

GSE/D-20

791

INORGANIC CHEMISTRY
Paper-I (CH-101)

Time : Three Hours]

[Maximum Marks : 32

Note : Attempt *five* questions in all, selecting at least *one* question from each section. Q. No. 1 is compulsory.

Compulsory Question

1. (a) What is significance of ψ and ψ^2 ?
(b) Write an expression for Schrodinger Wave Equation.
(c) How many orbitals are there in *f*-subshell ?
(d) Which has the smaller size and why ?

H⁻ or He

- (e) In a close packed array of N spheres, how many octahedral holes are present ?
(f) Which is more stable between CO and CO⁺ ?
(g) What is modern periodic law ?
(h) What is the geometry of ICl₂⁻ ion according to VSEPR theory. (1×8=8)

SECTION-A

2. (a) Draw radial probability distribution curve for 3*p* and 4*d* orbital. How many nodes are present in them ? 2

- (b) An electron is present in $4f$ subshell. Write down the possible values of quantum numbers n , l , m and s . 2
- (c) Calculate the effective nuclear charge for an electron in 3d orbital of Zn ($Z = 30$), using Slater's rules. 2
3. (a) Calculate the minimum uncertainty in velocity of a particle of mass 1.1×10^{-27} kg if uncertainty in its position is 3×10^{-10} cm. ($h = 6.6 \times 10^{-34}$ kg m² s⁻¹). 2
- (b) Write down the electronic configurations of Cr^{3+} and $\text{Mo}(Z = 42)$. 2
- (c) Discuss the factors responsible for the stability of half filled and completely filled orbitals. 2
4. (a) Define ionization energy. Discuss the factors on which ionization energy depends. 2
- (b) Define electronegativity. How does it vary along a period and down the group in the periodic table ? 2
- (c) Electron affinity of N is almost zero. Explain. 2
5. (a) Discuss Sanderson's scale of electronegativity. 2
- (b) Define atomic radii. How does the atomic radii of elements vary across a period ? 2
- (c) Size of Cl^- is greater than Cl atom while that of Na^+ is less than that of Na. Explain why ? 2

SECTION-B

6. (a) Calculate the percentage ionic character of carbon-chlorine bond in CCl_4 if the electronegativities of C and Cl are 2.5 and 3.0 respectively. 2
- (b) Discuss the shape of ClF_3 and SO_4^{2-} ion, on the basis of hybridization. 2
- (c) Bond angle of NH_3 is greater than of NF_3 while the bond angle of PH_3 is less than that of PF_3 . Explain. 2
7. (a) Draw MO energy level diagram for CO molecule. Calculate its bond order. 2
- (b) Give postulates of VSEPR theory. 2
- (c) Explain the effect of electronegativity on the shapes of molecules. 2
8. (a) Draw and discuss the structure of zinc blende. 2
- (b) Explain lattice defects in Stoichiometric crystals. 2
- (c) Explain why CuCl and AgCl are insoluble in water while NaCl is soluble in water. 2
9. (a) Calculate the lattice energy of KCl crystal from the following data :

Sublimation energy of $\text{K} = 102.5 \text{ KJ mol}^{-1}$

Dissociation energy of $\text{Cl}_2 = 230.5 \text{ KJ mol}^{-1}$

Ionization energy of K = $450.6 \text{ KJ mol}^{-1}$

Electron affinity of Cl = $-350.2 \text{ KJ mol}^{-1}$

Heat of formation of KCl = $-420.4 \text{ KJ mol}^{-1}$ $2\frac{1}{2}$

- (b) Explain metal excess defects in non-stoichiometric crystals. 2
- (c) Define Polarization and Polarizing power. $1\frac{1}{2}$
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