AT-128

May-2016

M.Sc., Sem.-II

409 : Chemistry
(Physical Chemistry)

Time : 3 Hours]   **[Max. Marks : 70**

Instructions : (1) **All** questions carry equal marks.

(2) Necessary constants :

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

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

$h = 6.626 \times 10^{-27}$ erg. sec. = 6.626×10^{-34} J. sec.

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

$F = 96500$ C

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

    = 8.314 J K^{-1} M^{-1}

    = 1.987 cal. K^{-1}M^{-1}

1. (a) Define thermodynamic probability. Derive an expression for Boltzmann's distribution law. **7**

OR

Discuss Permutations and Combinations.

(b) Derive an equation for translational partition function. **7**

OR

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

(ii) Calculate the rotational partition function of hydrogen gas at 273 °K. The following data are given.

Moment of inertia of molecular hydrogen = 0.459×10^{-40} gm.cm^2.

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

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

$R = 82.06$ c.c. atm / degree / mole

$\sigma = 2$ **3**

2. (a) Discuss the shell model of atomic nucleus and show how it explains the magic numbers. **7**

OR

What is Isotopes ? Discuss the use of radio-isotopes as tracers.

(b) (i) Write a note on nuclear binding energy. **4**

(ii) Assuming that $_8O^{16}$ is formed by bombarding $_6C^{12}$ with alpha particles, calculate energy released in the process.

$_8O^{16} = 16.00$ a.m.u. $_6C^{12} = 12.00381$ a.m.u.

$_2He^4 = 4.00387$ a.m.u.

1 a.m.u. = 931.5 MeV. **3**

OR

(i) Write a note on reaction cross section. **4**

(ii) Write a note on nuclear fusion reaction. **3**

3. (a) What is Anionic Polymerization ? Discuss the kinetics of Anionic Polymerization. **7**

OR

What is poly condensation ? Discuss the kinetics of acid catalyzed poly condensation.

(b) (i) Discuss the Osmotic Pressure measurement method for the determination of number average molecular weight ($\overline{M}n$) of polymer. **4**

(ii) Intrinsic viscosity of polymer solution (η) at 30 °C is 2.20 dl/gm. Relation between intrinsic viscosity (η) and molecular weight is given below.

$(\eta) = 8.63 \times 10^{-5} \cdot M^{0.70}$

Calculate molecular weight. **3**

OR

(i) Discuss thermodynamics of polymer solution. **4**

(ii) Calculate ($\overline{X}_n$) and ($\overline{X}_w$) for an equimolar mixture of a diacid and a glycol at the following extent of reaction :

P : 0.750, 0.900, 0.950 **3**

4. (a) How will you determine the dissociation constant of monobasic acid by potentiometric method ? **7**

OR

Derive an equation of polarographic wave.

(b) Describe the American, European and IUPAC conventions for expressing electrode potentials. **7**

OR

Determine dissociation constant of monobasic acid by conductometry.

5. Answer in brief (**one** mark each) : **14**

(1) At which temperature the value of partition function is one.

(2) What is the value of symmetric factor (σ) for symmetric diatomic molecules ?

(3) Define Partition function.

(4) Define spallation reaction.

(5) Define Nuclear fission reaction.

(6) Define Nuclear reaction.

(7) What is Osmosis ?

(8) What is C.G.S. unit of viscosity ?

(9) For the synthesis of commercial stereo regular polymer which catalyst is used ?

(10) What is Electrolyte ?

(11) Define Degree for dissociation.

(12) Define half-wave potential.

(13) What is Co-polymer ?

(14) Define Reduced Viscosity.

_____