



**GAM-142003**

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

**M. Sc. (Sem. II) Examination**

**March / April - 2019**

**MSCOC203 - Physical Chemistry**

Time : 3 Hours ]

[ Total Marks : 70

**Instructions :** All questions carry equal marks.

**Necessary constants :**

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

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

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

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

$$R = 8.314 \times 10^7 \text{ erg K}^{-1}\text{m}^{-1} = 8.314 \text{ J K}^{-1} \text{ M}^{-1} = 1.987 \text{ Cal K}^{-1} \text{ M}^{-1}$$

- 1 (a) Derive an expression for Boltzmann's most probable distribution law. 7

**OR**

- (a) Discuss permutation and combination when a cube (having six sides) is thrown. Calculate the possibilities of getting any number greater than 3.

- (b) (i) Derive an equation for translational partition function. 7
- (ii) Calculate the translational partition function for 1 mole of oxygen of 1 atm pressure at 25°C, assuming the gas to behave ideally. Atomic weight of oxygen = 16 gram mole<sup>-1</sup>.

**OR**

- (b) (i) Derive an equation for rotational partition function. 7
- (ii) Calculate the rotational partition function of H<sub>2</sub> at 0°C
- $$\sigma = 2 \quad I = 0.459 \times 10^{-40} \text{ gram cm}^2.$$

- 2 (a) Discuss the liquid drop model of atomic nucleus. 7

OR

- (a) Write note on : Uses of Radioisotopes as tracers.  
(b) (i) Write a note on reaction cross section. 4

OR

Write a note on nuclear fusion reaction.

- (ii) Calculate the binding energy per nucleon in MeV  
of Helium atom  ${}^4_2\text{He}$

Mass of helium atom ..... 4.00260 amu

Mass of neutron ..... 1.008665 amu

Mass of proton ..... 1.007825 amu

Mass of electron = 1.005486 amu

1 amu = 931.5 MeV

OR

If  $\text{C}_o^{60}$  has a life of 5.2 years how much of a 10.0 gram  
sample will still be radioactive after 31.2 years.

- 3 (a) Discuss kinetics of acid catalyzed polycondensation. 7

OR

- (a) Discuss kinetics of cationic polycondensation.  
(b) (i) Discuss any one method for determining 4  
molecular weight of polymers.

OR

Discuss thermodynamics of polymer solution.

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

OR

There are 50 polymer molecules of molecular weight  
2000, 100 molecules of molecular weight 20,000  
and 100 molecules of molecular weight 1,00,000,  
calculate  $\overline{M}_n$ .

- 4 (a) Determine the dissociation constant of monobasic acid by conductometry method. 7

OR

- (a) Describe the American, European and IUPAC conventions for expressing electrode potential. 7

- (b) Derive an equation for polarographic wave. 7

OR

Explain various currents produced in polarography.

- 5 Answer the following questions in one or two lines : 14

- (1) What is thermodynamic probability ?
  - (2) Define partition function.
  - (3) What is the value of  ${}_6C_4$  ?
  - (4) Write Sterling formula.
  - (5) Define isomer.
  - (6) Define nuclear fission.
  - (7) What is half life period ?
  - (8) What is co-polymer ?
  - (9) Define density.
  - (10) What is viscosity ?
  - (11) Write Ilkovic equation.
  - (12) Define polymerization.
  - (13) What is overvoltage ?
  - (14) What is the unit of cell constant ?
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