

C 4758

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Name

Reg. No. ....

**SECOND SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2016**

(CUCSS)

Chemistry

CH 2C 08—ELECTROCHEMISTRY, SOLID-STATE CHEMISTRY AND STATISTICAL THERMODYNAMICS

(2015 Admissions)

Time : Three Hours

Maximum : 36 Weightage

**Part A**

Answer **all** questions.

Each question carries a **weightage** of 1.

1. Write electrode reactions in the dry cell ( $Zn, MnO_2$ ).
2. Write equation for the activity of the following electrolytes **in terms of molal concentration** and mean ionic activity coefficient :  
(a)  $MX_2$  ; (b)  $M_2X_3$ .  
Define exchange current density. Explain its significance.
4. Explain the significance of slope and intercept of a **Tafel** plot.
5. Write **Hermann-Mauguin** symbol for the following (a)  $D_{ad}$  ; (b)  $C_{4v}$ .
6. Explain the term "glide plane".
7. Define Fermi level. Explain its significance.
8. What is birefringence ? Explain.
9. How many ways you can distribute two particles among three degenerate levels assuming (a) Bose Einstein statistics ; (b) Fermi Dirac statistics ?
10. Rationalise third law of thermodynamics using statistical concepts.
11. Calculate the heat capacity of solid (with characteristic temperature of 1000 K) at 10 K.
12. What do you mean by dilute system ?

(12 x 1 = 12)

**Part B**

Answer any **eight** questions.

Each question carries a **weightage** of 2.

13. Calculate the mean ionic activity coefficient of 0.01 **molal  $LaCl_3$**  in water at 25° C.  $A = 0.509$ .
14. Explain the working of a lead acid battery.

**Turn over**

15. Write a brief account of the various models of electrical double layer.
16. Briefly explain one of the theories of hydrogen over voltage.
17. Draw **stereographic** projection for (222) system.
18. Write briefly on the application of **non-stoichiometric** compounds.
19. Briefly explain **Meisner** effect.
20. Explain the working of a laser.
21. Calculate the residual entropy of  $\text{H}_2\text{O}$ .
22. Evaluate translational partition function of  $\text{CO}_2$  at  $0^\circ\text{C}$ . and 1 atm. pressure.
23. Derive an equation for the vibrational contribution towards heat capacity of gases.
24. Briefly explain Bose-Einstein condensation.

(8 x 2 = 16)

### Part C

*Answer any two questions.*

*Each question carries a weightage of 4.*

25. What are the assumptions in **Debye-Hückel theory** ? Following the theory, derive **Debye Hückel** limiting law.
26. Derive **Butler-Volmer** equation.
27. Derive Maxwell **Boltzman** statistics. Discuss.
28. Apply Fermi Dirac statistics for electrons in metals. Discuss.

(2 x 4 = 8)