

Roll No.

Total Pages : 04

GSE/D-21

791

CHEMISTRY

Paper I

Inorganic Chemistry

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.

1. (a) Write the electronic configuration of Pd ($Z = 46$).
- (b) Write an expression for Schrödinger wave equation.
- (c) Which has smaller size and why ?
N or O
- (d) How is bond length related to bond order ?
- (e) Which point defect lower the density of ionic solid and how ?
- (f) Name the type of hybridization of central atom in BF_3 .
- (g) In a close packed array of N spheres, how many tetrahedral holes are present ?
- (h) State ($n + l$) rule. **1×8=8**

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1

Section A

2. (a) State and explain Heisenberg's uncertainty principle. 2
- (b) On the basis of uncertainty principle show that an electron cannot exist in the nucleus. Given radius of nucleus = 10^{-14} m, $h = 6.6 \times 10^{-34}$ kg m².s⁻¹, $m = 9.1 \times 10^{-31}$ kg. 2
- (c) What are the limitations of Aufbau Principle ? 2
3. (a) Draw Radial probability distribution curve for $3d$ and $4s$ orbital. How many nodes are present in them ? 2
- (b) Give the value of n and l for the following subshells : 2
 $3d, 5f, 7s, 6p$
- (c) Using Slater's rules, calculate effective nuclear charge for $3d$ electron in Mn. 2
4. (a) Discuss Pauling scale of electronegativity. 2
- (b) Discuss various factors on which electronegativity depends. 2
- (c) Why first ionization energy of Magnesium is higher than sodium but second ionization energy of sodium is higher than magnesium ? 2

5. (a) The internuclear distance in KCl is 3.14\AA . Calculate the ionic radii of K^+ and Cl^- ions, using Pauling method. **2**
- (b) Out of F and Cl which have higher value of electron affinity and why ? **2**
- (c) What are isoelectronic ions ? Account for the decrease in size of the following isoelectronic ions :
 $\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{Mg}^{2+}$ **2**

Section B

6. (a) Draw MO energy level diagram for NO molecule. Calculate its bond order. **2**
- (b) Explain the structure of PF_5 on the basis of hybridization. **2**
- (c) What are differences between bonding and anti-bonding molecular orbitals ? **2**
7. (a) Calculate the percentage ionic character of HCl molecule from the following data :
 Electronegativities of H and Cl are 2.1 and 3.0 respectively. **2**
- (b) According to valence bond theory oxygen molecule is diamagnetic but molecular orbital theory explains its paramagnetic nature. Justify it. **2**

- (c) Draw the shape of perchlorate ion ClO_4^- on the basis of hybridisation. **2**
8. (a) Draw and discuss the structure of NaCl. **2**
 (b) Write down Fajan's rules. **2**
 (c) Give the difference between Frenkel and Schottky defects. **2**
9. (a) Non-stoichiometric sodium chloride is yellow, why ? **1½**
 (b) What is Born-Haber Cycle ? Give its applications also. **2**
 (c) Calculate the lattice energy of MgF_2 from the following data :
 Sublimation energy = $146.4 \text{ kJ mol}^{-1}$
 Dissociation energy of $\text{F}_2 = 158.8 \text{ kJ mol}^{-1}$
 Ionization energy = 2186 kJ mol^{-1}
 Electron affinity = $-332.2 \text{ kJ mol}^{-1}$
 Heat of formation of $\text{MgF}_2 = -1096.5 \text{ kJ mol}^{-1}$
2½