

## 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

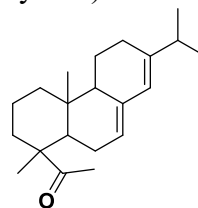
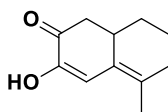
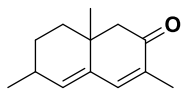
### Instructions for Candidate

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 ( $\lambda_{max}$ ) 288 nm,  $\epsilon = 24$   
IR very strong band at  $1715\text{ cm}^{-1}$   
NMR:  $\delta$  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  $\lambda_{max}$  (nm) for the following compounds: (any two)



**Base value** for  $\alpha$ ,  $\beta$ -unsaturated ketones = 215 nm

#### Increment for each substituent

Alkyl substituent or ring residue at the  $\alpha$ -position = 10 nm,  $\beta$ -position = 12 nm,  $\gamma$ - or  $\delta$ - or higher position = 18 nm,

Increment for hydroxyl (-OH) group at  $\alpha$ -position = 35 nm,  $\beta$ -position = 30 nm,  $\delta$ -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  $\text{CO}_2$  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,  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ , 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)