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^-, $[SnCl_3]^-$, $S_2O_4^{=}$)

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, $SO_4^{=}$)

h-The complex that obeys the 18 electron rule ($Mn(CO)_5$, $Ni\ F_6^{4-}$,$Ni(PPh_3)_4$, $Co(CO)_4$,)

i-The strongest oxidizing agent ($FeO_4^{=}$, $OsO_4^{=}$, $RuO_4^{=}$)

j- The molecule of D_4h point group ($SO_4^{=}$, 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 Δ^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^- (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+})