Day : Friday
Date : 01-07-2022   S-20139-2022

Time : 3.00 P.M. TO 6.00 P.M.
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	$N = 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	$k = 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
		$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	$h = 6.626 \times 10^{-27}$ erg s
		$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	$e = 4.803 \times 10^{-10}$ esu
		$= 1.602 \times 10^{-19}$ C
5.	1 eV	$= 23.06$ k cal mol^{-1}
		$= 1.602 \times 10^{-12}$ erg
		$= 8065.5$ cm^{-1}
6.	Gas Constant	$R = 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
		$= 8.314$ J K^{-1} mol^{-1}
		$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	$F = 96487$ C equiv^{-1}
8.	Speed of light	$c = 2.997 \times 10^{10}$ cm s^{-1}
		$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal	$= 4.184 \times 10^{7}$ erg
		$= 4.184$ J
10.	1 amu	$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	$\beta_e = 9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	$\beta_n = 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	$m_e = 9.11 \times 10^{-31}$ kg
14.	Mass of proton	1.672×10^{-27} kg

P.T.O.

SECTION – I

Q.1   Attempt **ANY THREE** of the following: **[15]**

   a) What do you understand by polar and non-polar molecules?

   b) Explain state and non-state functions.

   c) Describe the polarization of non-polar molecules in electrical field.

   d) Define the term adsorption. Distinguish between physical and chemical adsorptions.

   e) What are the inadequacies of first law of thermodynamics? Give different statements of second law of thermodynamics.

Q.2 **A)** Attempt **ANY TWO** of the following: **[10]**

   i) What are the assumptions of Langmuir theory?

   ii) Discuss the viscosity measurement technique to determine the molecular weight of polymer.

   iii) Explain any two applications of dipole moment in detail.

   B) Solve **ANY ONE** of the following: **[05]**

   i) Dipole moment of water is 1.884 D, while O – H bond moment is 1.5 D. Calculate H – O – H bond angle in H_2O.

   ii) Equal member of molecules with $M_1 = 10,000$ and $M_2 = 1,00,000$ are mixed. Calculate $\overline{M}_N$ and $\overline{M}_M$.

SECTION – II

Q.3   Attempt **ANY THREE** of the following: **[15]**

   a) State and explain phase rule and hence obtain the theoretical proof for the same.

   b) Obtain the Eyring equation for the rate of bimolecular reactions.

   c) Explain the term quantum yield in detail.

   d) Discuss the Einstein's law of photochemical equivalence.

   e) Explain how phase diagram can be drawn for a three component system.

Q.4 **A)** Attempt **ANY TWO** of the following: **[10]**

   i) Explain the phenomenon of photoconductivity.

   ii) What are diffusion controlled reactions? Obtain expression for rate constant of such reactions.

   iii) Write an explanatory note on 'Azeotropes'.

   B) Solve **ANY ONE** of the following: **[05]**

   i) The photo-decomposition of HI vapour was carried out with $\lambda = 2070$ Å radiation. Absorption of each calories of energy wave gave 1.44×10^{-5} gm of hydrogen. What is the quantum yield?

   ii) Calculate the magnitude of diffusion controlled rate constant at 298 K for which: **a)** decylbenzene and **b)** concentrated sulphuric acid, the viscosities of which are 3.36 cP and 27 cP respectively.

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