

(E) How bond length of diatomic molecules is determined with the help of rotational spectra ? 2½

(F) Explain selection rule for pure vibrational spectra. Out of H_2 , O_2 , N_2 , HCl , NO and CH_4 which will give pure vibrational spectra ? 2½

5. Attempt any **TEN** of the following :

- (i) What do you mean by efficiency of a system ?
- (ii) Define “Chemical Potential”.
- (iii) Why Helmholtz’s free energy is now called Helmholtz’s work function ?
- (iv) Define an electrochemical cell.
- (v) Why KCl is not used in the salt bridge in case of Cu-Ag Cell ?
- (vi) How is an oxidation-reduction electrode set up ?
- (vii) Define ‘Nuclear fission’.
- (viii) Define ‘Dipole moment’. What is its SI unit ?
- (ix) Write the relation between dielectric constant and dipole moment of a substance.
- (x) What is zero point energy ? What does it indicate ?
- (xi) Define force constant. State its SI unit.
- (xii) Write Morse equation. 10×1=10

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**Bachelor of Science (B.Sc.) Semester-IV
(C.B.S.) Examination
CHEMISTRY (Physical Chemistry)
Paper-II (CH-402)**

Time—Three Hours] [Maximum Marks—50

N.B. :— (1) All **FIVE** questions are compulsory and carry equal marks.

(2) Draw diagrams wherever necessary.

1. (A) Derive an expression for the entropy change accompanying the isothermal expansion of an ideal gas. 5
- (B) Derive Van’t-Hoff reaction isotherm. 5

OR

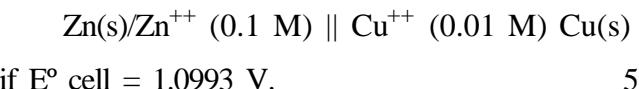
- (C) Derive Gibb’s Helmholtz equation. 2½
- (D) The free energy change for a reaction :

$N_2(g) + 3H_2(g) \rightleftharpoons 2(NH_3)(g)$
is -33.20 kJ at $25^\circ C$. Calculate the equilibrium constant. 2½

- (E) Give any five statements of 2^{nd} law of thermodynamics. 2½
- (F) Calculate the total entropy change when 5 moles of ice is converted into water at $0^\circ C$. The latent heat of fusion of ice is 80 cal gm^{-1} . 2½

2. (A) How can you determine various thermodynamic quantities such as ΔH , ΔG and ΔS accompanying the cell reaction ? 5

(B) Derive Nernst equation of EMF of a cell. Calculate the EMF of a cell at 25°C :



OR

(C) Define "Liquid junction potential". How can it be eliminated ? 2½

(D) How is pH of a solution calculated by using glass electrode ? 2½

(E) Derive an expression for emf of a concentration cell with transference. 2½

(F) Discuss briefly reversible and irreversible cells. 2½

3. (A) Discuss the liquid drop model of nucleus. What are the evidences in its favour and its limitations ? 5

(B) Explain the application of dipole moment in :
 (i) Differentiating O, M and P-isomers and
 (ii) Predicting the geometry of molecules. 5

OR

(C) Discuss applications of radioisotopes in :
 (i) Medical Science and
 (ii) Agriculture. 2½

(D) Calculate the binding energy per nucleon in helium atom $[_2^4\text{He}]$ which has a mass of 4.0026 amu. Calculated atomic mass is 4.03298 amu (1 amu = 931.5 MeV) 2½

(E) Explain Polarization of molecules in the electric field. 2½

(F) How is percentage of ionic character of a polar covalent bond calculated with dipole moment ? 2½

4. (A) What do you understand by non-rigid rotor ? Explain how its spectra differs from rigid rotor. Calculate rotational constant of HCl molecule. The H–Cl bond length is $136 \times 10^{-12} \text{ m}$. The reduced mass of molecule is $1.626 \times 10^{-27} \text{ kg}$. ($\hbar = 6.626 \times 10^{-34} \text{ JS}$, $C = 3 \times 10^8 \text{ ms}^{-1}$). 5

(B) What are harmonic and anharmonic oscillators ? Draw their potential energy diagram. What is fundamental band and overtones ? 5

OR

(C) The rotational constant of CO molecule is 166 m^{-1} . Calculate bond length if its reduced mass is $1.24 \times 10^{-26} \text{ kg}$. 2½

(D) Calculate number of modes of vibrations in NO molecule and show them with vibrational frequency. 2½