

Day : Monday
Date : 08/04/2019

S-2019-1169

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	$1.672 \times 10^{-27} \text{ kg}$

P.T.O.

SECTION – I

- Q.1** Attempt **ANY THREE** of the following: [15]
- Explain the distortion polarization of the non-polar molecule in the electric field.
 - Explain Maxwell's relation of free energy and entropy of mixing of ideal solution.
 - What are Helmholtz's and Gibb's functions? Show that Helmholtz function is related to maximum work.
 - Discuss any two applications of the dipole moment.
 - What are the assumptions of Langmuir theory?
- Q.2** **A)** Attempt **ANY TWO** of the following: [10]
- Explain the sedimentation equilibrium method to determine \overline{M}_w of macromolecules.
 - Derive an expression for entropy change of an ideal gas at constant volume and constant pressure.
 - Write a short note on 'BET equation'.
- B)** Solve **ANY ONE** of the following: [05]
- Dipole moment of H_2O is 1.84D , while $\text{O} - \text{H}$ bond moment is 1.5D . Calculate $\text{H} - \text{O} - \text{H}$ bond angle in H_2O .
 - A protein sample consists of an equimolar mixture of haemoglobin ($M = 15.5 \text{ kg mol}^{-1}$), ribonuclease ($M = 13.7 \text{ kg mol}^{-1}$) and myoglobin ($M = 17.2 \text{ kg mol}^{-1}$). Calculate the \overline{M}_n and \overline{M}_w . Which is greater?

SECTION – II

- Q.3** Attempt **ANY THREE** of the following: [15]
- Explain the phenomenon of chemiluminescence with suitable examples.
 - Obtain the mathematical expression for the rate constant of diffusion controlled reaction.
 - Explain the process of fractional distillation with the help of temperature composition diagram.
 - Describe a typical instrumental setup used for study of photochemical reactions.
 - State and explain phase rule and hence obtain the theoretical proof for the same.
- Q.4** **A)** Attempt **ANY TWO** of the following: [10]
- Draw and explain a typical potential energy diagram.
 - Give detailed account of photolysis of ammonia.
 - 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]
- A substance absorbs 2.0×10^{16} quanta of radiations per second and 0.002 mole of it reacts in 1204 seconds; calculate quantum yield of the reaction.
 - It is found that the boiling point of binary solution of A and B with $X_A = 0.42$ is 96°C . At this temperature the vapour pressure of pure A and pure B are 110.1 kPa and 94.93 kPa .
 - Is this solution ideal?
 - What is the initial composition of vapour above the solution?