

- (b) A fresh air is composed of Argon (1%) and oxygen (21%). Find the root mean square speed of Argon and O₂ at 25°C.

$$R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}. \quad 5$$

3. (a) What is the expression for critical pressure ? Draw a P-V diagram for a real gas explaining the deviation of the gas from ideality. 5

- (b) If $Z = 1.00054$ at 0°C and 1 atm pressure and the Boyle temperature of the gas is 107 K, estimate the values of a and b .

$$R = 0.0821 \text{ atm-L/mol-K} \quad 5$$

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B.Sc. (Hons.) (NEP-2020) (UTD)

EXAMINATION, 2025

(Second Semester)

PHYSICAL CHEMISTRY-I

B-23-CHE-204

Time : 3 Hours]

[Maximum Marks : 50

Before answering the question-paper, candidates must ensure that they have been supplied with correct and complete question-paper. No complaint, in this regard will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory.

1. (a) What are the nature of forces that acts between the gas molecules ? 1
- (b) Write the expression of the pressure of an ideal gas according to kinetic theory of gases. 1
- (c) State any *two* terms by which the collision between gas molecules can be expressed. 1
- (d) What are the number of atoms in a unit cell of a face centered cubic crystal ? 1
- (e) Define the term crystal lattice. 1
- (f) Nernst gave a very important law on distribution of solutes between two phases. Name the law and write proper expressions. 1

- (g) Can half-life be derived for a first order reaction. Give the related expressions. 1
- (h) What should be the pH scale for an acid ? 1
- (i) Can the dissociation constant of a weak acid be calculated. Name the law behind it. 1
- (j) What is hydrolysis of an acid ? Name the parameter by which can it be measured. 1

Unit I

2. (a) Write the expression for Maxwell's distribution of velocities. Name the various terms associated with it and draw the suitable probability distribution curves. 5

9. (a) Derive Henderson equation for finding out the pH of a buffer solution. 5

(b) What is solubility and solubility product ? What are the factors upon which the solubility of a solute in a solvent depends ? Explain any *one* of the factors 5



Unit II

4. (a) What is the rotating crystal method for measurement of X-ray diffraction ? Describe. 5

(b) What is Miller indices ? What is the Miller indices of planes which have indices : 5

(i) a, b, ∞

(ii) $3a, 2b, \infty$

(iii) $a, 3b, \infty$.

5. (a) Define surface tension and refractive index for a given liquid. What is its unit and give proper mathematical equations ? 4

- (b) What is centre of symmetry and plane of symmetry for a crystal ? Describe. 4
- (c) What is Bragg's Law ? Give suitable mathematical expressions. 2

Unit III

- 6. (a) Derive the integrated rate law of a reaction obeying first order ? 6
- (b) Write the Arrhenius equation. The rate constant for a first order reaction becomes eight times when the temperature is raised from 350 to 450 K. Calculate the activation energy of a reaction. 4
- 7. (a) Write the form of Nernst distribution law after dissociation of solute in one of the phases. Name the terms. 4

- (b) Derive the integrated rate law of a reaction obeying zero order. 6

Unit IV

- 8. (a) Name the law that expresses the relation of dilution of a weak acid to the concentration. Write the expression of the law and give one of the examples of an acid obeying the Law. 3
- (b) What is ionic product of water ? How is it related to pH of a solution ? 3
- (c) A tribasic acid has one of the dissociation constant of 2.6×10^{-6} at 35°C. Calculate the degree of dissociation at a concentration of 0.3 M at the same temperature. 4