

**Inorganic Chemistry- Competitive Examination (2015-2016)  
Ph.D Applicants**

**Q1-(60 deg) -Choose the right answer for each of the following statements:**

- a-The molecule of  $sp^3d$  hybridization ( $SO_3$ ,  $I_3^-$ ,  $[SnCl_3]^-$ ,  $S_2O_4^{2-}$  )
- b- Following the Lewis octet rule, the formal charge of Cl =+3 in ( $HClO_4$ ,  $HClO_3$ ,  $HOCl$ ,  $ClF_3$ )
- c-The octet rule of central atom is obeyed in ( $ClF_3$ ,  $ICl_4^-$ ,  $IF_6^+$ ,  $BF_4^-$ )
- d- According to MOT, the molecule of the highest bond order ( $CN$ ,  $O_2$ ,  $NO$ ,  $CO$ )
- e-The complex that shows d-d transitions is (  $[Os(H_2O)_6]^{3+}$ ,  $HgI_4^{2-}$ ,  $[Sc(H_2O)_6]^{3+}$ ,  $[Y(H_2O)_6]^{3+}$  )
- f-The term symbol for the ground state of Pt (g) is ( $^2D$ ,  $^3F$ ,  $^1S$ ,  $^3D$ ,  $^3G$ )
- g-The Lewis acid is ( $R_3As$ ,  $SiCl_4$ ,  $CF_4$ ,  $SO_4^{2-}$ )
- h-The complex that obeys the 18 electron rule (  $Mn(CO)_5$ ,  $NiF_6^{4-}$ ,  $Ni(PPh_3)_4$ ,  $Co(CO)_4$ , )
- i-The strongest oxidizing agent (  $FeO_4^{2-}$ ,  $OsO_4^{2-}$ ,  $RuO_4^{2-}$  )
- j- The molecule of  $D_{4h}$  point group ( $SO_4^{2-}$ ,  $ClO_4^-$ ,  $PtCl_4^{2-}$ ,  $CH_4$ , )

**Q2-(20 deg) Arrange the followings according to specified order**

- a-  $IF_7$ ,  $NCl_3$ ,  $ICl_4^-$ ,  $BrF_3$  ( increased degree of hybridization, specify the types of hybridizations )
- b-  $[Os(H_2O)_6]^{3+}$ ,  $[Ru(H_2O)_6]^{3+}$ ,  $[Fe(H_2O)_6]^{3+}$  ( increased value of  $\Delta^o$  )
- c-  $Ni(CO)_4$ ,  $Ni(CO)_3PF_3$ ,  $Ni(CO)_3(PPh_3)$ ,  $[Fe(CO)_4]^{2-}$  ( increased degree of back donation )
- d-  $NiF_6^{2-}$ ,  $RhCl_6^{4-}$ ,  $[Ni(NH_3)_6]^{2+}$  (highest value of spin magnetic moment  $\mu_{s.o}$ , give the values of  $\mu_{s.o}$  )
- e-  $PO_4^{3-}$ ,  $SO_2$ ,  $SO_3^{2-}$  ( Increased resonance structures- draw the resonance structures )

**Q3- a (10 deg) -Give the electron arrangement and energy level diagrams for the complex  $[Co(NH_3)_6]^{3+}$  following both CFT and MOT arrangements.**

- b- (10 deg) Choose the most stable oxidation state of each of the following metals in their chloride salts : ( $Pb^{2+}$ ,  $Pb^{4+}$ ) ( $Mn^{4+}$ ,  $Mn^{2+}$ ,  $Mn^{7+}$ ) ( $Cr^{3+}$ ,  $Cr^{6+}$ ), ( $Tl^+$ ,  $Tl^{3+}$ ,  $Tl^{2+}$ ), ( $Si^{2+}$ ,  $Si^{4+}$ ), ( $Bi^{3+}$ ,  $Bi^{5+}$ )