

M. SC. (Analytical Chemistry) / M. SC. (Organic Chemistry) / M. SC.
(Inorganic Chemistry) Sem-I (CBCS – 2018 Course) : SUMMER - 2019

SUBJECT : PHYSICAL CHEMISTRY - I

Day : Monday
Date : 08/04/2019

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

S-2019-1161

N.B.:

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

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. 1eV	$= 23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 8065.5 \text{ cm}^{-1}$
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	$1.672 \times 10^{-27} \text{ kg}$

P.T.O.

SECTION – I

- Q.1** Attempt any **THREE** of the following: (15)
- What is entropy? Give physical significance of entropy.
 - Derive the expression for Langmuir adsorption isotherm.
 - Explain electrical polarization with reference to non polar molecule.
 - Describe any two applications of dipole moment.
 - What are the inadequacies of first law of thermodynamics? Give various at least three statements of second law of thermodynamics.
- Q.2** **A)** Attempt any **TWO** of the following: (10)
- Discuss in detail the viscosity measurement method to determine molecular weight of polymer.
 - Elaborate on BET theory of multilayer adsorption.
 - What are state and non-state functions? Which of the following are state functions?
U, H, G,w, S, q.
- B)** Solve any **ONE** of the following: (05)
- Observed dipole moment of HCl is 1.03 D and H–Cl bond length is 1.272 \AA . Calculate the percentage ionic character associated with the bond.
 - What will be the change in entropy of 2 moles of an ideal gas when heated from a volume 50 dm^3 at 323 K to a volume of 120 dm^3 at 423 K? ($C_v = 32.91 \text{ JK}^{-1} \text{ mol}^{-1}$).

SECTION – II

- Q.3** Attempt any **THREE** of the following: (15)
- Explain the process of fractional distillation with the help of temperature composition diagram.
 - Explain transition state theory and significance of Eyring equation.
 - Draw and explain potential energy diagram.
 - Explain the role of salt added on the solubility by using phase diagram.
 - Write a note on flash photolysis.
- Q.4** **A)** Attempt any **TWO** of the following: (10)
- Explain the phenomenon of photoconductivity in detail.
 - Describe a typical instrumental setup used for the study of photochemical reactions.
 - Write a note on 'Azeotropes'.
- B)** Solve any **ONE** of the following: (05)
- A substance absorbs 2.0×10^{16} quanta of radiations per second and 0.002 mole of it reacts in 1204 seconds. Calculate the quantum yield of the reaction.
 - Collision theory demands knowing the fraction of molecular collision having at least kinetic energy E_a along the line of the flight. What is this fraction when **a)** $E_a = 15 \text{ KJ mole}^{-1}$ **b)** $E_a = 150 \text{ KJ mole}^{-1}$ at
1) 300 K and 2) 800 K.

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