

(Common For Analytical, Organic & Inorganic)

MASTER OF SCIENCE (CHEMISTRY) (CBCS - 2018 COURSE)

M.Sc. (Chemistry) Sem-I : WINTER :- 2021

SUBJECT: PHYSICAL CHEMISTRY - I

Day : Wednesday

Date 2/2/2022

W-20139-2021

Time : 02:00 PM-05:00 PM

Max. Marks: 60

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)
- Derive Gibbs-Helmholtz equation.
 - What do you understand by polar and non-polar molecules?
 - What are the assumptions of Langmuir theory?
 - What is Gibb's free energy? How can one evaluate the temperature and pressure dependence of Gibb's free energy?
 - State second law of thermodynamic in five different ways.
- Q.2** **A)** Attempt any **TWO** of the following: (10)
- Define the terms: adsorbent and adsorbate. Discuss briefly Freundlich adsorption isotherm.
 - Describe the sedimentation method to determine \overline{M}_w of macromolecules.
 - Discuss the dilute solution method for the measurement of dipole moment.
- B)** Solve any **ONE** of the following: (05)
- The compound nitrobenzene has a dipole moment 3.80 D. Estimate the dipole moment of m-dinitrobenzene.
 - A polymer sample has 50 and 100 gms of polymers of molecular weights 12500 and 15000 respectively. Find \overline{M}_n and \overline{M}_w .

SECTION – II

- Q.3** Attempt any **THREE** of the following: (15)
- Explain the collision theory of reaction rates. What is the role of energy factor and steric factor in the collision theory?
 - What is phase rule? Obtain the theoretical proof for the same.
 - Explain three component system involving liquids.
 - Discuss photodimerization of Anthracene.
 - Obtain mathematical expression for the rate constant of diffusion controlled reaction.
- Q.4** **A)** Attempt any **TWO** of the following: (10)
- What is chemiluminescence? Explain the phenomenon with suitable example.
 - What are photosynthesis and photosensitization? Explain with suitable examples.
 - Draw and explain a phase diagram for a system consisting of two metals which are insoluble with each other in solid state but miscible with each other in molten state.
- B)** Solve any **ONE** of the following: (05)
- Calculate the diffusion controlled rate constant at 298 K for species in
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 ii) per Einstein for radiations of wavelength 1000 \AA .