

Reg. No

Name

23U657

B. Sc. DEGREE END SEMESTER EXAMINATION : MARCH 2023

SEMESTER 6 : CHEMISTRY

COURSE : 19U6CRCHE12 : PHYSICAL CHEMISTRY – IV

(For Regular - 2020 Admission and Supplementary - 2019 Admission)

Time : Three Hours

Max. Marks: 60

PART A

Answer All (1 mark each)

1. Calculate the degree of ionization of NH_4OH in 0.02 M solution. Given: the ionization constant of NH_4OH is $1.8 \times 10^{-5} \text{ mol L}^{-1}$ at 25°C .
2. What is a buffer solution? Give two examples for buffer solutions.
3. What is cell constant?
4. Calculate the ionic strength of a 0.015 molal BaCl_2 solution.
5. What are the three primary components of electrolytic cells?
6. What is the advantage of measuring pH of the solution using quinhydrone electrode?
7. What are isotonic solutions?
8. Ebullioscopy deals with study of

(1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. What mass of KOH (molecular mass=56) must be present in 1L of the solution to have a solution of pH 9?
10. Derive an expression for the hydrolysis constant of a salt of weak acid and a strong base.
11. The molar conductivities of sodium acetate, HCl and NaCl at infinite dilution are 91.0, 426.16 and $126.45 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ respectively at 298 K. Calculate the limiting molar conductivity of acetic acid.
12. The molar conductivity of M/32 acetic acid is $9.2 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ at 298K. Calculate the percentage of dissociation of the acid at this dilution if the molar conductivity at infinite dilution of acetic acid is $389 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$.
13. Write a note on the constants A and B in Onsager equation.
14. Write electrode reactions and cell reaction of the cell $\text{Hg} / \text{Hg}_2\text{Cl}_2 / \text{Cl}^- // \text{Cu}^{2+} / \text{Cu}$.
15. State the difference between a gas electrode and a redox electrode.
16. How many grams of methyl alcohol must be added to 10 litre tank of water to prevent its freezing at -5°C ? The molal freezing point constant for water is 1.86° .

(2 x 6 = 12)

PART C

Answer any 4 (5 marks each)

17. What are acid-base indicators? Explain the action of phenolphthalein as an acid-base indicator on the basis of Ostwald's theory.
18. The cell constant of a cell is 0.5 cm. The resistance of an electrolyte solution taken in a cell is 50 ohms. Calculate the conductivity of the solution.
19. Explain hydrogen-oxygen fuel cell.
20. How pH of solution can be determined using hydrogen electrode?
21. Why elevation in boiling point of a solution is considered as a colligative property? Use thermodynamic derivation to prove elevation in boiling point as a colligative property.
22. Derive Raoult's law. Find the expression to calculate the molecular weight of the solute from relative lowering of vapour pressure.

(5 x 4 = 20)

PART D

Answer any 2 (10 marks each)

23. a) Explain the buffer action of a mixture of acetic acid and sodium acetate. b) Explain the buffer action of a mixture of ammonium hydroxide and ammonium chloride c) Derive Henderson's equation for the pH of an acidic buffer.
24. Discuss the Hittorf's theoretical device in connection with the discharge of ions during electrolysis.
25. a) Derive the Nernst equation for the EMF of an electrochemical cell.
b) Calculate the EMF of a Daniel cell at 25 °C when the concentrations of ZnSO_4 and CuSO_4 solutions are respectively 0.001 M and 0.1 M. Given $E^\circ \text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V}$, $E^\circ \text{Cu}^{2+}/\text{Cu} = 0.34 \text{ V}$.
26. Describe the fractional distillation of any two types of completely miscible liquid mixtures

(10 x 2 = 20)