

2014

(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

G15—250/140a

(Turn Over)

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 \AA . If the density of the element is 7.20 g cm^{-3} , how many unit cells are there in 100 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 NaOH, NaCl and BaCl_2 are 248×10^{-4} , 126.5×10^{-4} and $280 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$ respectively. Calculate $\Lambda_m^\circ [\text{Ba}(\text{OH})_2]$. 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 conductometric titrations over ordinary volumetric methods? 2

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(**Physical Chemistry—II**)

(PART : A—OBJECTIVE)

(Marks : 20)

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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 ()

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 \AA and inter-planar distance 4.04 \AA are diffracted is

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

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

(c) 180° ()

(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) Ωcm^{-1} ()

(d) Sm^{-1} ()

(4)

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

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

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

4. Using the third law of thermodynamics, show that

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

CHEMISTRY

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(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 part ()

(b) 4 times ()

(c) 2 times ()

(d) 1/2 ()

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

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

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

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

(D) None of the above

3. Michaelis constant K_m is given by

(A) $K_m = (k_1 + k_2) / k_3$

(B) $K_m = (k_1 + k_2) / k_1$

(C) $K_m = k_2 / k_1$

(D) $K_m = k_1 / (k_2 + k_3)$ ***