

Seat No.:

13E-111

May-2015

M.Sc., Sem.-II

409 : Chemistry

(Physical Chemistry)

Time : 3 Hours]

[Max. Marks : 70]

Instructions : (1) All questions carry equal marks.

(2) Necessary constants :

$$N = 6.022 \times 10^{23} \text{ mole}^{-1}$$

$$k = 1.38 \times 10^{-16} \text{ ergs} \cdot \text{K}^{-1} = 1.38 \times 10^{-23} \text{ J K}^{-1}$$

$$h = 6.626 \times 10^{-27} \text{ ergs} \cdot \text{sec.} = 6.626 \times 10^{-34} \text{ J} \cdot \text{sec}$$

$$C = 2.998 \times 10^{10} \text{ cm} \cdot \text{sec}^{-1} = 2.998 \times 10^8 \text{ m} \cdot \text{sec}^{-1}$$

$$F = 96500 \text{ C}$$

$$R = 8.314 \times 10^7 \text{ ergs} \cdot \text{K}^{-1} \text{ M}^{-1}$$

$$= 8.314 \text{ J K}^{-1} \text{ M}^{-1}$$

$$= 1.987 \text{ Cal} \cdot \text{K}^{-1} \text{ M}^{-1}$$

- (a) Define thermodynamic probability. Derive an equation for Boltzmann's most probable distribution. 7

OR

What is partition function? Derive an equation for rotational partition function.

- (b) Discuss permutation and combination. 7

OR

- (i) Derive an equation for vibrational partition function. 4

- (ii) Calculate the translational partition function for 1 mole of nitrogen at 2 atmospheric pressure at 300 °K, assuming the gas to behave ideally. The following data's are given : 3

Atomic weight of Nitrogen = 14.008

$$N = 6.022 \times 10^{23}$$

$$k = 1.38 \times 10^{-16} \text{ erg / degree / mole}$$

$$h = 6.624 \times 10^{-27} \text{ erg} \cdot \text{sec.}$$

$$R = 82.06 \text{ c.c. atm / degree / mole}$$

2. (a) Discuss the Fermi gas model of atomic nucleus.

OR

Discuss the use of radio isotope as tracers.

(b) (i) Write a note on reaction cross section.

(ii) Write a note on nuclear binding energy.

OR

(i) Write a note on linear accelerators.

(ii) Calculate binding energy per nucleon for ${}^2\text{He}$, whose atomic mass is 4.0026 a.m.u.

Mass of proton = 1.00783 n.m.u.

Mass of neutron = 1.00870 a.m.u.

1 a.m.u. = 931.4 MeV

3. (a) What is Cationic Polymerization? Discuss Kinetics of Cationic Polymerization.

OR

Discuss the kinetics of free radical chain polymerization.

(b) (i) Discuss any one method for the determination of molecular weights of polymers.

(ii) Intrinsic viscosity of a polymer in chloroform at 25 °C $[\eta] = 4.1686 \text{ dl/gm}$. Relation between intrinsic viscosity and molecular weight is given below.
 $[\eta] = 2.3 \times 10^{-3} \cdot M^{0.65}$

Calculate molecular weight of polymer.

OR

(i) Write a note on polycondensation.

(ii) There are 100 polymer molecules of molecular weight 1000, 200 molecules of molecular weight 10000 and 200 molecules of molecular weight 100000.

Calculate \bar{M}_n

+ 2/1000 + 200/10000 + 200/100000 X 10³

4. (a) Determine dissociation constant of monobasic acid by conductometry.

OR 500

✓ How will you determine dissociation constant of dibasic acid by potentiometric method?

✓ (b) Derive an equation of polarographic wave.

OR

✓ Explain the origin and characteristics of various current produced in polarography.

5. Answer in brief (one mark each) :

- (1) What is dimension of partition function?
- (2) At absolute zero temperature, what is the value of partition function?
- (3) Define Statistical Thermodynamics.
- (4) Define Nuclear Reaction.
- (5) Define Half-life period of radioactive an element.
- (6) Define Nuclear fission.
- (7) What is relation between viscosity and fluidity?
- (8) What is Polydispersity Index (P.D.I.)? The rat as pol
- (9) Define Initiators.
- (10) Define Zeta potential.
- (11) Define Over Voltage.
- (12) What is unit of cell constant?
- (13) Ostwald dilution law is applicable for which type of electrolyte solution?
- (14) What is SI unit of viscosity? Nm²/s