GGSIPU EAST DELHI CAMPUS
Mid Term Examination-2023

Subject: Engineering Chemistry-I (BS-109) **Semester: I**
Time: 1.5 h **MM: 30**

Note: *Question no. 1 is compulsory. Attempt any four questions from question no.2 to question no.6.*

1: Attempt any five questions. Each question carries 02 marks. **(2 x5 = 10)**

a) Derive de-Broglie equation.
b) Arrange the following species in order of their increasing size:
N^{3-}, O^{2-}, F^-
c) What are the n, l and m values for 3s and $3d_{xy}$ electrons?
d) What is effective atomic number rule? Calculate effective atomic number for the central metal ion in: (i) $K_4[Fe(CN)_6]$ (ii) $[Ni(NH_3)_6]Cl_2$
e) The electron affinity of F is less than that of Cl, Why?
f) Write down the electronic configuration of Cu (A.N. 29) and Cr (A.N. 24).
g) Discuss the hybridization and the molecular geometries of the following:
(i) H_2O (ii) CH_4 (iii) NH_3 (iv) SiF_4
(Atomic number: C = 6, N = 7, O = 8, Si = 16)

2. What are the postulates of VSEPR theory? Using this theory explain the shapes of H_2O, NH_3 and SiF_4. (5)

3. Write down the mathematical expression of Schrödinger equation in Cartesian coordinates. Convert it into polar coordinates. (5)

4. Write the molecular orbital electronic configuration and draw the molecular orbital energy diagram for O_2^+ molecule. Calculate its bond order and predict its magnetic property. (5)

5. Write short notes on: (2.5+2.5)

(a) Kirchhoff's Equation.

(b) Hess's Law

6. (a) Define heat of neutralization. (1+4)

(b) Calculate the lattice energy in kJ/mol when solid MgF_2 is formed from its elements: $Mg(s) + F_2(g) \rightarrow MgF_2(s)$. Sketch a Born-Haber cycle for the process.

$\Delta H_{sublimation} = 147.7$ kJ/mol
Bond Dissociation Energy, D ($F_2(g)$) = 158 kJ/mol
$E_{i1} = 737.7$ kJ/mol
$E_{eg} = -328$ kJ/mol
$E_{i2} = 1450.7$ kJ/mol
Formation of MgF_2: $Mg^{2+}(g) + 2F(g) \rightarrow MgF_2(s)$
-2957 kJ/mol