B.Sc. 3rd Semester (Honours) Examination, 2020 (CBCS)

Subject: Chemistry

(Inorganic Chemistry-II)

Paper: CC-6

Time: 2 Hours   **Full Marks: 40**

Candidates are required to give their answers in their own words as far as practicable

Answer any *eight* questions from the following: **8 × 5 = 40**

1. Write and explain Fajan's polarization rules. Predict the ionic or covalent nature of CsCl and AuCl using Fajan's rule.

2. Write down the hybridization, geometry and shapes of $\overset{\bullet}{C}H_3$ and $\overset{\bullet}{C}F_3$ using VSEPR theory.

3. Write down the necessary conditions of linear combination of atomic orbitals (LCAO) to form molecular orbital (MO). "The bond length in N_2^+ is greater than that in N_2 while bond length in NO^+ is less than that in NO". Explain the observation using MO theory.

4. 'Binding energy for majority of elements lie in the region of 7.5 to 8.0 MeV.' Explain.
   The binding energy per nucleon of ^{16}O is 7.97 MeV and that of ^{17}O is 7.75 MeV. Calculate the energy needed to remove a neutron from ^{17}O.

5. What are equivalent and non-equivalent hybrid orbitals? Do you except the structure of PCl_3F_2 and PF_3Cl_2 to be different? If so, why?

6. Discuss the principle of 'Radiocarbon dating'. Is it possible to find out the age of a flowering plant by this method? Comment.

7. Define lattice energy. Establish Born-Haber cycle for the formation of MgS(s) starting from Mg(s) and S_8(s), and hence calculate the electron affinity of S(g) for the $S(g)+2e \longrightarrow S^{2-}(g)$ reaction using the thermochemical data given below:
   Enthalpy of formation = 345 kJmol^{-1}, Enthalpy of sublimation of Mg(s) = 153 kJmol^{-1}, Sum of 1st and 2nd ionization potentials of Mg(g) = 2187 kJmol^{-1}, Enthalpy of atomization of S_8(s)= 559 kJmol^{-1}, Lattice energy of MgS(s) = 2948 kJmol^{-1}. Here 's' and 'g' stands for solid and gas, respectively.

8. Distinguish between intramolecular and intermolecular hydrogen bonding with suitable examples. 'In water methane is sparingly soluble whereas the solubility of methanol is high in water.' Explain

9. Write short notes on 'artificial radioactivity' and 'nuclear spallation reaction'.

10. 'The more polar the bond in a diatomic molecule the higher is the dipole moment' Comment. Calculate the formal charge on sulphur in SO_3 and SO_2.