

Total No. of Printed Pages—7

2 SEM TDC CHMH (CBCS) C 3

2 0 2 5

(May)

CHEMISTRY

(Core)

Paper : C-3

(Organic Chemistry)

Full Marks : 53

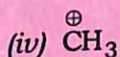
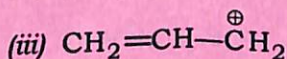
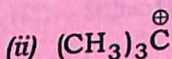
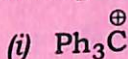
Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Choose the correct answer from the following : 1×5=5

(a) Which is the most stable carbocation among the following?



(2)

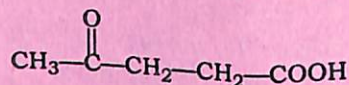
(b) Which of the following compounds will show geometrical isomerism?

- (i) 2-Butene
- (ii) Propene
- (iii) 1-Phenylpropene
- (iv) 2-Methyl-2-butene

(c) How many optically active isomers are possible for *meso*-tartaric acid?

- (i) 2
- (ii) 3
- (iii) 4
- (iv) 6

(d) The IUPAC name of the compound :



is

- (i) 4-oxopent-1-oic acid
 - (ii) 4-oxopentan-1-oic acid
 - (iii) 2-oxo-5-pentanoic acid
 - (iv) 2-formylpentan-5-oic acid
- (e) The hybridization of C atoms in C=C single bond of $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_3$ is
- (i) sp^2-sp^2
 - (ii) $sp-sp^2$
 - (iii) $sp-sp$
 - (iv) sp^3-sp^3

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(3)

UNIT—I

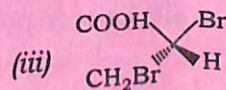
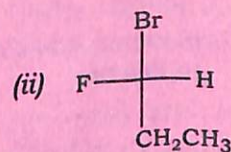
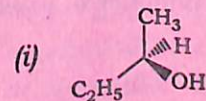
2. Answer the following questions : $2 \times 3 = 6$

- (a) What effect does hybridization have on the stability of bonds?
- (b) "Benzyl carbocation is more stable than propyl carbocation." Explain.
- (c) Draw the energy profile diagrams of one-step reaction. Why are thermodynamic products stable than kinetic products?

UNIT—II

3. Answer any six of the following questions : $2 \times 6 = 12$

(a) Specify the following stereoisomers as R and S (any two) : $1 \times 2 = 2$

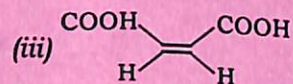
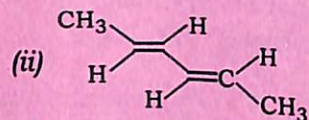
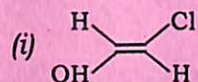


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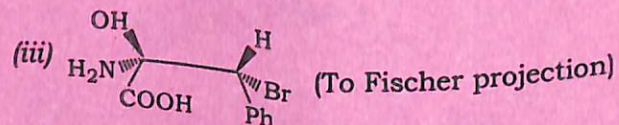
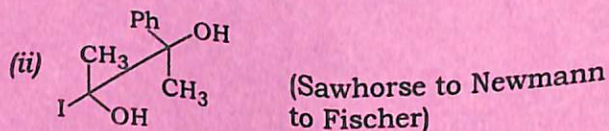
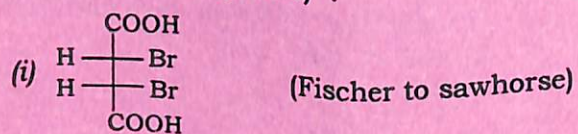
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(4)

- (b) Specify the following geometrical isomers as *E* and *Z* (any two) : $1 \times 2 = 2$



- (c) Interconvert the following projections as directed (any two) : $1 \times 2 = 2$



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(5)

- (d) What is *meso* compound? Give one example. $1+1=2$
- (e) Define the following : $1+1=2$
- (i) Racemic mixture
- (ii) Resolution
- (f) What are threo- and erythro-forms? 2
- (g) What is the difference between relative and absolute configuration? 2

UNIT—III

4. Answer the following questions :

- (a) How will you synthesize ethane from methane? 2
- (b) Why is dry ether used in Wurtz reaction? 2
- (c) HCl and HI do not give anti-Markovnikov's products in the presence of peroxide. Explain. 2
- (d) Three isomeric alkenes A, B and C having the molecular formula C_4H_8 . On ozonolysis, A gives a molecule of propanal and one molecule of formaldehyde, B gives two ethanol molecules and C gives one acetone and one formaldehyde molecules. Predict the structure of A, B and C. 3

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(Turn Over)

(6)

- (e) Diels-Alder reactions are most efficient for an electron-rich diene and an electron-deficient dienophiles. Explain. 2
- (f) What is Wittig reaction? Stabilized ylide gives *cis*-alkene and unstabilized ylide gives *trans*-alkene. Explain. 3
- (g) Write short notes on 1,2- and 1,4-addition reactions in conjugated dienes by taking a suitable example. 2

UNIT—IV

5. (a) Why is the eclipsed conformation the least stable conformation of ethane? 2
- (b) What will be the angle strain if a cyclooctane has an internal bond angle of 135° ? 2

Or

Even though cycloheptane and higher members are free of angle strain, they cannot be synthesized easily. Explain.

- (c) Chair conformation of cyclohexane is more stable than boat conformation. Explain. 2
- (d) Draw the energy profile diagram for the conformations of *n*-butane. 2

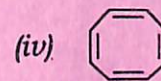
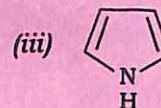
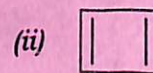
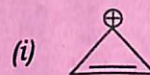
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UNIT—V

6. (a) Which of the following compounds are aromatic, anti-aromatic and non-aromatic? 2



- (b) Electrophilic substitution occurs more easily in toluene than in benzene. Explain. 2
- (c) Explain why $-\text{CF}_3$, $-\text{NO}_2$ and $-\text{CHO}$ should be deactivating and *meta*-directing in a typical electrophilic aromatic substitution reaction. 2

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CHEMISTRY

(Core)

Paper : C-4

(Physical Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Choose the correct option from the following : 1×6=6

(a) Identify the correct statement regarding a spontaneous process.

(i) For a spontaneous process in an isolated system, the change in entropy is positive.

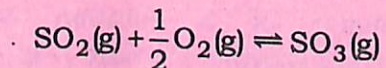
(ii) Endothermic reactions are never spontaneous.

(2)

- (iii) Exothermic reactions are never spontaneous.
- (iv) Lowering of energy in the reaction process is the only criterion for spontaneity.
- (b) The heats of formation of CO (g) and CO₂(g) are -26.4 kcal and -94.0 kcal respectively. The heat of combustion of carbon monoxide according to Hess's law will be
- (i) +26.4 kcal
- (ii) +94 kcal
- (iii) -67.6 kcal
- (iv) -120.4 kcal
- (c) The change in free energy of a system is given by
- (i) $\Delta G = \Delta A + P\Delta V$
- (ii) $\Delta G = \Delta H - T\Delta S$
- (iii) $\Delta G = \Delta U + P\Delta V - T\Delta S$
- (iv) All of the above

(3)

- (d) For the reaction



if $K_p = K_c(RT)^x$, where the symbols have their usual meaning, the value of x is (assuming ideality)

- (i) $\frac{1}{2}$
- (ii) 1
- (iii) -1
- (iv) $-\frac{1}{2}$
- (e) p_A and p_B are the partial pressures of liquid components, A and B respectively of an ideal binary solution. If x_A represents the mole fraction of component A, the total pressure of the solution will be
- (i) $p_A + x_A(p_B - p_A)$
- (ii) $p_A + x_A(p_A - p_B)$
- (iii) $p_B + x_A(p_B - p_A)$
- (iv) $p_B + x_A(p_A - p_B)$

(f) The relative lowering in vapour pressure of a solution containing a non-volatile solute is directly proportional to the mole fraction of the solute. This statement is called

- (i) Henry's law
- (ii) Raoult's law
- (iii) Konoaloff's rule
- (iv) Lever rule

2. Answer the following questions : $2 \times 7 = 14$

- (a) The internal energy of an isolated system is constant. Explain.
- (b) State and explain Hess's law of constant heat summation.
- (c) Explain what is meant by change of entropy (ΔS) of a system.
- (d) Explain inversion temperature.
- (e) Write the physical significance of chemical potential.
- (f) What do you mean by fugacity?
- (g) What do you understand by 'colligative properties of dilute solutions'?

UNIT—I

3. Answer any four of the following questions :

$3 \times 4 = 12$

- (a) Distinguish between isothermal and adiabatic process. Explain—*isothermal reversible work of expansion for an ideal gas is greater than that for a real gas between the same initial and final states.* $1 + 2 = 3$
- (b) Explain the terms molar heat capacity at constant volume and at constant pressure. Derive the relationship $C_P - C_V = R$ thermodynamically. $1 + 2 = 3$
- (c) Distinguish between bond energy and bond dissociation energy. What is meant by resonance energy? $2 + 1 = 3$
- (d) Enthalpy of neutralization of a strong monobasic acid by a strong base is always equal to $-57.32 \text{ kJ mol}^{-1}$. Explain. 3
- (e) State second law of thermodynamics. Explain molecular and statistical interpretation of entropy. $1 + 2 = 3$
- (f) Write the expression of Joule-Thomson coefficient. Derive Gibbs-Helmholtz equation. $1 + 2 = 3$

(6)

- (g) Derive the following relation : 3

$$\left(\frac{\partial V}{\partial S}\right)_T = \left(\frac{\partial T}{\partial P}\right)_V$$

UNIT—II

4. Answer any one of the following questions : 4

- (a) What is chemical potential? What is the effect of temperature on it? Discuss the chemical potential in a mixture of ideal gases. 1+1+2=4
- (b) State Gibbs-Duhem equation. Describe the change in thermodynamic functions on mixing of ideal gases. 1+3=4

UNIT—III

5. Answer any three of the following questions : 3×3=9

- (a) State and explain chemical equilibrium and describe its characteristics. 3
- (b) Give the thermodynamic derivation of relations between the various equilibrium constants K_p , K_c and K_x . 3
- (c) What is reaction quotient? What is the relation between Gibbs free-energy of reaction and reaction quotient? 1½+1½=3
- (d) Write a note on free energy of mixing.

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(7)

UNIT—IV

6. Answer any two of the following questions : 4×2=8

- (a) State and explain Henry's law. Write a note on excess thermodynamic functions. 2+2=4
- (b) Define the term 'freezing point'. Derive the relation for calculating the depressing in freezing point of a solution containing non-volatile solute. 1+3=4
- (c) Derive the relationship between elevation in boiling point and relative lowering of vapour pressure. 4

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