

8. (a) State and justify the use of relaxation and electrophoretic effect to deduce the Debye-Huckel-Onsagar equation of Coulombic conductance.
- (b) Calculate the ionic strength of a solution containing 0.01 moles kg^{-1} of Cupric Sulphate and Aluminium Sulphate.
9. (a) Define Zero Point Energy.
- (b) What are Hermitian Operators ?

(PG508)

Roll No.

S.C.No.—701102

M. Sc. EXAMINATION, 2021

(First Semester)

(Main/Re-appear) (2020/2019)

CHEMISTRY

19CHE102

Physical Chemistry-I

Time : 2 Hours

Maximum Marks : 80

Note : Attempt any *Four* questions. All questions carry equal marks.

1. (a) Discuss the basic postulates of quantum mechanics.
- (b) Find the value of commutator for the $[L_x, L_z]$ and $[L^2, L_y]$.
2. (a) Derive an expression for energy of particle in 3D-box and also discuss the concept of degeneracy.

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- (b) Discuss the ladder operators and their significance. Also discuss the Uncertainty principle.
3. (a) Derive an expression for the determination of partial molar volume of binary components.
(b) Explain the Entropy change in reversible and irreversible processes.
4. (a) Derive an expression for the determination of molar free energy change in the ideal gas mixture.
(b) Show that the molar free energy of mixing for a ternary ideal gas mixture is minimum when they are present in equimolar ratio.
5. (a) Give explanation for different hypothesis for unimolecular reaction and discuss Hinshelwood's treatment with limitations over Lindemann-Christiansen Hypothesis for Unimolecular reactions.
- (b) Derive the integrated rate law expression for second order reaction having different reactants.
6. (a) What are chain reactions ? Drive an expression for rate of formation of HCl and explain, how Thermal and Photochemical induced modes for this reaction are different.
(b) For a gas phase unimolecular reaction at temperature 298 K, the number of molecules colliding per second is 2.17×10^{13} . Calculate the entropy of activation in $\text{JK}^{-1}\text{mol}^{-1}$.
7. (a) Explain the behaviour of weak and strong electrolytes on the basis of Debye-Huckel theory. What type of modifications were made by Onsagar and why ?
(b) The mean activity co-efficient in a $0.500 \text{ mol kg}^{-1} \text{ LaCl}_3$ (aq.) solution is 0.303 at 25°C . What is the percentage error in the value predicted by Debye-Huckel limiting law ?