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Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2023

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** questions. **Each** question carries **1** mark.

1. What is meant by order of a reaction?
2. Define the term K_C.
3. What is meant by the term transport number?
4. The initial rate of a second order reaction becomes ———— times when the initial concentrations of the reactants are doubled.
5. Among rhombic sulphur (S_R), monoclinic sulphur (S_M), liquid sulphur (S_L) and vapour sulphur (S_v), the phases that coexist in metastable equilibrium at the metastable triple point of the sulphur system are ————
6. What will happen to the S^{2-} concentration of an aqueous solution of H_2S upon the addition of HCl to it?
7. Write down the van't Hoff equation.

8. What is meant by chemiluminescence?

9. For a first order reaction. k=0.693 s^{-1}. The half-life period of the reaction is _____

10. Give an example for *an anion reversible electrode*.

(10 × 1 = 10 Marks)

SECTION – B

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

11. Explain the term *consecutive reactions* with a suitable example.

12. Show that the half-life is inversely proportional to the initial concentration of the reactant for a *second order reaction*.

13. Explain the *Michaelis-Menten theory*.

14. What is the significance of triple point in the case of the water system?

15. Give an example for a binary system of partially miscible liquids showing both upper and lower CST and draw its phase diagram

16. Calculate the EMF of the cell at 298 K: $Mg_{(s)}/Mg^{2+}(0.001\ M)//Cu^{2+}0.0001\ M)/Cu_{(s)}$. Given $E^0_{Mg^{2+}/Mg}$=–2.37 V; $E^0_{Cu^{2+}/Cu}$=+0.34 V.

17. Mention any two applications of emf measurements

18. What is *quinhydrone electrode*?

19. Explain the reasons for the low quantum yield in certain photochemical reactions

20. Give an example for a *simple eutectic system*. What are the phases that coexist in equilibrium at its eutectic point?

21. Define the equilibrium constant in terms of partial pressures.

22. Explain *Debye-Falkenhagen effect.*

(8 × 2 = 16 Marks)

SECTION – C

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

23. A first order reaction is 20% complete in 15 min at 40°C and in 3 min at 60°C. Calculate the energy of activation for the reaction.

24. Describe any two methods for the determination of the order of a reaction.

25. Discuss the moving boundary method for the determination of transport number of ions.

26. Write a note on potentiometric titrations.

27. Calculate the degree of hydrolysis of 0.2 M sodium acetate solution in water. (K_a of acetic acid=1.8×10^{-5} $K_W = 1 \times 10^{-14}$) Also calculate the pH of the solution.

28. Describe the principle of conductometric titrations considering the titration of strong base with (a) strong acid and (b) weak acid.

29. Discuss the distillation behaviour of a completely miscible binary system showing large *positive deviations*.

30. State and explain Einstein's law of photochemical equivalence. Explain the term quantum efficiency.

31. Explain the effect of pressure on the freezing point of water on the basis of Le Chatlier principle.

($6 \times 4 = 24$ Marks)

SECTION – D

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

32. Explain the collision theory of reaction rates.

33. (a) Derive the Nernst equation for the e.m.f. of a cell. **5**

    (b) Given $E^0_{Cd^{2+}/Cd}$=–0.40 V and $E^0_{Cu^{2+}/Cu}$=+0.34 V, represent the standard cell, give the electrode and cell reactions and calculate the standard emf. **5**

    (c) Discuss two methods for the determination of *Arrhenius parameters*. **5**

34. (a) Define single electrode potential. Outline how it can be measured?

(b) Derive an expression for the rate constant of a first order reaction.

35. (a) Explain the terms *electrophoretic effect* and *relaxation effect* implied in the Debye-Huckel theory of strong electrolytes. **7**

(b) Explain how distribution law can be applied to the study of association of solutes in the solution phase. **8**

(2 × 15 = 30 Marks)