

B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023

Fifth Semester

Chemistry — Core

PHYSICAL CHEMISTRY - II

(For those who joined in July 2021 - 2022)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 4 = 40 marks)

Answer ALL questions.

Choose the correct answer :

- Thermodynamics is applicable to _____ system only.
(a) Microscopic (b) Macroscopic
(c) Homogeneous (d) Heterogeneous
- Which of the following is true?
(a) $C_p > C_v$ (b) $C_p < C_v$
(c) $C_p = C_v$ (d) $C_p = C_v = 0$
- The unit of ionic mobility is
(a) cm^2s^{-1} (b) cm s^{-1}
(c) $\text{cm v}^{-1}\text{s}^{-1}$ (d) $\text{cm}^2\text{v}^{-1}\text{s}^{-1}$
- The fraction of the total molecules which is ionised in a solution of an electrolyte is
(a) dissociation constant
(b) degree of dissociation
(c) mole fraction of electrolyte
(d) ionisation constant
- Pure rotational spectrum is observed in
(a) visible region
(b) infra red region
(c) ultra violet region
(d) microwave region
- The number of vibrational modes of H_2O molecule is
(a) 2 (b) 3
(c) 4 (d) 5

- Entropy is a measure of _____ of a system.
(a) efficiency
(b) work done
(c) randomness
(d) orderliness
- At equilibrium, ΔG is
(a) positive (b) negative
(c) zero (d) none
- Clapeyron-Clausius equation is applicable to equilibrium involved in _____ system.
(a) one component two phase
(b) one component three phase
(c) two component two phase
(d) two component three phase
- When a small amount of acid is added to a buffer solution?
(a) pH increases
(b) pH decreases
(c) pH will not change
(d) None of these

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 250 words.

- (a) State and explain Zeroth law of thermodynamics. What is its significance?
Or
(b) Derive Kirchoff's equation and explain.
- (a) What do you understand about the term 'residual entropy'? Why does it exist? Explain with an example.
Or
(b) Derive Gibbs Helmholtz equation.
- (a) Draw the phase diagram of Zn-Mg system and explain.
Or
(b) Write notes on :
(i) Ionic product of water
(ii) pH value.

14. (a) The equivalent conductance at infinite dilution of NH_4Cl , NaOH and NaCl at 18°C are 129.8, 227.4 and $108.9 \text{ ohm}^{-1}\text{cm}^{-2} \text{ g equiv}^{-1}$ respectively. Calculate the equivalent conductance of NH_4OH at infinite dilution at 18°C .

Or

- (b) Explain Ostwald's dilution law and its limitations.

15. (a) Which of the following molecules will show rotational spectra? Explain

HCl , N_2 , CO and CO_2

Or

- (b) Compare IR and Raman spectroscopy.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Three moles of an ideal gas at 27°C expand isothermally and reversibly from 20 litres to 60 litres. Calculate the value of ΔE , ΔH , q and w .

Or

- (b) Explain Joule-Thomson coefficient. Prove that for an ideal gas the Joule-Thomson coefficient is zero.

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17. (a) (i) Write a note on thermodynamic scale of temperature.

- (ii) State and explain Nernst heat theorem.

Or

- (b) (i) Explain Chemical potential.

- (ii) Derive Gibbs-Duhem equation.

18. (a) (i) Derive phase rule thermodynamically.

- (ii) Explain the phase diagram of water system.

Or

- (b) (i) Explain common ion effect.

- (ii) Derive Henderson equation to calculate pH of a buffer solution.

19. (a) How is transport number determined by Hittorf method?

Or

- (b) Explain in detail the Debye-Huckel theory of strong electrolytes.

20. (a) Discuss the vibration-rotation spectrum of diatomic molecules.

Or

- (b) (i) Show how the Stokes and anti Stokes lines appear in the Raman spectrum.

- (ii) Explain Franck-Condon principle.

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