(6 pages) **Reg. No. :** .....

Code No. : 20466 E **Sub. Code : CMCH 52**

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 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Thermodynamics is applicable to ———— system only.
   (a) Microscopic (b) Macroscopic
   (c) Homogeneous (d) Heterogeneous

2. Which of the following is true?
   (a) $C_p > C_v$ (b) $C_p < C_v$
   (c) $C_p = C_v$ (d) $C_p = C_v = 0$

3. Entropy is a measure of ———— of a system.
   (a) efficiency
   (b) work done
   (c) randomness
   (d) orderliness

4. At equilibrium, ΔG is
   (a) positive (b) negative
   (c) zero (d) none

5. Clapeyson-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

6. 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

7. The unit of ionic mobility is

(a) cm^2s^{-1} (b) cms^{-1}

(c) $cmv^{-1}s^{-1}$ (d) $cm^2v^{-1}s^{-1}$

8. 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

9. Pure rotational spectrum is observed in

(a) visible region

(b) infra red region

(c) ultra violet region

(d) microwave region

10. The number of vibrational modes of H_2O molecule is

(a) 2 (b) 3

(c) 4 (d) 5

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) State and explain Zeroth law of thermodynamics. What is its significance?

Or

(b) Derive Kirchoff's equation and explain.

12. (a) What do you understand about the term 'residual entropy'? Why does it exist? Explain with an example.

Or

(b) Derive Gibbs Helmholtz equation.

13. (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 $ohm^{-1}cm^{-2}$ 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 × 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.

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 Hittor'f 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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