(6 pages)

Code No. : 7774   **Sub. Code : WCHE 13**

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

First Semester

ELECTIVE – II – Chemistry

ELECTROCHEMISTRY

(For those who joined in July 2023 onwards)

Time : Three hours   Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. Cooking time of food is reduced in a pressure cooker because

   (a) Boiling point of water is lowered.

   (b) Higher pressure softens the food.

   (c) Boiling point of water is raised.

   (d) Uniform distribution of heat.

2. Calculate the ionic strength of 0.15 M KCL

   (a) 0.30   (b) 0.15

   (c) 0.075   (d) 0.015

3. If liquid A and B ideal behavior

   (a) Enthalpy of mixing is zero.

   (b) Entropy of mixing is zero.

   (c) Free energy of mixing is zero.

   (d) Free energy as well as entropy mixing are each zero.

4. The Gouy–Chapman theory is applicable to

   (a) Diluted colloid   (b) Concentrated colloid

   (c) Both (a) and (b)   (d) None of the above

5. A typical Surface tension (γ) versus V electrocapillary curve is almost a

   (a) Parabola   (b) Circle

   (c) Ellipsoid   (d) Rectangular

6. Sedimentation potential is also called

   (a) Gold number   (b) Dorn effect

   (c) Colloidal disperson   (d) Zeta potential

7. The standard reduction potential values of three metallic cation X, Y, Z are 0.52, -3.03 and -1.18 V respectively. The order of the reducing power of corresponding metals is

   (a) Y>Z>X   (b) X>Y>Z

   (c) Z>Y>X   (d) Z>X>Y

8. Which of the following metal ion is more reactive?
   (a) Cu   (b) Ag
   (c) Hg   (d) K

9. Primary reference electrode is
   (a) SHE
   (b) Calomel
   (c) Glass
   (d) Ion selective electrode

10. The rate determining step is the _____ step in a chemical reaction.
    (a) Fastest   (b) Slowest
    (c) Barrier   (d) None of the above

11. The stoichiometric number of the rate-determining step was first introduced by
    (a) Horiuti   (b) Evans
    (c) Nernst   (d) Kohlrausch's

12. The hydrogen over voltage for palladium is
    (a) 0.21 V   (b) 0.48 fuel cells
    (c) 0.15 V   (d) 0.00 V

13. What is the type of cell used for building laptop battery pack?
    (a) Lithium ion   (b) Ni-Cd
    (c) Zn-Silver oxide   (d) Led acid

14. Which types of water used in electrolyte
    (a) Ordinary water   (b) Distilled water
    (c) Coolant   (d) None of the above

15. Fuel cell performance is not limited by _____ thermodynamics.
    (a) First law   (b) Second Law
    (c) Third law   (d) All the three law

PART B — (5 × 4 = 20 marks)

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

16. (a) Define Van't Hoff factor and its relation to colligative properties.

    Or

    (b) Calculate the mean activity coefficient $\gamma \pm$ of 0.01 M Nacl in aqueous solution at 25° C. [For water at 25° constant A=0.509]

17. (a) Write any four evidence of electrical double layer.

    Or

    (b) Discuss the term Electro-Osmosis.

18. (a) Discuss the factors affecting discharge of ions.

    Or

    (b) Explain briefly about anodic and cathode currents.

19. (a) Explain Pourbiax diagram.

Or

(b) Write short note on polarization and depolarization.

20. (a) Explain supporting electrolyte with suitable examples.

Or

(b) List out any four applications of fuel cell.

PART C — (5 × 8 = 40 marks)

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

21. (a) Derive DHLL equation.

Or

(b) Differentiate positive and negative deviation from ideal behavior.

22. (a) Discuss briefly about the measurement and application of zeta potential.

Or

(b) Explain the Helmholtz perrin models of electrical double layer.

23. (a) Examine the different types and measurement of over voltage.

Or

(b) Derive Butler-Volmer equation for single step one electron transfer electrode reaction.

24. (a) The Tafel anodic and cathodic slopes $\partial\Delta\phi / \partial \log i$ for a two electron process were found to be 0.04 & 0.12 respectively. Determine the transfer coefficients and Stoichiometric number for the reaction.

Or

(b) Derive an expression for transfer coefficient and its significance.

25. (a) Discuss the following fuel cells.

(i) Alkaline fuel cells.

(ii) Phosphoric acid fuel cells.

Or

(b) Describe the principles and application of polarography.

————