

SUBJECT : PHYSICAL CHEMISTRY – I

Day : Tuesday
Date : 09/10/2018

W-2018-0977

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

N.B.

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

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	$= 23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 8065.5 \text{ cm}^{-1}$
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 do you understand by state and non-state functions?
 - Elaborate on dipole moment.
 - Give a detailed account of partial molal quantities.
 - Describe the polarization of non-polar molecules in the electric field.
 - What is entropy? Give physical significance of entropy.
- Q.2** A) Attempt **ANY TWO** of the following : (10)
- Discuss the BET theory for multilayer adsorption.
 - Explain the viscosity measurement technique to calculate the molecular weight of polymer.
 - What is adsorption isotherm? Obtain the equation of Langmuir adsorption isotherm.
- B) Solve **ANY ONE** of the following : (05)
- Equal number of molecules with $M_1=10,000$ and $M_2=1,00,000$ are mixed. Calculate \overline{M}_N and \overline{M}_M .
 - The dipole moment of chlorobenzene is 1.549 D. If bond distance of C–Cl is 2.8Å, estimate the ionic character of the bond.

SECTION – II

- Q.3** Attempt **ANY THREE** of the following : (15)
- What is lever rule? How it is used in finding the composition of ‘vapour - liquid’ mixture?
 - What is potential energy diagram? Explain how it helps in understanding the rate of reaction rates.
 - Discuss photodimerisation of anthracene.
 - Derive the Eyring equation of the rate of bimolecular reactions.
 - Draw and explain phase diagram for three component system.
- Q.4** A) Attempt **ANY TWO** of the following : (10)
- What are diffusion controlled reactions? Obtain expression for rate constant of such reactions.
 - What is chemiluminescence? Explain the phenomenon with suitable examples.
 - Discuss role of energy factor and steric factor in collision theory of reaction rates.
- B) Solve **ANY ONE** of the following : (05)
- Calculate the magnitude of diffusion controlled rate constant at 298 K for species i) decylbenzene and ii) concentrated Sulphuric acid , the viscosities of which are 3.36 cP and 27 cP respectively.
 - Calculate the energy in joules. i) per quantum and ii) per einstein, for radiations of wavelength 1000Å .

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