Total No. of Questions :6]

SEAT No. :

P2904

[Total No. of Pages :3

[5023] - 1001

M.Sc.-I

PHYSICAL CHEMISTRY

CHP - 110 : Fundamentals of Physical Chemistry - I

(2014 Pattern) (Semester - I) (4 Credits)

Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of logarithmic tables / calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	=	6.022×10^{23} mol^{-1}
2.	Boltzmann Constant	k	=	1.38×10^{-16} erg K^{-1} molecule^{-1}
			=	1.38×10^{-23} J K^{-1} molecule^{-1}
3.	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} J s
4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{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	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
11.	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION -I

Q1) Attempt the following: **[10]**

a) Explain the terms black body radiation, ultraviolet catastrophe and Rayleigh - Jeans law.

b) Define heat capacity. Distinguish between heat capacity and molar heat capacity.

c) Define vapour pressure of liquids. How does it vary with temperature?

d) What are colligative properties? Explain the terms osmosis and osmotic pressure.

e) Define Helmholtz free energy. Show that it is state function.

Q2) Attempt any two of the following: **[10]**

a) Give eigen function and eigen value equation for partical in one dimensional box. Sketch and explain the probability distribution curves for the first four energy levels of a partical in a one dimensional box.

b) Derive the vant - Hoff reaction isotherm. Give its application?

c) Derive the workdone in a reversible isothermal expansion of a perfect gas.

d) Define chemical potential. Explain the phase diagram of solid - liquid boundary with respect to $\frac{dP}{dT}$.

Q3) Solve any one of the following. **[5]**

a) The energy required for the ionisation of a certain atom is 3.44×10^{-18}J. The absorption of a photon of unknown wavelength ionises the atom and eject an electron with velocity $1.03 \times 10^{6} ms^{-1}$. Calculate the wavelength of incident radiation.

b) Calcualate the change in entropy with 2 moles of nitrogen gas are mixed with 8 gm chlorine gas at 25ºC.

[Atomic wts. N = 14, Cl = 35.5]

SECTION -II

Q4) Attempt the following: **[10]**

a) Give second order reaction rate constant equation for equal initial concentration and show that $t_{1/2} = \frac{1}{ak}$.

b) Explain Lineweaver and Eadie plot for enzyme uncompetitive inhibition.

c) State the law of photochemical equivalence and Define the term 'einstein'.

d) What are fast reactions? Distinguish between flow technique and stopped flow technique.

e) Explain Fermi-Dirac statistics.

Q5) Attempt any two of the following. **[10]**

a) What is partition function? Obtain an expression for rotational partition function.

b) Derive the expression for the velocity constant of the bimolecular reactions on the basis of absolute reaction rate theory.

c) What are consecutive reactions? How can the kinetics of such reactions be studied by using steady state principle.

d) Explain the terms initiation, propogation, inhibition and termination. Discuss with suitable examples the phenomenon of chain reaction.

Q6) Solve any one of the following: **[5]**

a) What will be the initial rate of a reaction if its rate constant is 10^{-3} min^{-1} and the concentration of the reactant 0.2 mol dm^{-3}. How much of reactant will be converted in to product in 200 minutes.

b) The enzymatic conversion of substrate at 25ºC has a Michaelis constant 0.035. The rate of reaction is 1.2×10^{-3} MS^{-1}, when the substrate concentration is 0.11 M. What is the rate constant of enzymolysis of the initial concentration of enzyme is considered constant.