2023

(May/June)

CHEMISTRY

(Honours)

(Organic Chemistry—VI)

(Chem–H–602)

Marks : 37

Time : 2 hours

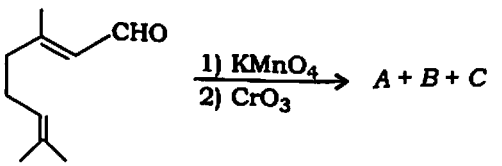
The figures in the margin indicate full marks for the questions

1. *(a)* State the number of carbon atoms and the number of isoprene units in the following terpenes : 1+1=2

(i) Diterpenes

(ii) Tetraterpenes

(b) Identify the compounds in the following reaction : 2



(c) What do you understand by the terms 'coenzyme', 'apoenzyme' and 'haloenzyme'? Write down the full name and structure of NAD^+. 1½+1½=3

(d) What are nucleic acids? Write the different components of a nucleic acid with their structures. 1+2=3

OR

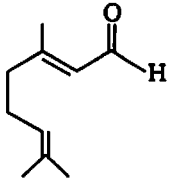
2. (a) Write short notes on the following : 2×2=4

(i) Replication of DNA

(ii) ATP-ADP cycle

(b) How do temperature and pH affect the enzyme activity? 2

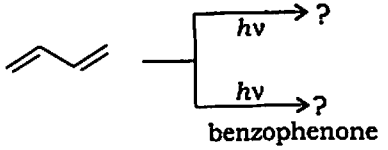
(c) Write the steps involved in the synthesis of the following from methyl heptenone : 3



(d) Draw the structure of cocaine. 1

3. (a) What are the different types of excitations possible in a compound containing carbonyl group on irradiation with UV light? 2

(b) Indicate the product that could be formed on irradiating the following compound with light : 2



benzophenone

(c) Briefly explain the following terms (any *one*) : 2

(i) Singlet and triplet states

(ii) Photochemical energy

OR

4. (a) Predict the products and suggest the mechanism for the following photochemical equations (any *two*) : 1½×2=3

(i) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH_3 \xrightarrow{h\nu} ?$

(ii) $C_6H_5-\overset{\overset{O}{\|}}{C}-C_6H_5 + H_3C(CH_3)C{=}CH_2 \xrightarrow{h\nu} ?$

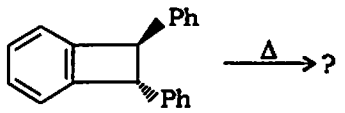
(iii) $C_6H_5COC_6H_5 \xrightarrow[\text{isopropyl alcohol}]{h\nu} ?$

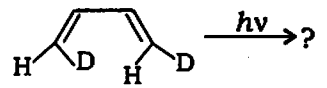
(b) Write short notes on the following : 1½×2=3

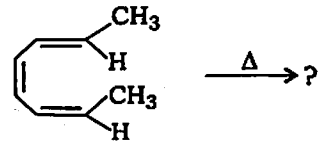
(i) Frank-Condon principle

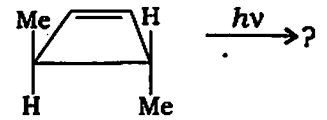
(ii) Quantum efficiency

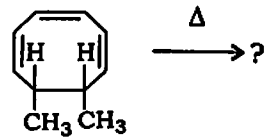
5. *(a)* Write down the product with proper stereochemistry and mention the modes of rotation in the following reactions (any *four*) : 1½×4=6

(i) 

(ii) 

(iii) 

(iv) 

(v) 

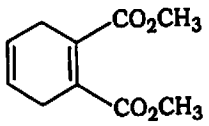
(b) Explain why $(\pi_s^4 + \pi_s^2)$ cycloaddition is thermally allowed and photochemically forbidden. 2

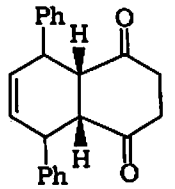
(c) What do you understand by the terms 'suprafacial' and 'antarafacial'? 1

OR

6. *(a)* Explain why thermocyclic reactions with $4n$ electrons give conrotatory motion whereas $4n+2$ electrons give disrotatory motion. Give one example of each. 3

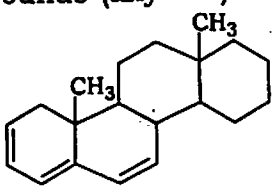
(b) Synthesize the following compounds by using Diels-Alder reaction : 2+2=4

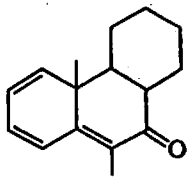
(i) 

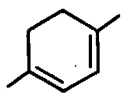
(ii) 

(c) Applying Woodward-Hoffmann rules for electrocyclic reaction, how one can convert *trans*-5,6-dimethyl-1,3-cyclohexadiene into its *cis*-isomer? 2

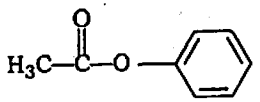
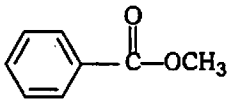
7. *(a)* Calculate λ_{max} for the following compounds (any *two*) : 2×2=4

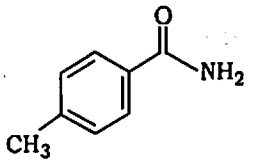
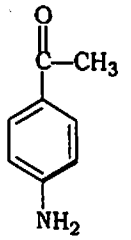
(i) 

(ii) 

(iii) 

(b) How will you distinguish the following pairs by IR spectroscopy? 1½+1½=3

(i)  and 

(ii)  and 

(c) Sketch and compare the ^{1}H-NMR spectra of ultrapure ethanol and dilute ethanol. 3

(d) Mention the important characteristics of metastable ions. 2

OR

8. (a) Explain the effect of solvents on the absorption maximum (λ_{max}) of α, β-unsaturated carbonyl compounds. 3

(b) Explain the effect of hydrogen bonding in the IR absorption bonds of O—H in aliphatic alcohols. 3

(c) A hydrocarbon shows m/e values at 86, 71, 57, 43 (100%) and 29. Deduce the structure of the hydrocarbon with proper justification and show the various fragmentation modes. 3

(d) What are the basic functions that a mass spectrometer can perform? 1½

(e) Give a rough sketch of the ^{1}H-NMR spectrum of ethyl acetate. 1½

★★★