

Day : Tuesday  
Date : 09/10/2018

W-2018-0980

Time : 03.00 PM TO 06.00 PM  
Max. Marks : 60

**N.B.:**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Draw neat and labeled diagrams **WHEREVER** necessary.
- 4) Use of logarithmic tables / calculator is **ALLOWED**.
- 5) Graph papers will be provided.
- 6) Answers to both the sections should be written in **SEPARATE** answer books.

**Physico-Chemical Constants**

1. Avogadro Number	$N = 6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	$K = 1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	$h = 6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	$e = 4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV	$= 23.06 \text{ Kcal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	$R = 8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	$F = 96487 \text{ C equiv}^{-1}$
8. Speed of light	$c = 2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal	$= 4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu	$= 1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	$\beta_e = 9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	$\beta_n = 5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
14. Mass of Proton	$1.672 \times 10^{-27} \text{ kg}$

## SECTION – I

- Q.1** Attempt **ANY THREE** of the following: [15]
- What is adsorption isotherm? Obtain the expression for the Langmuir adsorption isotherm.
  - What is an entropy? What is significance of entropy? What are units of entropy?
  - What do you understand by polar and non-polar molecules?
  - Give a brief account of dilute solution method for the measurement of dipole moment.
  - Give different statements of second law of thermodynamics.
- Q.2** **A)** Attempt **ANY TWO** of the following: [10]
- What are partial molar quantities? Describe in detail partial molar volume.
  - Describe the viscosity measurement technique to calculate the molecular weight of a polymer.
  - Explain the determination of a surface area of adsorbent on the basis of BET theory.
- B)** Solve **ANY ONE** of the following: [05]
- The dipole moment of chlorobenzene is 1.549D. If bond distance of C – Cl is 2.8Å, estimate the ionic character of the bond.
  - Calculate the increase in entropy of 3 moles of an ideal gas as it changes from 300K at  $0.2 \times 10^5$ Pa to 1000K at  $2 \times 10^5$ Pa. ( $R = 8.314 \text{ Jmol}^{-1}$ ,  $C_p = 29.29 \text{ JK}^{-1} \text{ Mol}^{-1}$ .)

## SECTION – II

- Q.3** Attempt **ANY THREE** of the following: [15]
- Discuss the role of energy factor and steric factor in the collision theory of reaction rates.
  - Discuss in detail the term 'Azeotropes'.
  - Explain how phase diagram can be drawn for a three component system.
  - For two component system consisting of two miscible liquid derive the mathematical expression  $\frac{1}{p} = \frac{Y_A}{P_A^0} + \frac{Y_B}{P_B^0}$
  - What are Hot atoms? Explain the characteristics of Hot atoms.
- Q.4** **A)** Attempt **ANY TWO** of the following: [10]
- What are activation controlled and diffusion controlled reactions? Derive the mathematical expression for a typical bimolecular reaction which elaborates the role of the activation and the diffusion.
  - Explain the phenomenon of photoconductivity in detail.
  - Draw and explain a potential energy diagram for the reaction  ${}^a\text{H}_2 + {}^b\text{H} \rightarrow {}^a\text{H} + {}^a\text{H} - \text{H}^b$ .
- B)** Solve **ANY ONE** of the following: [05]
- For a photochemical reaction  $\text{B} \rightarrow \text{C}$ .  $1.0 \times 10^{-5}$  mole of B was decomposed on absorption of  $6.62 \times 10^7$  ergs at 3600Å. Calculate efficiency.
  - Calculate the magnitude of diffusion controlled rate constant at 298 K for species in i) decylbenzene and ii) concentrate sulphuric acid, the viscosities of which are 3.36cP and 27 cP respectively.