



বিদ্যাসাগর বিশ্ববিদ্যালয়

**VIDYASAGAR UNIVERSITY**

**B.Sc. Honours Examination 2021**

**(CBCS)**

**4th Semester**

**CHEMISTRY**

**PAPER—C8T & C8P**

**PHYSICAL CHEMISTRY - III**

*Full Marks : 60*

*Time : 3 Hours*

*The figures in the right-hand margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**THEORY : C8T**

Answer any *two* questions.

2×15

1. (a) Derive the expression for depression of freezing point of solution.  
(b) Addition of  $\text{HgI}_2$  to aqueous solution of KI shows an increase in vapour pressure - Why?

- (c) Justify the statement. – Eutectic is a mixture not a component.
- (d) At 26°C, V<sub>pour</sub> pressure of CHCl<sub>3</sub> and CCl<sub>4</sub> are 200 mm and 115 mm. What is the weight percent of CHCl<sub>3</sub> in the vapour phase in equilibrium with a liquid mixture of 1 mole of each of the pure liquids.
- (e) What is metastable state in phase diagram? 5+2+2+4+2
- 2.** (a) What are the limitations of Debye-Huckel Theory?
- (b) Derive the Nernst equation for e.m.f. and equilibrium constant.
- (c) Calculate the pH of a buffer solution containing 0.2 (M) of NH<sub>4</sub>Cl and 0.1 (M) NH<sub>4</sub>OH per litre. (K<sub>b</sub> for NH<sub>4</sub>OH = 1.85 × 10<sup>-5</sup>)
- (d) The salts of strong acid and strong base do not undergo hydrolysis – Explain.
- (e) Is the molar polarisation temperature dependent? Explain with Clausius Mossotti equation. 2+4+4+2+3
- 3.** (a) Prove that ‘Eigen value of Hermitian operators are real’.
- (b) What is Spherical Harmonics?
- (c) Draw the radial probability distribution for 2s and 3p orbital and explain.
- (d) ‘Probability of finding the electron in s-orbitals is maximum near to the nucleus’— Justify or criticize. 3+3+2 $\frac{1}{2}$ +2 $\frac{1}{2}$ +4
- 4.** (a) What are the limitations of Raoult’s law?
- (b) Derive the Clausius-Clapeyron equation for vapourisation.

- (c) Explain why – a mixture of tin and lead are used for soldering.
- (d) Draw and explain the potentiometric titration of acetic acid with NaOH.
- (e) Calculate ionic activity Co-efficient of 0.0325 (m) solution of  $K_4Fe(CN)_6$  at 298K. 2+5+2+3+3

Answer any *one* question.

1×10

- 5.** (a) Explain why – “The elevation of boiling point of 0.1 (M) NaCl and 0.1 (M) sugar solution are not same.”
- (b) What happens when blood cells are placed in pure water?
- (c) What is Lever rule?
- (d) Explain p-dinitrobenzene is non polar but p-dihydroxy benzene has dipolemoment 1.64D.
- (e) Calculate the pH (at 25°C) of 0.01 (M) HCl solution. 2+2+2+3+1
- 6.** (a) What are the physical significances of commutation rule?
- (b) Show that  $[\hat{L}^2, \hat{L}_z] = 0$ .
- (c) What is equal probability contour diagram? 3+5+2

**PRACTICAL : C8P**

Answer any *one* question.

1×20

Discuss any *one* of the following experiments with respect to working principle, experiment procedure and nature of plots.

1. Potentiometric titration for Mohr's salt solution against standard  $K_2Cr_2O_7$  solution.
2. Study of phenol-water phase diagram.
3. pH metric titration of acid (mono and dibasic) against strong base.

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