

C 63030

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Name.....

Reg. No.....

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2019

(CUCSS)

Chemistry

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

(2015 Admissions)

Time : Three Hours

Maximum : 36 Weightage

Section A

Answer all questions.

Each question carries 1 weightage.

1. Write equation for the activity of the following electrolyte in terms of molal concentration 'm' and mean conic activity co-efficient :
(a) LaCl_3 ; (b) $\text{Ca}_3(\text{PO}_4)_2$.
2. Write electrode reactions for H_2 - O_2 fuel cell under (a) acidic condition ; (b) alkaline condition.
3. Write Tafel equation. Explain the significance of slope and intercept of a Tafel plot.
4. What is transfer co-efficient (α) ? Explain its significance.
5. Write Hermann Maugin symbol for (a) D_4h ; (b) C_{2v} .
6. Explain with examples 'screw axis' and glide plane.
7. A plane cuts the axes at $2a$, $3b$ and $1c$. Find Miller indices.
8. Explain the term "birefringence".
9. Define thermodynamic probability. How is it related to entropy ?
10. Arrange translational, rotational, vibrational and electronic partition function in the increasing order of magnitude. Justify your answer.
11. Find characteristic temperature of HCl. The fundamental vibrational frequency is 2990 cm^{-1}
12. Explain with example 'dilute system'.

Section B

(12 × 1 = 12 weightage)

Answer any eight questions.

Each question carries 2 weightage.

13. Calculate the thickness of ion atmosphere around k^+ in 0.01 molal KCl at 25°C . in water. Dielectric constant of water is 78.5.
14. Discuss the working of a methanol fuel cell.

Turn over

15. What are the contributing factors to "over voltage" ? Discuss.
16. Show that 5-fold axis of symmetry is absent in solids.
17. Briefly explain Meisner effect.
18. Discuss briefly the working of a two-stage laser.
19. Derive an equation for rotational partition function for a rigid rotor.
20. Calculate translational entropy for CO_2 at 1 atm. pressure and 0°C .
21. Discuss Bose-Einstein condensation.
22. Calculate heat capacity of diamond at 1000 K. Characteristic temperature is 1860 K.
23. What are the advantages of a "dropping mercury electrode" in polarography ?
24. Draw stereographic projection for 'mmm'. Discuss.

(8 × 2 = 16 weightage)

Section C

Answer any two questions.

Each question carries 4 weightage.

25. Derive Debye Hückel limiting law. Discuss.
26. Derive Butler-Volmer equation. Discuss.
27. (a) How would you calculate equilibrium constant of a reaction using molecular data ? Discuss.
(b) Derive an equation for the vibrational contribution towards heat capacity of solids. Show that it approximates to R at very high temperatures.
28. Apply Fermi Dirac statistics for electrons in metals. Discuss.

(2 × 4 = 8 weightage)