T.Y.BSC

Sem V

Chemistry: PO I
Physical Chemistry (Rev)(R-2016)-17
2016-17

QP Code : 77097

(2½ Hours) [**Total Marks : 75**

N.B. : (1) **All** questions are **compulsory.**
(2) **Figures** to the **right** indicate **full** marks.
(3) **Use** of log table/non programmable **calculator** is **allowed.**

Physical constants :–

N	=	6.022×10^{23}	$\frac{2.303\ RT}{F}$	=	0.0592 at 298K
F	=	96500 C	1 amu	=	1.66×10^{-27}kg
R	=	8.314 J mol^{-1} K^{-1}	H	=	1 amu
h	=	6.626×10^{-34} Js	Cl	=	35.5 amu
C	=	3.8×10^{8} ms^{-1}			
π	=	3.142			

1. Attempt **any three** of the following :-

(A) Derive an expression for frequency separation of lines in rotational spectrum of a diatomic molecule. 5

(B) Show that for an anharnomic oscillator the frequency of fundamental, first and second overtone bands are in the ratio 1:2:3. 5

(C) The frequency separation of successive lines in the rotational spectrum of HCl is 2.5×10^{3} m^{-1}. Calculate the equilibrium inter-nuclear distance in the molecule. 5

(D) Explain the IR spectra of CO_2 molecule. 5

(E) How does quantum theory explain Raman effect ? 5

(F) A substance was exposed to radiation of wavelength 4.4×10^{-6} m. A Raman line appeared at 4.6×10^{-6}m. Is it Stokes's line or anti-Stoke's line ? Calculate the Raman shift. 5

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2. Attempt **any three** of the following :-

(A) Derive Nernst equation for single electrode potential. 5

(B) Derive an expression for emf of electrolyte concentration cell without transference reversible to anion. 5

(C) Calculate mean activity coefficient of KCl in a solution containing 0.1m KCl and 0.01 m $CaCl_2$ (A = 0.509 at 298 K) 5

(D) Explain any three types of ion specific electrodes with examples. 5

(E) Derive an equation for emf of electrolyte concentration cell with transference reversible to cation. 5

(F) The emf of the cell 5

$$\ominus Pt, H_{2(g)}\ 1\ atm. \mid HCl\ m = 0.12\ \gamma = 0.789 \mid HCl\ m = 0.2\ \gamma = 0.765 \mid H_2, Pt \oplus\ 1\ atm.$$

is 0.0037 volt at 298 K. Calculate t_{H^+} and t_{Cl^-}

3. Attempt **any three** of the following :-

(A) Derive Clapeyron equation. 5

(B) Define boiling point. A solution containing 1.5g of non-volatile solute in 150g CCl_4 gave boiling point elevation of 0.75K. If molal elevation constant is 5.02K kg mol^{-1}, Calculate the molecular weight of the solute. 5

(C) State the Gibbs phase rule and explain the terms involved. 5

(D) Derive the equation $\Delta T_f = K_f.m$ 5

(E) Explain the application of phase rule to water system. 5

(F) Explain the phase diagram of a three component system. 5

4. Attempt **any three** of the following :-

(A) Explain the determination of surface area of an adsorbent on the basis of BET equation. 5

(B) What are the characteristic features of a catalyst ? 5

(C) Give an account of the origin of charge on colloidal particles. 5

(D) Define adsorbent. The volume of gas adsorbed at S.T.P. and required to form a monolayer on 1g silica gel is $0.130 dm^3$. Calculate the surface area of silica gel, if area occupied by each gas molecule is 16.0×10^{-20} m^2. 5

(E) Write a note on electrophoresis. 5

(F) What are surfactants ? How are they classified ? 5

5. (A) State true of false :- 4

(a) Unit of dipole moment is Debye.

(b) Dipole moment helps in elucidating molecular structure of compounds.

(c) In bending vibrations the bond angle changes.

(d) Higher the value of force constant, greater is the bond strength.

OR

(A) Match the following :- 4

(p) Polar molecule	(i) angular structure
(q) SO_2	(ii) (3n-5)
(r) Linear molecule	(iii) HCl
(s) Rocking	(iv) In-plane vibration
	(v) (3n-6)

(B) State true of false :- 4

(a) In a galvanic cell, oxidation takes place at left hand electrode.

(b) For an ideal solution $\gamma = 1$

(c) The salt used in salt bridge is KCl

(d) HCl is a uni-bivalent electrolyte.

OR

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(b) Match the following :- 4

(p)	Uni-trivalent electrolyte	(i)	Redox electrode
(q)	$Pt / Sn^{+2}, Sn^{+4}$	(ii)	$a = 27\ m^4\gamma^4$
(r)	Reduction	(iii)	agar-agar
(s)	Salt bridge	(iv)	gain of electrons
		(v)	gas electrode

(C) State true or false :- 4

(a) Reverse osmosis is used to concentrate fruit juices.
(b) Osmosis occures in plant cells.
(c) In sulphur system at the triple points F = 0.
(d) Condensed phase rule is written as F = C - P + 2.

OR

(C) Match the following :- 4

(p)	Binodal curve	(i)	Lead-silver system
(q)	Eutectic point	(ii)	Water purification
(r)	Reverse osmosis	(iii)	lowering of vapour pressure
(s)	Raoult's law	(iv)	Ternary system
		(v)	K_b

(D) State true or false :- 3

(a) Catalyst poisons supress the activity of the catalyst.
(b) Hydrolysis of methyl acetate is an example of acid-catalysis.
(c) The migration of dispersion medium is called electrophoresis.

OR

(D) Choose the correct answer :- 3

(p) A catalyst _____ the energy of activation of the reaction.
(increases , lowers , maintains)

(q) Lyophobic sols are _____ .
(solvent hating , solvent loving , none)

(r) _____ are called negative catalyst .
(Inhibitors , promotors , none)

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