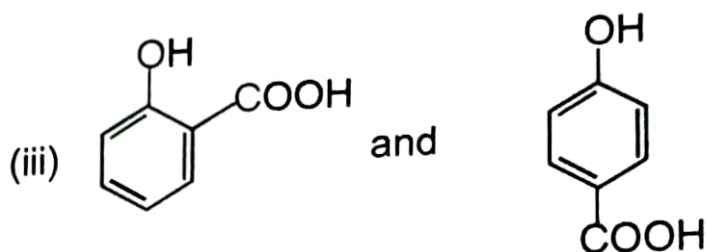
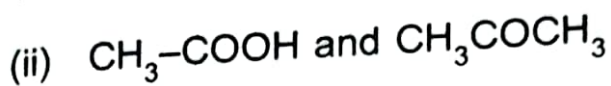
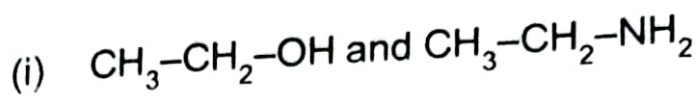
OR

Explain the following :

- (i) Increase in polarity of the solvent shifts $\pi \rightarrow \pi^*$ band to longer wavelength but $n \rightarrow \pi^*$ and $n \rightarrow \sigma^*$ to shorter wavelength. [4]
- (ii) The energy required to excite σ -electrons is more than that of π -electrons. [2]

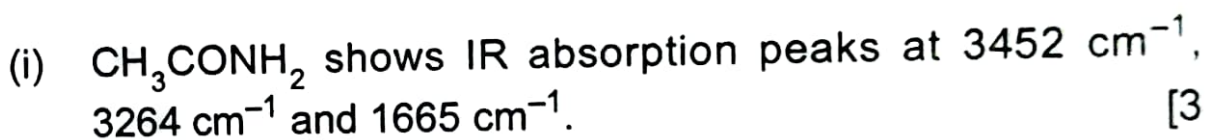
[5]

5. How can you distinguish between following pairs of compound with the help of IR spectra ? [2 + 2 + 2]



OR

Explain the following :



6. Write notes on : [3 + 3]

(i) Chemical shift in NMR spectra

(ii) Splitting of NMR signal

OR

Identify the following m/e peaks of n-butane at : [5 + 1]

58, 43, 41, 29, 27 and 15.

Which is the base peak ?

P.T.O.

7. Write notes on :

[3 + 3]

(i) TLC

(ii) Ion-exchange chromatography

OR

What are different types of paper chromatography ? How can you separate a mixture of two amino acids ?

[3 + 3]