

SET B

Unique Paper Code : 32171602
Name of the Paper : Organic Chemistry V: Spectroscopy
Name of the Course : B Sc (Hons.) Chemistry
Semester : VI
Duration : 3 hours
Maximum Marks : 75

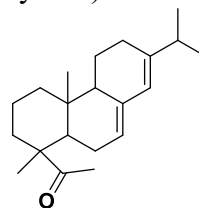
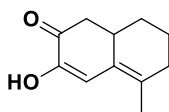
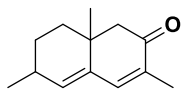
Instructions for Candidate

Answer any FOUR questions. All questions carry equal marks.

1. a) Explain why $\nu_{C=O}$ frequency in IR spectroscopy for m-chlorobenzoic acid is higher than that for p-chlorobenzoic acid?
b) Differentiate between 3-pentanone and 2-pentanone using proton NMR spectroscopy.
c) An organic compound with molecular formula $C_6H_{12}O$ showed the following data:
UV (λ_{max}) 288 nm, $\epsilon = 24$
IR very strong band at 1715 cm^{-1}
NMR: δ 2.0 (3H, s), 1.0 (9H, s)
Calculate the double bond equivalent (DBE) and explain UV, IR and NMR peaks and give the structure of the compound.

(5, 4, 9.75)

2. a) What is spin-spin coupling in NMR spectroscopy? Discuss with an example.
b) Calculate the λ_{max} (nm) for the following compounds: (any two)



Base value for α , β -unsaturated ketones = 215 nm

Increment for each substituent

Alkyl substituent or ring residue at the α -position = 10 nm, β -position = 12 nm, γ - or δ - or higher position = 18 nm,

Increment for hydroxyl (-OH) group at α -position = 35 nm, β -position = 30 nm, δ -position = 50 nm

Exocyclic double bond = 5 nm, Double bond extended conjugation = 30 nm.

Base value for acyclic/ heteroannular diene = 214 nm, Homoannular diene = 253 nm

Increment for each substituent: Alkyl substituent or ring residue = 5 nm, Exocyclic double bond = 5 nm, Double bond extending conjugation = 30 nm.

- c) Differentiate between hypsochromic and bathochromic shift with examples.

d) What are fundamental and non-fundamental molecular vibrations? Discuss by taking CO₂ as an example.

(4, 6, 3, 5.75)

3. a) How was the configuration of (+) - Glucose established?

b) Mechanistically explain the formation of Glucosazone. Why does the reaction not proceed beyond C-2?

c) Draw the structure of Lactose and write its systematic name. Mention the structural differences between Lactose and Sucrose.

(6.75, 6, 6)

4. a) Write brief description of:

i. Edible Dyes

ii. Biodegradable Polymers

b) A carbohydrate X, C₁₂H₂₂O₁₁, shows reducing behaviour. Hydrolysis by emulsin yields only D-Glucose. Methylation of X followed by hydrolysis gives 2, 3, 4, 6-tetra-O-methyl-D-Glucose and 2, 3, 4-tri-O-methyl-D-Glucose. Elucidate the structure of X.

c) Outline and explain the reactions that establish that D-Glucose exists in cyclic hemiacetal forms.

(6, 6, 6.75)

5. a) Phenolphthalein is colorless in acidic medium, deep pink in alkaline solution but again colorless in stronger alkaline solution. Explain using structure and give its synthesis.

b) How was the structure of Alizarin elucidated? Give the synthesis of Alizarin starting from anthracene.

c) What is PVC? Give one synthesis of its monomer from acetylene and explain the formation of polymer using free radical mechanism.

(6.25, 6.25, 6.25)

6. a) Explain the following

(i) Fingerprint region in IR spectroscopy

(ii) Addition and condensation polymer

b) What is a leucobase? Explain giving an example.

c) What are syndiotactic, atactic and isotactic polymers? Explain using one example.

d) Give the structure and synthesis of polyamide and polyester fibers.

(6, 2, 4.5, 6.25)