

2023

Time - 3 hours

Full Marks - 60

Answer all groups as per instructions.

Figures in the right hand margin indicate marks.

GROUP - A

1. Answer all questions and fill in the blanks as required. [1 × 8]
- (a) Number of vibrational degree of freedom for water molecule is _____.
- (b) Small drop of liquid is spherical in shape due to _____.
- (c) The value of ionic product of water is _____ at 25⁰ C.
- (d) ZnS is a _____ type of crystal.
- (e) Solution of NH₄Cl is _____ in nature.
- (f) What is the pH of 1 M HCl ?
- (g) The velocity possessed by maximum number of molecules is called _____.
- (h) What is the reciprocal of co-efficient of viscosity ?

[2]

GROUP - B

2. Answer any eight of the following within two or three sentences each. [1½ × 8

- (a) What is intrinsic viscosity ?
- (b) What is the relation between most probable velocity and rms velocity ?
- (c) When pH of a solution is 2, what is its hydrogen ion concentration in mole / litre ?
- (d) The solubility product of BaCl_2 is 4×10^{-9} . What is its solubility ?
- (e) Which crystal shows both Schottky and Frankel defect ?
- (f) Why degree of dissociation of CH_3COOH decreases by adding sodium acetate ?
- (g) What is the effect of temperature on surface tension of liquid ?
- (h) What is the expression for Boyle's temperature ?
- (i) Define pH of a solution.
- (j) Under what conditions, the real gases behave ideally ?

GROUP - C

3. Answer any eight of the following within 75 words each. [2 × 8

- (a) What is critical temperature ?

[3]

- (b) State the law of equipartition of energy.
- (c) Define surface tension of liquid.
- (d) What is degree of ionization ?
- (e) How many elements of symmetry are present in a cube ?
- (f) How degree of hydrolysis is related to hydrolysis constant ?
- (g) Write Henderson equation for acidic buffer.
- (h) Calculate pH of 0.001 M NaOH.
- (i) What are liquid crystals ?
- (j) What are strong electrolytes ? Give one example.

GROUP - D

Answer any four questions within 500 words each.

- 4. What is the law of corresponding state ? Derive mathematical expression for it. [6]
- 5. Explain the following. [2 × 3]
 - (a) Why needle floats on water surface ?
 - (b) Why insects can walk on the surface of water ?
 - (c) Why viscosity of liquid decreases whereas for gases viscosity increases with increase in temperature ?

[4]

6. Explain ionic product of water. What is the effect of temperature on it ? [6]
7. State and explain the laws of crystallography. [6]
8. What is buffer solution ? Derive pH of basic buffer. [6]
9. Derive an expression for mean free path. What is the effect of temperature and pressure on mean free path ? [6]
10. Explain Ostwald theory of indicators taking the example of phenolphthalein. [6]