Total No. of Questions : 6]

SEAT No. : ____

P2012

[Total No. of Pages : 3

[4923]-402

M.Sc.

PHYSICAL CHEMISTRY

CHP - 411 : Surface Chemistry and Electrochemistry

(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

<u>Physico - Chemical Constants</u>

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) Answer precisely the following: **[10]**

a) Give the characteristics of a liquid monomolecular film.

b) What is cmc? Give the structure of micellas.

c) State two limitations of BET theory.

d) What are 'ink-bottle' pores?

e) Write Gibbs equation for adsorption and define the terms therein.

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

a) Describe the tracer method for verification of the Gibbs equation.

b) Stating the assumptions, derive the Langmuir equation for adsorption.

c) Derive the two dimensional ideal gas law for the film of adsorbed solute in dilute solutions.

d) Discuss the Zsigmondy's theory for adsorption hysteresis.

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

a) A solid in contact with gas at 12kPa and 28ºC adsorbs 2.5×10^{-3}g of the gas and obeys the langmuir isotherm. The enthalpy change when 1.0 mmol of the adsorbed gas is desorbed is +10.2J. What is the equilibrium pressure for the adsorption of 2.5mg of the gas at 40ºC?

b) The adsorption of butane vapour on 1.85g catalyst was studied at 0ºC. The data when fitted in BET equation yielded a linear plot with the slope of 3.895×10^{-2} ml^{-1} and intercept of 1.85×10^{-3} ml^{-1}. The area occupied per molecule of butane is 44.6 $\mathring{A}^2$. Determine the specific surface area of the catalyst.

SECTION - II

Q4) Answer precisely the following: **[10]**

a) Define true electrolyte and potential electrolyte.

b) Write equation for heat of hydration of positive ion having co-ordination number four based on Bernal - Fowler model. Explain the terms involved in it.

c) Define the term flux and enlist the names of three types of fluxes.

d) Define the terms drift velocity and absolute mobility of ion.

e) Write the equation for corrosion current and explain the terms involved in it.

Q5) Answer any two of the following: **[10]**

a) Derive the Fick's first law for steady-state diffusion.

b) Derive the D.H. equation for activity coefficient considering the ion size parameter 'a'.

c) Write a note on any one fuel cell.

d) Discuss the stern theory of electrical double layer.

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

a) If the Tafel constants a and b have values 0.64 and 0.123 respectively for reduction of hydrogen ion. Calculate the transfer coefficient 'α' and exchange current density i_o at 298K.

b) Calculate the thickness of ionic atmosphere at 25ºC in 0.05M solution of LiCl.

[Given: Dielectric constant of water = 78.54].