

Name: Enrolment No:			
UPES End Semester Examination, December 2025 Course: Inorganic Chemistry Program: BSc Physics/ BSc (H)Geology Course Code: CHEM1020 Semester: I Time : 03 hrs. Max. Marks: 100 Instructions: 1. Use of scientific calculator is allowed. 2. Attempt all questions. 3. Q 8 and Q 11 have internal choices.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	State Aufbau principle and highlight its significance in atomic structure.	4	CO1
Q 2	Using Slater's rules, calculate the effective nuclear charge (Z^*) experienced by a 3d electron in Cobalt ($Z = 27$).	4	CO2
Q 3	Draw and explain the Lewis structure of $(CH_3)_2CO$.	4	CO3
Q 4	Briefly describe Schottky and Frenkel defects in solids.	4	CO4
Q 5	Explain how Fajan's rule explains the relative covalent/ionic character of LiI and CsI pair.	4	CO4
SECTION B (4Qx10M= 40 Marks)			
Q 6	Deduce the possible sets of all four quantum numbers with $n = 4$. Write the names of the sub-orbitals.	10	CO1
Q 7	a) Calculate electronegativity of carbon at Pauling scale given that $E_{H-H} = 104.2$ kcal/mol, $E_{C-C} = 83.1$ kcal/mol, $E_{C-H} = 98.8$ kcal/mol, electronegativity of hydrogen = 2.1 b) On the same scale, the electronegativity of Sulphur is 2.5 and that of Oxygen is 3.5. Why is Sulphur less electronegative than Oxygen.	5 + 5	CO2
Q 8	Write short-notes on the following: a) Bent's rule b) Equivalent and non-equivalent orbitals OR Explain the types of hydrogen bonding in molecules with suitable examples.	10	CO3

Q 9	Compare the structures of NH_3 and BF_3 based on VSEPR theory.	10	CO4
SECTION-C (2Qx20M=40 Marks)			
Q 10	a) Draw a Born-Haber cycle for the formation of CuBr(s) lattice and calculate the lattice energy of CuBr(s) using the given data: <i>Data:</i> Enthalpy of sublimation of Cu(s) = 337.7 kJ/mol 1st ionization energy of Cu(g) = 745 kJ/mol Enthalpy of vaporization of $\text{Br}_2(\text{l})$ = 29.96 kJ/mol Bond dissociation energy of $\text{Br}_2(\text{g})$ = 193.87 kJ/mol 1st electron affinity of Br(g) = -324.54 kJ/mol Standard enthalpy of formation of CuBr(s) = -104.6 kJ/mol b) Discuss <u>any five</u> applications of Born-Haber cycle.	10 + 10	CO3
Q 11	a) Draw the Molecular Orbital diagram to show the structures of O_2 and HCl molecule. b) Discuss in detail the types of weak chemical forces that exist between molecules. OR a) Define semiconductors and discuss different types of semiconductors with energy band diagrams. b) Illustrate 'band model' in metals and explain how it accounts for conductors, semiconductors and insulators.	10 + 10	CO4