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Your Roll No. .....

5774

B.Sc. (H) CHEMISTRY/III Sem. **B**

Paper—CHHT-305

INORGANIC CHEMISTRY

(Admission of 2010 and onwards)

Time : 3 *Hours* *Maximum Marks* : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Do any *five* questions.

All questions carry equal marks.

1. (*a*) Compare and contrast the Valence Bond Theory and the Molecular Orbital Theory. 4

(*b*) With the help of Molecular Orbital Theory which of the following species is paramagnetic in nature and which are dia-magnetic in nature : 5

O_2^+, O_2, O_2^-, O_2^{2-} and NO^+

(*c*) Explain on the basis of Molecular Orbital Theory which of the following species will have identical Bond orders : 3

O_2^-, NO^+ and N_2

P.T.O.

(*d*) What are the conditions for hybridization ? Give the characteristics of hybrid orbitals. 3

2. (*a*) Which of the following complexes are stable ? Explain on the basis of HSAB principle : 4

$[Co(CN)_5 I]^{3-}$, $[Co(N)_5 F]^{3-}$, $[Co(NH_3)_5 I]^{2+}$, $[Co(NH_3)_5 F]^{2+}$

(*b*) On the basis of VSEPR theory predict the shapes of the following molecules : 6

IF_7 and $[ICl_4]^-$, BrF_3

(*c*) Which out of the two will have a shorter bond angle and give reason for your answer : 5

H_2S or H_2O

3. (*a*) Predict the shape of PCl_5 and explain why the equatorial and axial bond lengths in PCl_5 are not equal ? 5

(*b*) If X, Y and Z represents elements of atomic numbers 9, 17 and 55 respectively, predict the type of bonding you would expect to occur between (*a*) X and Y, (*b*) X and Z, (*c*) Y and Z. Predict giving reasons the volatility, electrical conductance and solubility in water of the compounds thus formed. 10

4. (*a*) What is a conjugate acid base pair ? Explain with suitable examples that a strong acid will always have a weak conjugate base and a weak acid has a strong conjugate base. 5

(*b*) Bond energy of a single covalent bond is approximately 200 kJ $Mole^{-1}$. But the bond energy of H-H single bond is 458 kJ $Mole^{-1}$. Explain. 4

(*c*) Explain why CuCl and AgCl are insoluble in H_2O and NaCl is soluble in H_2O. 6

5. Give reasons for the following :

(*a*) Draw possible resonating structures of azide union N_3^-. How do they differ from those of hydrozoic acid HN_3 ? 5

(*b*) AgI_2^- complex is stable but AgF_2^- is unstable. 3

(*c*) CsF reacts with LiI even though both are ionic in nature. 3

(*d*) BF_3 combines with F^- and not with H^-. 4

6. Write short notes on :

(*a*) The Band Model of Metals. 5

(*b*) London Forces. 2

(*c*) Hydrogen Bonding. 3

(*d*) Defects in ionic solids. 5

P.T.O.

7. (*a*) Drive Born Lande's expression to calculate the Lattice Energy of ionic crystal. 7

(*b*) Draw Born Haber cycle and calculate lattice energy of sodium chloride from the following data : 8

Heat of sublimation of sodium = 10.5 kJ mol^{-1}

Dissociation energy of Cl_2 = 243.0 kJ mol^{-1}

Ionization energy of Na = 495.2 kJ mol^{-1}

Electron affinity of chlorine = –348.3 kJ mol^{-1}

Enthalpy of formation of NaCl = –381.8 kJ mol^{-1}