2018

CBCS

1st Semester

CHEMISTRY

PAPER—C1T

(Honours)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Oraganic Chemistry–I

Group–A

1. Answer any *five* questions : 5×2

(a) Compare with proper justification the stabilities of isobutene, Z-2-butene and E-2-butene.

(b) Arrange with explanation, the following compounds in order of increasing dipole moments :

CH_3CH_2Cl, $HC \equiv C - Cl$, $CH_2 = CHCl$

(c) Depict the symmetry elements of the following molecules in terms of σ and Cn.

(i) cis – 1, 2-dimethyl cyclopropane

(ii) Trans-1, 2-dichloroethene

(d) Give an orbital representation of singlet and triplet carbene

(e) Write the fishcher projection formula of meso-tartaric acid and represent it in Newman and Sawhorse projection formulae.

(f) Write the canonical forms of diazomethane $(CH_2^- - N^+ \equiv N)$ and select the most contributing structure.

(Continued)

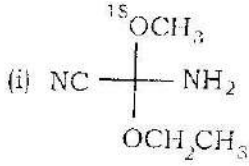
(g) Calculate the double bond equivalents of (i) C_3H_7N and (ii) $C_7H_6O_2$. 2

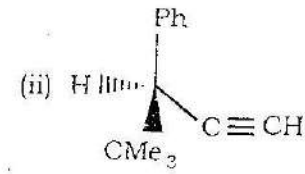
(i) Draw the Fischar projection formula of L-2-hydroxy propanoic acid and assign R/S configuration to the chiral carbon atom. 2

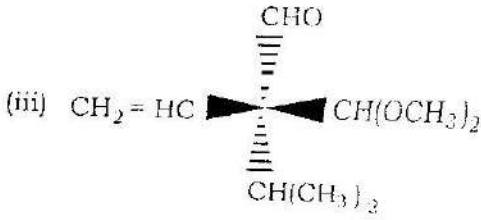
Group—B

Answer any *four* questions : 4×5

2. (a) Assign R/S confligation of the following compounds and also show the priority order of the groups : 3

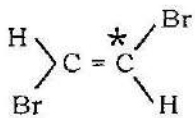
(i) 

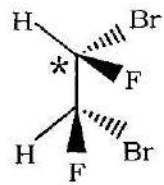
(ii) 

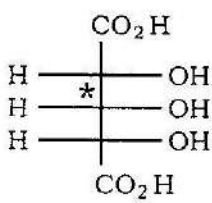
(iii) 

(b) Outline the chemical method of resolution of racemic acid. 2

3. Designate the indicated centres (*) of the following compounds as stereogenic / non-stereogenic and chirotopic / achirotopic. Give reasons

(i) 

(ii) 

(iii) 

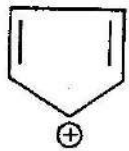
4. (a) What is meant by the terms 'Optical purity' (OP) and 'enantiomeric excess' (ee) ? 2

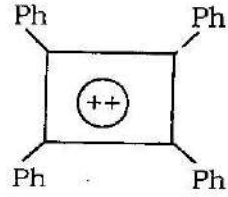
(b) Calculate the ee and the specific rotation of a mixture containing 10g of (+) – 2 – butanol and 6 g of (–) -2-butanol. The specific rotation of enantiometrically pure (+) 2-butanol is +13.5°. 3

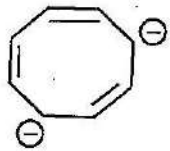
5. Draw all the π molecular orbitals of (E)–1, 3-butadiene. Arrange them in order of increasing energy level, designating the HOMO and LUMO in the ground state.

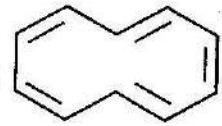
6. Which of the following compounds are aromatic, non-aromatic and antiaromatic ?

Justifiy your answer

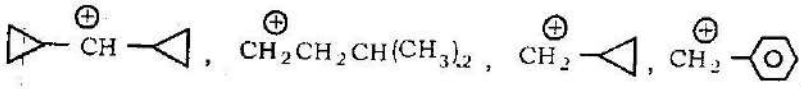
(i) 

(ii) 

(iii) 

(iv) 

7. (a) Arrange the following carbocations in order of increasing stability and explain the order 3



(b) Classify each of the following species as electrophile and nucleophile and give your reasoning. 2

$(CH_3)_3 C^{\oplus}$, CCl_2, NH_3, $Cl^{\ominus}$.

Group—C

8. Answer any *one* question :

(a) How many stereoisomers are possible for the following compounds. Are all of them optically active ?

(i) $CH_3CH(Br)\ CH(Br)\ CH(Br)\ CH_3$

(ii) $CH_3CH = CH - CH\ (OH) - CH = CH\ CH_3$

Give Fischer projection formulae of all the stereoisomers. 3+3

(b) Write down the (2E, 4E)-hepta -2, 4-diene in the s-cis and s-trans conformations. 2

(c) The ketone (+) $CH_3CH_2COCH(OH)CH_3$ racemises on treatement with alkali, whereas the isomeric ketone (+) $CH_3\ CO\ CH_2\ CH(OH)\ CH_3$ does not, Explain. 2

9. (a) Draw orbital picture of cerbene in sp^2-singlet, sp^2 – triplet and sp–triplet states. 3

(b) Which of the indicated bonds in each pair of compounds is shorter and why ? 3

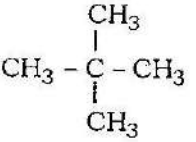
(i) $CH_3CH_2 - \underset{\underset{H}{|}}{C} = CH_2$ and $CH_3CH_2 - C \equiv C - H$

(ii) $CH_3CH_2NH - H$ and $(CH_3)_2C = N - H$

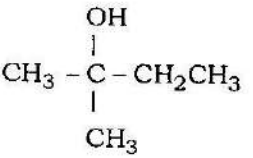
(iii) $CH_3 - \overset{O}{\overset{\|}{C}} - H$ and $H - CH_2OH$

(c) Arrange the following compounds in order of increasing boiling point and explain the order. 4

(i) $CH_3CH(CH_3)CH(CH_3)CH_3$

(ii) 

(iii) $CH_3CH_2CH_2 - CH_2CH_2 - CH_3$

(iv) 

(v) $CH_3CH_2CH_2CH_2 - CH_2OH$