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**325411**

**May 2026**

**B.S.C. (LS) IV SEMESTER**

**Physical Chemistry-I (NBLS/MIC-401)**

Time : 3 Hours]

[Maximum Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any **four** questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

**PART-A**

1. (a) State Charles's law for gases. (1.5)
- (b) Define Boyle's temperature. How is it related to van der Waals constant 'a' and 'b'. (1.5)
- (c) Calculate the vibration degree of freedom in  $\text{CH}_4$ . (1.5)
- (d) Define viscosity and the coefficient of viscosity of a liquid. (1.5)
- (e) Define Critical Micelle Concentration (CMC). (1.5)
- (f) The distance separation between the (123) planes is 0.5 nm. What will be the distance separation between (246) planes? (1.5)

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- (g) What are the coordination numbers of  $\text{Na}^+$  and  $\text{Cl}^-$  present in the different positions of  $\text{NaCl}$  crystal? (1.5)
- (h) Define buffer capacity of a buffer. (1.5)
- (i) Calculate pH of 0.2 M  $\text{H}_2\text{SO}_4$  solution. (1.5)
- (j) Explain common ion effect with a suitable example. (1.5)

### PART-B

2. (a) Explain the viscosity of gases. Derive the relation between mean free path and the coefficient of viscosity. (10)
- (b) Discuss the postulates and significance of kinetic theory of gases. (5)
3. (a) Define Solubility and solubility product of sparingly soluble salts, and explain applications of the solubility product principle in detail. Derive the relation between solubility and solubility product for  $\text{AX}_2$  and  $\text{AX}_3$  type salt. (10)
- (b) Derive Henderson-Hasselbalch for basic and acidic buffers. (5)
4. (a) Define surface energy and surface tension. Describe any two methods for the measurement of surface tension. (10)
- (b) Briefly discuss about the cleansing action of detergents. (5)
5. (a) Describe the rotating crystal method and powder pattern method for analysis of crystal structure. (10)

- (b) Discuss the various elements of symmetry present in a cube. (5)
6. (a) What do you mean by compressibility factor ( $Z$ )? Discuss the variation of compressibility factor ( $Z$ ) with pressure and temperature of a real gas. Briefly explain how real gases show deviation from ideal behaviour. (10)
- (b) What is the degree of ionization? Explain the factors affecting the ionization of weak electrolytes in solution. (5)
7. (a) Explain the following: (15)
- (i) Law of corresponding states.
- (ii) Effect of temperature on the viscosity of liquids.
- (iii) Bragg's law.
- (iv) Critical pressure ( $P_c$ ) and temperature ( $T_c$ ).
- (v) Theory of acid-base indicators.