

34. (a) Explain *Wein effect and Debye-Falkenhagen effect*. 6
 (b) State and explain Nernst distribution law. Give the thermodynamic derivation of the law. 9
35. (a) Derive the van't Hoff equation showing the temperature-dependence of equilibrium constant and arrive at its integrated form. 9
 (b) Explain the phase diagram of Pb-Ag system. 6
- (2 × 15 = 30 Marks)

(Pages : 4)

T – 1645

Reg. No. :

Name :

Sixth Semester B.Sc. Degree Examination, April 2024

First Degree Programme under CBCSS

Chemistry

Core Course – XII

CH 1643 : PHYSICAL CHEMISTRY – III

(2017 – 2019 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** the questions. Each question carries **1** mark.

- Chemically, enzymes are a highly specialized class of _____
 - The equilibrium constant K_c of a reaction depends upon the _____ if ΔH is not equal to zero.
 - Sketch the conductance titration curves for $\text{HCl} \times \text{NH}_4\text{OH}$.
 - The specific reaction rate for a first order reaction is $1.0 \times 10^{-3} \text{ min}^{-1}$. If the initial concentration is $2.0 \times 10^{-3} \text{ M}$, the initial rate is _____
 - Pattinson's process is used for the profitable removal of _____
 - Among CS_2 -acetone, benzene-toluene, acetone-chloroform and hexane-heptane binary systems, which system forms a maximum boiling azeotrope?
 - What are galvanic cells designed to convert the energy of combustion of fuels like hydrogen, methane, methanol, etc. directly into electrical energy called?
 - Glow of phosphorous is due to _____
 - The half-life period of a first order reaction with rate constant $1 \times 10^{-1} \text{ s}^{-1}$ is _____
 - At 298 K, the potential of a hydrogen electrode at $\text{pH} = 2$ is _____
- (10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. Each question carries **2** marks. (Short answer)

11. Explain the intermediate compound formation theory of catalysis.
12. Write the Arrhenius equation and explain the terms.
13. Calculate the pH of a 0.1 M solution of a weak acid HA at 298 K. Given $K_a = 4.9 \times 10^{-8}$.
14. K_p for a reaction at 327 K and 347 K are 1×10^{-12} and 5×10^{-12} respectively. Assuming ΔH to be constant in the above temperature range, calculate ΔH .
15. What are the limitations of distribution law?
16. What is Walden's rule?
17. Methanol and ethanol form a nearly ideal solution at 300 K. A solution is made by mixing 32 g of methanol and 23 g of ethanol. Calculate the partial pressures of its constituents and the total pressure of the solution at 300 K.
18. What are concentration cells? How are they classified?
19. What is meant by quenching of fluorescence?
20. Define efflorescence. Give two examples for efflorescent substances.
21. On the basis of Le Chatelier principle, discuss the effect of increasing temperature on the solubility of salts in water.
22. The molar conductivities of Ba(OH)_2 , BaCl_2 and NH_4Cl at infinite dilution at 298 K are respectively 228.8, 120.3 and $129.8 \text{ cm}^2 \text{ mol}^{-1}$. Calculate the molar conductivity of NH_4OH at infinite dilution at 298 K.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks. (Short essay)

23. k for a second order reaction has a value of $5.70 \times 10^{-5} \text{ L/mol/s}$ at 298 K and a value of $1.64 \times 10^{-4} \text{ L/mol/s}$ at 313K. Calculate the Arrhenius parameters.
24. Explain the terms *eutectic point* and *congruent melting point* with suitable examples.

25. Give the *Debye-Huckel-Onsager equation* and explain its limitations.

26. The EMF of the cell with transference : Ag/AgCl/HCl (mean ionic activity = 0.01751)/ HCl (mean ionic activity = 0.009049)/ AgCl/Ag is 0.02802 V. The corresponding cell without transference has an EMF of 0.01698 V. Calculate the

(a) the *liquid junction potential*

(b) the transport number of H^+ .

27. An organic acid undergoes dissociation in water. The partition coefficient of the acid between the water and benzene is 4 in favour of water. When 13 g of the acid is shaken with a system of 100 mL and 100 mL of benzene, 2 g of it passes into the benzene layer. Calculate the percentage dissociation of the acid in water.

28. The conductivity of a saturated solution of AgCl at 298 K, after subtracting the conductivity of water is $2.28 \times 10^{-6} \text{ ohm}^{-1} \text{ cm}^{-1}$. Calculate the solubility of AgCl in water at 298K. Given : the molar ionic conductances of Ag^+ and Cl^- ions at infinite dilution are respectively 61.94 and $76.36 \text{ ohm}^{-1} \text{ cm}^2/\text{mol}$; molar mass of $\text{AgCl} = 143.5 \text{ g/mol}$.

29. Explain the *azeotropic mixtures* with examples.

30. Write a note on photochemical equivalence and quantum yield.

31. What is meant by a *heterogeneous equilibrium*? Apply the law of chemical equilibrium to the dissociation of ammonium hydrosulphide.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks. (Essay)

32. Discuss the *Lindemann theory of unimolecular reactions* with special reference to the use of *steady state approximation*.

33. (a) Determine the pH of a solution obtained by mixing equal volumes of 0.1 M ammonium nitrate and 0.02 M ammonium hydroxide. K_b for $\text{NH}_4\text{OH} = 1.8 \times 10^{-5}$. 6

(b) Describe the construction of quinhydrone electrode and glass electrode. How can you determine the pH of a solution using these electrodes? 9