

18P216

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Name:.....

Reg. No:.....

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2019

(Regular/Improvement/Supplementary)

(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 has 1 weightage.

1. Write down the Nernst equation for potential of hydrogen electrode. Describe the terms involved.
2. Give the electrode reactions in phosphoric acid fuel cell.
3. Write Butler-Volmer equation. What is its significance?
4. Define electrolytic polarization.
5. What are screw axes?
6. Give the Hermann–Mauguin notations for D_{2d} and T_d point groups.
7. Explain the effect of temperature on Ferrimagnetic materials.
8. Sketch the first brillouin zone of the simple cubic lattice.
9. What do you mean by statistical weight factor?
10. What are ensembles? Give the basic expression for microcanonical ensemble.
11. State Dulong-Petit law.
12. Account for the statement “Heat capacity decreases exponentially with temperature at low temperatures.”

(12 x 1 = 12 Weightage)

Section B

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

13. Illustrate how cell potential could be derived from the Gibb’s free energy change of a reaction?
14. Explain the Debye-Hückel equation. How can we evaluate the effect of ionic strength on reaction rates in solution using the Debye-Hückel equation?
15. Write a note on oxygen overvoltage. Explain the effect of electrode material and nature of electrolyte on oxygen overvoltage.

16. Describe the correlation between electrode kinetics and electrical double layer structure.
17. Write a note on imperfections in solids.
18. Explain the features of stereographic projections of crystal faces. Sketch and describe the stereographic projection of monoclinic system.
19. Define Hall Effect. Explain how Hall Effect can be used to determine the conductivity of semiconductors?
20. Explain the Electronic Band theory of solids.
21. Explain the principle of equipartition of energy in terms of partition functions.
22. Give the significance of Sterling approximation in entropy calculations.
23. Debye temperature for copper is 445 K. Calculate the thermal energy of one mole of copper at Debye temperature on the basis of classical theory of heat capacity.
($k_B = 1.38 \times 10^{-23} \text{ JK}^{-1}$)
24. Define super fluidity and correlate it to Bose-Einstein condensation.

(8 x 2 = 16 Weightage)

Section C

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

25. Explain in detail the principle and applications of polarography. What are the limitations of this electroanalytical process?
26. Describe the various optical properties of solids.
27. What are canonical partition functions? Derive the thermodynamic total energy from the partition functions.
28. Explain Einstein's quantum theory of heat capacity of solids.

(2 x 4 = 8 Weightage)
