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CHH/ACH/OCH/CAH 453

II Semester M.Sc. Degree Examination, September/October 2022
(CBCS – 2016-17 Syllabus) (Freshers and Repeaters)
CHEMISTRY/APPLIED CHEMISTRY/ORGANIC CHEMISTRY/ANALYTICAL
CHEMISTRY
Advanced Physical Chemistry

Time : 3 Hours

Max. Marks : 70

Instructions : 1) Answer Part – **A** and **any four** questions from Part – **B**.
2) Figures to the **right** indicate marks.

PART – A

1. Answer **all** sub-divisions. **(9×2=18)**
- a) Explain the significance of Van't Hoff reaction isochore.
 - b) Write any two applications of Gibbs Helmholtz equation.
 - c) State and explain Lewis Randall rule.
 - d) Differentiate between Bosons and Fermions.
 - e) Define electronic partition function. Give its significance.
 - f) Write the relationship between force and flux with suitable example.
 - g) State the conditions for orthogonality and normalization of wave functions.
 - h) Set up the kinetic energy operator for a particle moving in one direction.
 - i) Using molecular orbital theory, calculate the bond order of O₂.

PART – B

Answer **any four full** questions. **(4×13=52)**

2. a) By deriving a suitable mathematical expression, explain the variation of chemical potential with temperature. **5**
- b) Derive any two Maxwell's relations. **4**
- c) Explain the intercept method for the determination of partial molar volume. **4**

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3. a) State Nernst heat theorem and compare it with third law of thermodynamics. Write the applications of the theorem. **6**
- b) Describe the variation of fugacity with pressure and temperature. **4**
- c) Explain the entropy change for the isothermal expansion of an ideal gas with suitable equation. **3**
4. a) Derive Sackur-Tetrode equation for a monoatomic gas. **6**
- b) Calculate the translational partition function of benzene in a volume of 1m^3 at 298 K. (Given : $m = 1.295 \times 10^{-25} \text{ kg mol}^{-1}$, $k = 1.38 \times 10^{-23} \text{ JK}^{-1}$, $h = 6.626 \times 10^{-34} \text{ Js}$, $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$). **3**
- c) Describe the irreversible thermodynamics of biological systems. **4**
5. a) Outline Einstein theory of heat capacity of solids. **8**
- b) Give a comparative account of different statistical distributions. **5**
6. a) Give a comparative account of valence bond and molecular orbital theories. **6**
- b) Construct quantum mechanical operator for angular momentum. **4**
- c) Define eigen functions and eigen values. Explain their physical significance in quantum mechanics. **3**
7. a) Obtain and solve Schrodinger equation for a particle in three dimensional box. **8**
- b) Discuss the applications of Huckel molecular orbital theory to ethylene molecule. **5**
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