TDC (CBCS) Even Semester Exam., 2024

CHEMISTRY

(2nd Semester)

Course No. : CHMHCC-201T

(Organic Chemistry)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* questions from the following : 2×2=4

(a) The central bond of buta-1,3-diyne is 137 pm whereas a normal C—C bond length is 154 pm. Account for this difference in bond lengths.

(b) Acyl cation has resonating structures (*I*) and (*II*) :

(*I*) (*II*)

Which structure is more stable and why?

(c) Which of the following is a better nucleophile? Give reason :

(i) $Cl^{(-)}$ or (ii) $Br^{(-)}$

2. Answer *either (a) or (b)* : 6

(a) (i) Select the compounds from the following which have sp^3-, sp^2- and *sp*-hybridization : ½×4=2

NH_3, H_2O, $HC{\equiv}CH$, C_6H_6

(ii) What are carbenes? Explain the multiplicity of carbenes. 1+1=2

(iii) Buta-1,3-diene when accepts a proton, an allylic cation is formed. Which one of the following does not represent a resonance structure? Give reason for your choice : 2

(1) $CH_2{=}CH{-}\overset{(+)}{C}H{-}CH_3$

(2) $CH_2{=}CH{-}CH_2{-}\overset{(+)}{C}H_2$

(3) $CH_3{-}CH{=}CH{-}\overset{(+)}{C}H_2$

(b) (i) Bring out the differences between inductive effect and mesomeric effect. 2

(ii) Pickup the electrophile and nucleophile from the following : 2

(1) $:CCl_2$

(2) $\ddot{N}H_3$

(3) BF_3

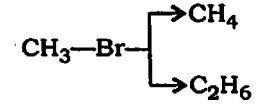
(4) $AlCl_3$

(iii) What is ambident nucleophile? Explain with example. 2

UNIT—II

3. Answer any *two* questions from the following : 2×2=4

(a) Carry out the following single-step conversions :



(b) (i) When alkanes are heated, C—C bonds break rather than C—H bond. Explain why.

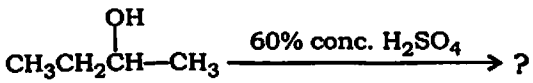
(ii) Identify the product in the following reaction :

$$HC{\equiv}CCH_2CH_3 + 2HBr \rightarrow ?$$

(c) Why does HI not show peroxide effect?

4. Answer *either (a) or (b)* : 6

(a) *(i)* Predict the major product and propose a reasonable mechanism for the following reaction : 2½

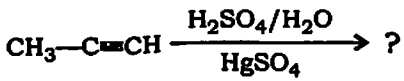


(ii) Describe E1cB mechanism with an example. 2½

(iii) What product is predominantly formed when HBr adds to 1-phenyl-propene? (Write the equation and name of the product) 1

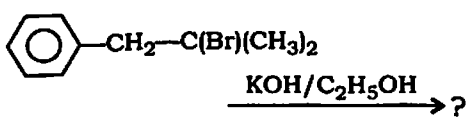
(b) *(i)* What is Diels-Alder reaction? Give an example. 1½

(ii) Complete the following reaction and propose a reasonable mechanism for the conversion : 2½



(iii) Predict the major products of the following reactions : 1×2=2

(1) 

(2) 

UNIT—III

5. Answer any *two* questions from the following : 2×2=4

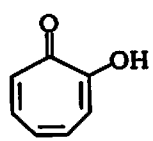
(a) Benzene is an unsaturated hydrocarbon but failed to give addition reactions. Explain.

(b) Which of the following is aromatic? Justify :

(i) 

Or *(ii)* 

(c) Which of the following is anti-aromatic? Why?

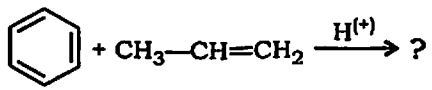
(i)  *Or* *(ii)* 

6. Answer *either (a) or (b)* : 6

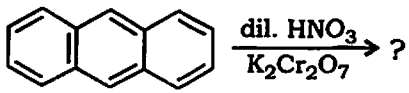
(a) *(i)* Visualize the mechanism of nitration of benzene including generation of electrophile for the reaction. 3

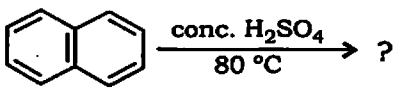
(ii) How will you justify that naphthalene contains two *ortho*-fused benzene ring? 3

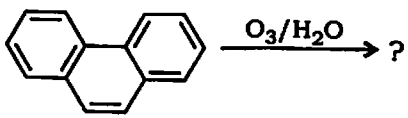
(b) (i) Complete the following reaction and propose its mechanism : 3



(ii) Complete the following reactions : 1×3=3

(i) 

(ii) 

(iii) 

UNIT—IV

7. Answer any *two* questions from the following : 2×2=4

(a) Explain specific rotation.

(b) What is optical activity? What is essential requirement for a substance to be optically active?

(c) Distinguish between enantiomer and diastereomer.

8. Answer *either (a) or (b)* : 6

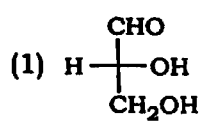
(a) (i) 1,2-dichloroethene exists in two geometrical isomeric forms. One of the isomers has a dipole moment of $\mu = 1{\cdot}85D$ while the dipole moment value of the other isomer is $\mu = 0$. Draw the structures of these two different isomers and explain their different dipole moment values. 3

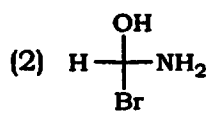
(ii) What is the process of separation of components of enantiomers called? Discuss the principle of chemical method of separation of components of enantiomers from their mixture. ½+1½=2

(iii) Represent the *erythro*-2,3-dihydroxy butanoic acid in (1) Fischer and (2) Newmann projection formulae. ½+½=1

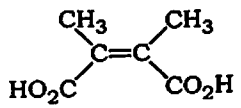
(b) (i) What is a *meso*-compound? Why are *meso*-copounds optically inactive? 1+1=2

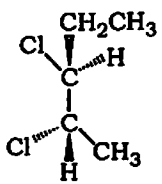
(ii) Assign the configurations, whether *R* or *S* to the following : 1+1=2

(1) 

(2) 

(iii) Draw the diastereomers for each of the following compounds : 1+1=2

(1) 

(2) 

UNIT—V

9. Answer any *two* questions from the following : 2×2=4

(a) Chair conformation of cyclohexane is more stable than boat conformation. Explain.

(b) Cyclopropane is least stable member of cycloalkanes. Justify.

(c) Depict the most stable conformers for the following :

(i) *cis*-1-tert-butyl-3-methyl cyclohexane

(ii) *trans*-1-tert-butyl-3-methyl cyclohexane

10. Answer *either (a) or (b)* : 6

(a) Discuss chair- and boat-conformation of cyclohexane. What are axial and equitorial bonds? Why is its equitorial substituted chair-conformation more stable than the axial substituted chair-conformation? 2+2+2=6

(b) Compare the stabilities of *cis*- and *trans*-cyclohexane-1,3-diol by drawing the conformations and with proper reasoning. 6

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