

K21P 0521

Reg. No.:

Name :

**First Semester M.Sc. Degree (CBSS – Reg./Suppl. (Including Mercy
Chance)/Imp.) Examination, October 2020
(2014 Admission Onwards)**

CHEMISTRY

CHE 1C.04 : Physical Chemistry – 1

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **all** questions in **one words** or **sentence**. Each question carries **1** mark.

(8×1=8)

1. Show that $\left(\frac{\partial u}{\partial v}\right)_T = \frac{a}{V^2}$ for a van der Waals gas (a – van der Waals constant).
2. What is residual entropy? Write one example.
3. Account for the high ionic mobility of H^+ and OH^- .
4. Explain Debye Falkenhagen effect.
5. What is Stern model of electrical double layer?
6. What is meant by exchange current density?
7. Devise an electrochemical cell in which the reaction $2H^+ + Fe \rightarrow Fe^{2+} + H_2$ takes place.
8. What do you mean by iR drop? Explain its significance.

SECTION – B

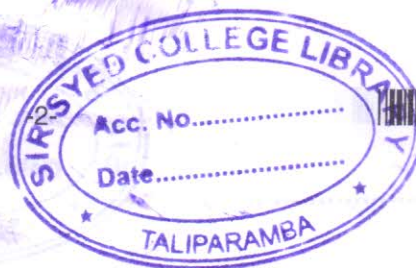
Answer **eight** questions. Answer may be in **one** or **two** sentences. Each question carries **2** marks.

(8×2=16)

9. Define phenomenological coefficient. Show that direct coefficients are always positive.

P.T.O.

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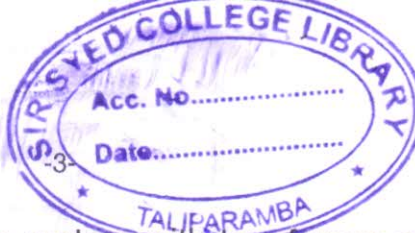
10. Show that $\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$.
11. Define excess thermodynamic functions. Explain the significance of excess enthalpy and excess entropy.
12. Calculate the thickness of ion atmosphere around K^+ in 0.01 molal KCl at 25°C. Dielectric constant of water is 78.5.
13. Explain the terms :
- a) Local equilibrium
 - b) Active transport.
14. Define :
- a) Thermoelectricity
 - b) Soret effect.
15. What is transfer coefficient ? Explain its significance.
16. Write Tafel equation. Explain the significance of slope and intercept of a Tafel plot.
17. Explain terms :
- a) Migration current
 - b) Diffusion current.
18. Find the cell potential of $Zn | Zn^{2+}_{a=0.0004} || Cd^{2+}_{a=0.2} | Cd$. The standard electrode potentials of Zn and Cd are -0.767 and -0.403 V respectively.
19. Explain Cathodic protection.
20. Write electrode reaction for corrosion in alkaline medium.

SECTION – C

Answer **four** questions. **Each** question carries **three** marks.

(4×3=12)

21. What are the conditions under which linear relationship exists between force and flux ? What are the advantages of a linear relationship between force and flux ? Explain.



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22. Explain steady state condition for a system with two forces and two fluxes. Evaluate steady state values of both forces and fluxes.
23. Calculate mean ionic activity coefficient of 0.01 molal CaCl_2 in water at 25°C . $A = 0.509$ (Use Debye Huckel equation)
24. The solubility of a sparingly soluble salt MX_2 in water at 25°C is $2 \times 10^{-5} \text{ M}$. Find the solubility of the salt in 0.1 molal with respect to X^- .
25. Derive an equation for the EMF of a concentration cell with transference.
26. Derive Ilkovic equation.
27. Draw Pourbaix Diagram for Al. Discuss.
28. The EMF of the cell $\text{Pt} | \text{H}_2 | \text{HBr} | \text{AgBr}_{(s)} | \text{Ag}$ is 0.3524 V at 25°C . Calculate the mean ionic activity coefficient of 0.01 molal HBr. The standard electrode potential of $\text{Br}^- | \text{AgBr}_{(s)} | \text{Ag}$ is 0.2224 V.

SECTION – D

Answer either 'a' or 'b' of **each** question. **Each** question carries **6** marks. **(4×6=24)**

29. a) Using irreversible thermodynamics rationalise (i) thermal diffusion
(ii) thermal osmosis.
OR
b) i) Using third law of thermodynamics, show that absolute zero of temperature is unattainable.
ii) What is the need for third law of thermodynamics ? Discuss.
30. a) Derive Debye Huckel Onsager equation.
OR
b) Discuss briefly :
i) Walden equation.
ii) Abnormal ion conductance.
31. a) Derive Butler Volmer equation.
OR
b) Discuss theory and applications of polarography.
32. a) How would you study kinetics of corrosion ? Discuss.
OR
b) Write a brief account of the different types of corrosion.