



Seat No. : \_\_\_\_\_

**TA-116**

**April-2013**

**M.Sc. Semester – II**

**409 : CHEMISTRY**

**(Physical Chemistry)**

**Time : 3 Hours]**

**[Max. Marks : 70**

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

(2) Necessary constants :

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

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

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

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

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

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

$$= 8.314 \text{ JK}^{-1} \text{ M}^{-1}$$

$$= 1.987 \text{ cal. K}^{-1} \text{ M}^{-1}$$

1. (A) Derive an expression for Boltzman's law of most probable distribution. 7

**OR**

Discuss permutations and combinations.

(B) (I) Derive an equation for translational partition function. 4

(II) Calculate the translational partition function for 1 mole of nitrogen at 2 atm. Pressure at 30 °C, assuming the gas to behave ideally. The following data's are given. 3

Atomic weight of Nitrogen = 14.008

$$N = 6.023 \times 10^{23}$$

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

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

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

**OR**

- (I) Derive an equation for vibrational partition function. 4
- (II) Calculate the vibrational partition function of molecular iodine at 300 °K, assuming it to be a harmonic oscillator. The vibration frequency is  $214 \text{ cm}^{-1}$ ,  $K = 1.38 \times 10^{-16} \text{ erg.deg}^{-1}$  and  $h = 6.624 \times 10^{-27} \text{ erg.sec}$ . 3
2. (A) Discuss the liquid drop model of atomic nucleus. 7
- OR**
- Discuss the uses of Radio isotopes as a Tracers.
- (B) (I) Write a note on reaction cross section. 4
- (II) Calculate the binding energy per nucleon for  ${}^{20}_{10}\text{Ne}$  whose atomic mass is 19.9924 amu.  
 Mass of proton = 1.00783 amu  
 Mass of neutron = 1.00870 amu  
 1 amu = 931.4 meV 3
- OR**
- (I) Write a note on Linear accelerators. 4
- (II) Write a note on nuclear fusion reaction. 3
3. (A) Discuss kinetics of non-catalyzed poly condensation. 7
- OR**
- Discuss the kinetics of cationic polymerization.
- (B) (I) Discuss any one method for determining molecular weights of polymers. 4
- (II) A polydispersed sample of polystyrene is prepared by mixing three mono disperse samples in the following proportions : 3
- 1 gm of molecular weight 10,000  
 1 gm of molecular weight 50,000  
 0.5 gm of molecular weight 1,00,000  
 Calculate the number average molecular weight of the mixture.
- OR**
- (I) Discuss the thermodynamics of polymer solution. 4
- (II) Intrinsic viscosity of methyl acrylate in benzene at 30 °C ( $\eta$ ) is 2.19 dl/gm. Relation between intrinsic viscosity and molecular weight is given below :  
 $[\eta] = 8.63 \times 10^{-5} \cdot M^{0.725}$   
 Calculate molecular weight of polymer. 3

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

**OR**

Describe the American, European and IUPAC conventions for expressing electrode potentials.

- (B) Determine dissociation constant of monobasic acid by conductometry. 7

**OR**

Derive an equation of polarographic wave.

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

- (1) Define thermodynamic probability.
  - (2) At which temperature the value of partition function is one.
  - (3) Define partition function.
  - (4) Define Isotopes.
  - (5) Define nuclear reaction.
  - (6) Define nuclear fission.
  - (7) What is functionality of monomer ?
  - (8) Define Initiators.
  - (9) Define relative viscosity.
  - (10) What is unit of specific conductance (K) ?
  - (11) Define over voltage.
  - (12) Define Degree of dissociation.
  - (13) Define half wave potential.
  - (14) What is polymerization ?
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