

**17P218**

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Name.....

Reg. No.....

**SECOND SEMESTER M.Sc. DEGREE EXAMINATION, MAY 2018**

(Regular/Supplementary/Improvement)

(CUCSS - PG)

**CC15P CH2 C08 - ELECTROCHEMISTRY, SOLID STATE CHEMISTRY AND  
STATISTICAL THERMODYNAMICS**

(Chemistry)

(2015 Admission onwards)

Time: Three Hours

Maximum:36 Weightage

**Section A**

Answer *all* questions. Each question carries 1 weightage.

1. How does  $E_{\text{cell}}$  depend on concentration? Explain.
2. Represent the lead-acid storage cell. Explain the electrode reactions of the cell.
3. X rays of 0.1537 nm from a Cu target are diffracted from the (111) planes of an FCC metal. The Bragg angle is  $19.2^\circ$ . Calculate the Avogadro number if the density of the crystal is  $2698 \text{ kg/m}^3$  and the atomic weight 26.98.
4. Construct and explain the stereographic projection of 2-fold rotation axis.
5. Write down any two advantages of overvoltage.
6. What are the characteristics of a superconductor in a Meissner state?
7. Why paramagnets never achieve saturation magnetization experimentally?
8. How does the BCS theory explain the phenomenon of superconductivity?
9. Calculate the translational partition function of an  $\text{I}_2$  molecule at 300K. Assume V to be 1 liter.
10. State the equipartition principle.
11. Show that the limiting value of heat capacity of solids at constant volume and at high temperature, calculated by Debye's formula is  $3R$ .
12. Account for the fact that Maxwell-Boltzmann distribution law is the classical limit of Bose-Einstein and Fermi-Dirac distribution laws.

**(12 x 1 = 12 Weightage)**

**Section B**

Answer any *eight* questions. Each question carries 2 weightage.

13. What are fuel cells? Explain the cell reactions of a) alkaline fuel cells and phosphoric acid fuel cells.
14. Explain the significance of Debye-Hückel, limiting law to calculate the effect of ionic strength on ion reaction rates in solution.

15. What are Bravais lattices? Write a short note on the Bravais lattices of the seven crystal systems?
16. What are point groups? Explain the properties of crystallographic point groups.
17. Explain the working principle of polarographic analysis. Why mercury is used as the working electrode in polarography?
18. Explain: a) Mechanism of luminescence using suitable examples. b) Colour centre defect in solids.
19. How can we classify materials with respect to exchange integral? At what temperature do materials lose their ferro-, anti ferro- and ferrimagnetic properties?
20. Describe the concentration polarization in detail using suitable diffusion models.
21. Stirling's approximation is an integral part of derivation of Maxwell-Boltzmann distribution. Explain.
22. Define equilibrium constant. Using the partition functions, Show that the equilibrium constant itself is only a function of temperature.
23. Discuss Fermi-Dirac statistics using the electron gas model.
24. Explain the superfluidity of liquid helium using Bose-Einstein condensate.

**(8 x 2 = 16 Weightage)**

### **Section C**

Answer any *two* questions. Each question carries 4 weightage.

25. Write a note on imperfections in solids. How do defects affect material properties?
26. Explain Tafel's theory of over voltage. How is over voltage determined experimentally?
27. Describe the molecular partition functions. Explain its importance in calculating the thermodynamic properties of a system of independent particles.
28. Explain in detail the electrical and thermal properties of solids.

**(2 x 4 = 8 Weightage)**

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