

**2 0 1 4**

**( 5th Semester )**

**CHEMISTRY**

**SEVENTH PAPER (CHEM-353)**

**( Physical Chemistry—II )**

*Full Marks : 55*

*Time : 2 hours*

**( PART : B—DESCRIPTIVE )**

**( Marks : 35 )**

*The figures in the margin indicate full marks  
for the questions*

1. (a) What is collision diameter? 1
- (b) Discuss the effect of temperature on  
distribution of molecular velocities. 3
- (c) Calculate various degrees of freedom  
for (i)  $H_2$ , (ii)  $H_2O$  and (iii)  $C_6H_6$   
molecules. 3

OR

2. (a) What do you mean by the term 'mean free path?' 1
- (b) What is Maxwell generalization? Why does thermal motion cease completely at absolute zero? 3
- (c) State and explain the law of equipartition of energy. 3
3. (a) What is surface tension? Why water has abnormally high surface tension? 2
- (b) Define viscosity with a neat labelled diagram. Discuss the determination of viscosity by Ostwald viscometer method. 5

OR

4. (a) What is acid-base catalysis? 2
- (b) Describe the Lindeman's theory of unimolecular reactions. 5
5. (a) How does chemical potential vary with temperature? 2

- (b) How can you express the criteria for reversible and irreversible processes in terms of entropy  $S$  alone? 3
- (c) What is residual entropy? 2

OR

6. (a) Deduce the expression for chemical potential for a system of ideal gases. 5
- (b) What are partial molar quantities? Why are they called extensive properties? 2
7. (a) State the law of rational indices. 2
- (b) The parameters of an orthorhombic unit cell are  $a = 50$  pm,  $b = 100$  pm and  $c = 150$  pm. Determine the spacing between the (123) planes. 3
- (c) How many number of atoms are present within (i) a body-centred cubic unit cell and (ii) a face-centred cubic unit cell? 2

OR

8. (a) What is axis of symmetry? A hexagonal crystal has hexad axis. Comment. 3
- (b) Calculate the coordination number of an atom in (i) a body-centred cubic unit cell and (ii) a face-centred cubic unit cell. 2

(c) An element exists as a cubic lattice whose edge length is  $2.88 \text{ \AA}$ . If the density of the element is  $7.20 \text{ g cm}^{-3}$ , how many unit cells are there in  $100 \text{ g}$  of the metal?

2

9. (a) Explain the following :

4

(i) Ionic atmosphere

(ii) Inter-ionic effect

(b) The molar conductances at infinite dilutions for  $\text{NaOH}$ ,  $\text{NaCl}$  and  $\text{BaCl}_2$  are  $248 \times 10^{-4}$ ,  $126.5 \times 10^{-4}$  and  $280 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$  respectively.

Calculate  $\Lambda_m^\circ [\text{Ba(OH)}_2]$ .

3

OR

10. (a) How does the speed of an ion in an electric field vary with the applied potential gradient? What is this effect called?

2

(b) Explain why conductance of strong electrolytes increases with increase in frequency of applied alternating current.

3

(c) What are the advantages of conducto-

**2014**

**( 5th Semester )**

**CHEMISTRY**

**SEVENTH PAPER (CHEM-353)**

**( Physical Chemistry—II )**

**( PART : A—OBJECTIVE )**

**( Marks : 20 )**

*The figures in the margin indicate full marks for the questions*

**SECTION—A**

**( Marks : 5 )**

Put a Tick (✓) mark against the correct answer in the  
brackets provided : 1×5=5

**1. The excluded volume per mole of a gas is — the  
actual volume of the gas molecule.**

(a) 1/10th time ( )

(b) 4 times ( )

(c) 2 times ( )

(d) 1/2 ( )

2. According to third law of thermodynamics, at absolute zero for a perfect crystal

(a)  $\Delta S = \text{positive}$  ( )

(b)  $\Delta S = \text{negative}$  ( )

(c)  $\Delta S = \text{zero}$  ( )

(d) None of the above ( )

The figures in the margin indicate full marks for the questions

SECTION—A

( Marks : 5 )

3. Michaelis constant  $K_m$  is given by

(a)  $K_m = (k_{-1} + k_2) / k_1$  ( )

(b)  $K_m = (k_{-1} + k_1) / k_2$  ( )

(c)  $K_m = k_{-1} / k_1$  ( )

(d)  $K_m = k_1 / (k_{-1} + k_2)$  ( )

4. The angle at which first-order reflection will occur in X-ray spectrometer of wavelength  $1.54 \text{ \AA}$  and inter-planar distance  $4.04 \text{ \AA}$  are diffracted is

(a)  $110^\circ 68'$  ( )

(b)  $10^\circ 59'$  ( )

(c)  $180^\circ$  ( )

(d)  $22^\circ 24'$  ( )

5. The SI unit of specific conductance is

(a)  $\text{S}^{-1} \text{m}^{-1}$  ( )

(b)  $\Omega^{-1} \text{cm}$  ( )

(c)  $\Omega \text{cm}^{-1}$  ( )

(d)  $\text{Sm}^{-1}$  ( )

( 4 )

SECTION—B

( Marks : 15 )

3×5=15

Answer the following questions :

1. What is transport number? How is it related to Faraday's first law of electrolysis?



( 5 )

2. Write a short note on optical exaltation.

3. Calculate the Miller indices of crystal planes which cut through the crystal axes at—

(a)  $(2a, 3b, c)$ ;

(b)  $(a, b, c)$ ;

(c)  $(2a, -3b, -3c)$ .

- Using the third law of thermodynamics, show th

$$\lim_{T \rightarrow 0} \left( \frac{\partial P}{\partial T} \right)_V = 0$$

4. Using the third law of thermodynamics, show that

$$\lim_{T \rightarrow 0} \left( \frac{\partial P}{\partial T} \right)_V = 0$$

5. What is most probable velocity? Derive its expression from Maxwell distribution of molecular velocities.

...