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

Code No. : 20062 E Sub. Code : AMCH 52

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2025.

Fifth Semester

Chemistry — Core

PHYSICAL CHEMISTRY — II

(For those who joined in July 2020 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following is not a state function?
   (a) Internal energy
   (b) Concentration
   (c) Enthalpy
   (d) Entropy

2. For an adiabatic process
   (a) $\Delta E = q$ (b) $\Delta H = 0$
   (c) $\Delta E = W$ (d) $q = P\Delta V$

3. Decrease of free energy in a reacting system indicates a/an
   (a) exothermic reaction
   (b) equilibrium reaction
   (c) spontaneous reaction
   (d) slow reaction

4. The basis for the enunciation of third law of thermodynamics is
   (a) Van't Hoff isotherm
   (b) Gibb's phase rule
   (c) Nernst distribution law
   (d) Nernst heat theorem

5. According to Le-Chatelier principle, increase of temperature favours the following reaction
   (a) Endothermic reaction
   (b) Exothermic reaction
   (c) Both (a) and (b)
   (d) None of these

6. For a system at the triple point, the number of degrees of freedom is

(a) 0 (b) 1

(c) 2 (d) 3

7. Ostwald's dilution law is applicable to which of the following?

(a) NaCl (b) NaOH

(c) NH_4Cl (d) NH_4OH

8. The SI unit of specific conductance

(a) Ohm m (b) Ohm m^{-1}

(c) S m (d) S m^{-1}

9. Which amalgam is used in Weston standard cell?

(a) Cd / Hg (b) Fe / Hg

(c) Zn / Hg (d) Al / Hg

10. E° for half cell Zn^{2+}/Zn is –0.76 V. The E° cell of $Zn / Zn^{2+} // 2H^+ / H_2$, Pt is

(a) –0.76 V (b) 0.76 V

(c) –0.38 V (d) 0.38 V

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) What are extensive and intensive properties? Give examples.

Or

(b) State the first law of thermodynamics in various forms.

12. (a) (i) What is meant by entropy of a system?

(ii) Explain the relation between entropy and probability.

Or

(b) State and explain Nernst heat theorem.

13. (a) Derive the relationship between K_P and K_C.

Or

(b) Explain the phase diagram of KI-water system.

14. (a) (i) What is a buffer solution?

(ii) Explain the buffer action of a mixture of acetic acid and sodium acetate.

Or

(b) How is the equivalent conductance of a solution determined?

15. (a) Describe the construction and working of calomel electrode.

Or

(b) What is meant by liquid junction potential? How is it eliminated?

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 600 words.

16. (a) (i) Define C_P and C_V. Prove that $C_P - C_V = R$.

(ii) Derive an expression for the maximum work done when an ideal gas undergoes reversible isothermal expansion.

Or

(b) (i) State and explain Zeroth law of thermodynamics.

(ii) What is inversion temperature? Explain.

17. (a) Derive Gibbs Helmholtz equation and write its applications.

Or

(b) (i) Explain partial molar properties.

(ii) Derive Gibbs Duhem equation.

18. (a) Derive Van't Hoff isochore from Van't Hoff isotherm.

Or

(b) (i) Derive phase rule thermodynamically.

(ii) Explain the phase diagram of water system.

19. (a) (i) Write a note on P^H scale.

(ii) Derive Henderson equation to calculate P^H of a buffer solution.

Or

(b) Discuss Kohlrausch's law and its applications.

20. (a) (i) Explain hydrogen electrode and write its advantages and disadvantages.

(ii) How will you determine the P^H of a solution using hydrogen electrode?

Or

(b) Write a note on potentiometric titrations.

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