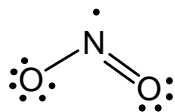


Homework 8

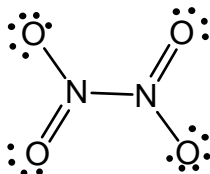
Chapter 20:

16. a. NO_2 , $5 + 2(6) = 17 e^-$



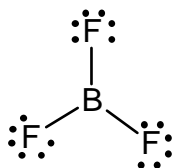
plus other resonance structures

N_2O_4 , $2(5) + 4(6) = 34 e^-$

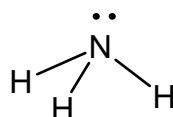


plus other resonance structures

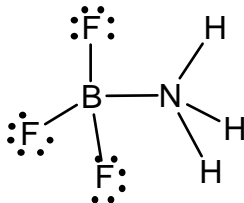
b. BF_3 , $3 + 3(7) = 24 e^-$



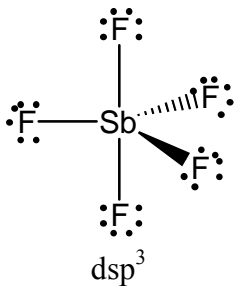
NH_3 , $5 + 3(1) = 8 e^-$



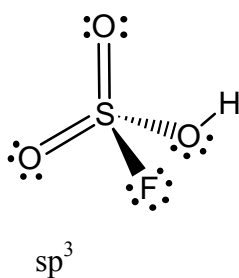
BF_3NH_3 , $24 + 8 = 32 e^-$



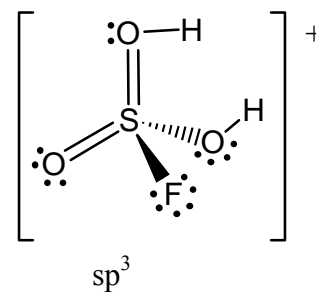
28. a. SbF_5 , 40 valence e^-



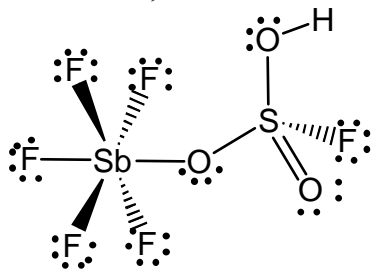
HSO_3F , 32 valence e^-



$\text{H}_2\text{SO}_3\text{F}^+$, 32 valence e^-

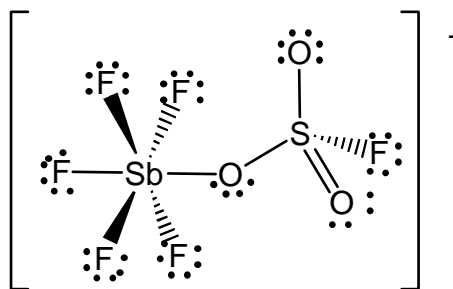


$\text{F}_5\text{SbOSO}_2\text{FH}$, 72 valence e^-



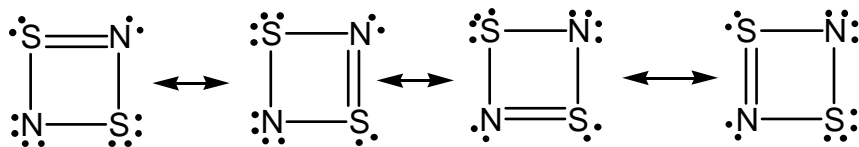
$\text{Sb} = d^2sp^3$, $\text{S} = sp^3$

$\text{F}_5\text{SbOSO}_2\text{F}^-$, 72 valence e^-



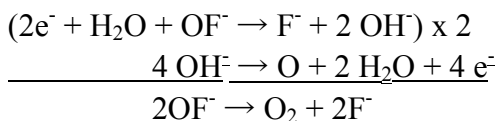
$\text{Sb} = d^2sp^3$; $\text{S} = sp^3$

34. S_2N_2 has $2(6) + 2(5) = 22$ valence electrons



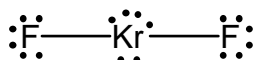
38. a. $F_2 + H_2O \rightarrow HOF + HF$; $2HOF \rightarrow 2 HF + O_2$, $HOF + H_2O \rightarrow HF + H_2O_2$ (dilute acid)

In dilute Base, HOF exists as OF^- and HF exists as F^- . The balanced equation is:

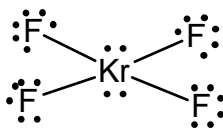


b. HOF: Assign +1 to H and -1 to F. The oxidation state of oxygen is then zero. Oxygen is very electronegative. A zero oxidation state is not very stable since oxygen is a very good oxidizing agent.

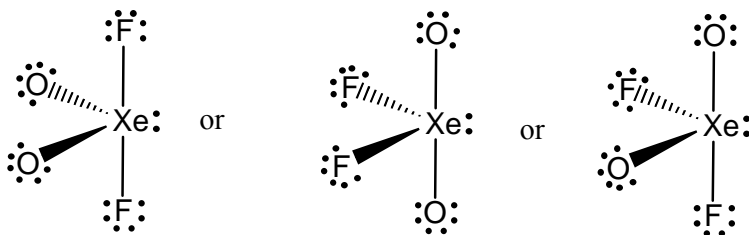
42. a. KrF_2 , $8 + 2(7) = 22 e^-$



KrF_4 , $8 + 4(7) = 36 e^-$

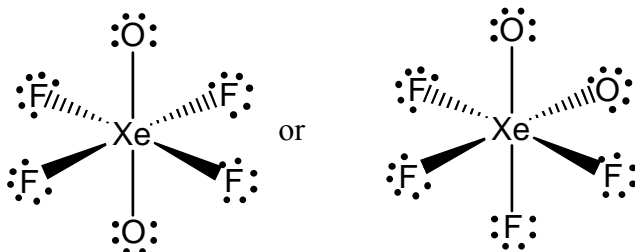


c. XeO_2F_2 , $8 + 2(6) + 2(7) = 34 e^-$



All are see-saw; $\approx 90^\circ$ and $\approx 120^\circ$, dsp^3

d. XeO_2F_4 , $8 + 2(6) + 4(7) = 48 e^-$



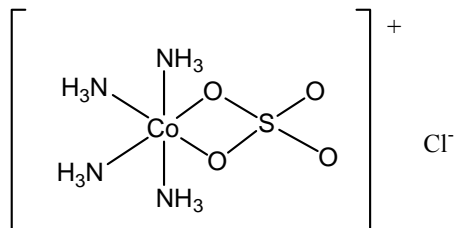
All are: octahedral; 90° ; d^2sp^3

Chapter 21

20. Transition metal ions lose the s electrons before the d electrons.

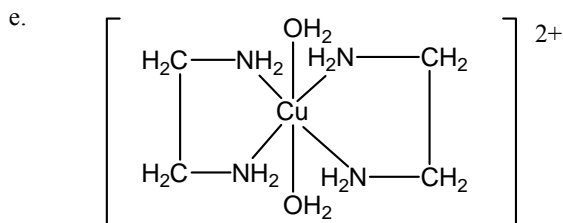
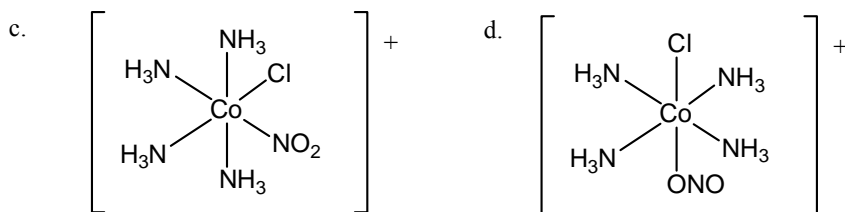
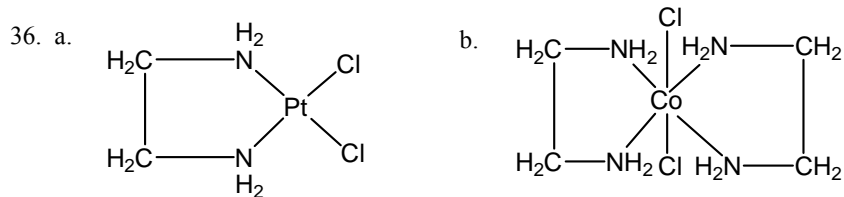
- a. Ni^{2+} : $[\text{Ar}]3d^8$ b. Cd^{2+} : $[\text{Kr}]4d^{10}$
 c. Zr^{2+} : $[\text{Kr}]4d^1$ d. Os^{2+} : $[\text{Xe}]4f^{14}5d^6$; Os^{3+} : $[\text{Xe}]4f^{14}5d^5$

28. BaCl_2 gives no precipitate, so SO_4^{2-} must be in the coordinate sphere. A precipitate with AgNO_3 means the Cl^- is not in the coordination sphere. Since there are only four ammonia molecules in the coordination sphere, the SO_4^{2-} must be acting as a bidentate ligand. The structure is:

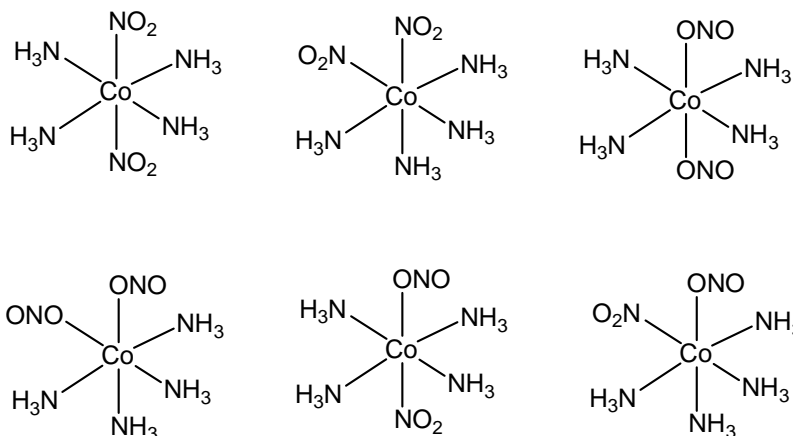


30. a. tetracyanonicklate(II) ion b. tetraamminedichlorochromium(III) ion
 c. tris(oxalate)ferrate(III) ion d. tetraaquadithiocyanatocobalt(III) ion

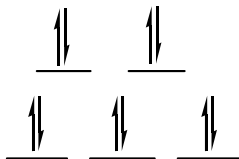
32. a. pentaquabromochromium(III) bromide b. sodium hexacyanocobaltate(III)
 c. bis(ethylenediamine)dinitroiron(III) chloride d. tetraamminediiodoplatinum(IV)
 tetraiodoplatinate(II)



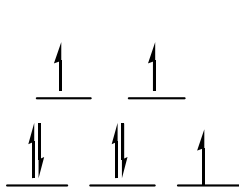
40.



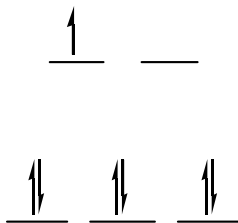
44. a. $\text{Zn}^{2+}: [\text{Ar}]3d^{10}$



b. $\text{Co}^{2+}: [\text{Ar}]3d^7$



High spin, small Δ



Low spin, large Δ

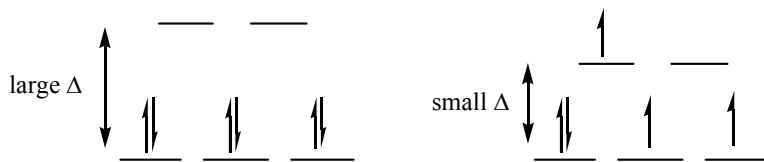
c. $\text{Ti}^{3+}: [\text{Ar}]3d^1$



46. NH_3 and H_2O are neutral ligands, so the oxidation states of the metals are Co^{3+} and Fe^{2+} . Both have six d electrons ($[\text{Ar}]3d^6$). To explain the magnetic properties, we must have a strong-field for $\text{Co}(\text{NH}_3)_6^{3+}$ and a weak field for $\text{Fe}(\text{H}_2\text{O})_6^{2+}$.

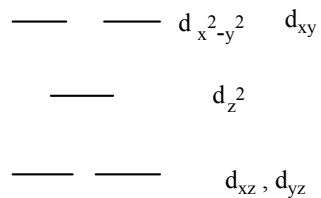
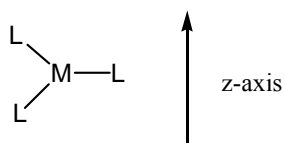
$\text{Co}^{3+}: [\text{Ar}]3d^6$

$\text{Fe}^{2+}: [\text{Ar}]3d^6$



Only this splitting of d -orbitals gives a diamagnetic $\text{Co}(\text{NH}_3)_6^{3+}$ (no unpaired electrons) and a paramagnetic $\text{Fe}(\text{H}_2\text{O})_6^{2+}$ (unpaired electrons present).

72.



The $d_{x^2-y^2}$ and d_{xy} orbitals are in the plane of the three ligands and should be destabilized the most. The amount of destabilization should be about equal when all the possible interactions are considered. The d_{z^2} orbital has some electron density in the xy plane (the doughnut) and should be destabilized a lesser amount as compared to the $d_{x^2-y^2}$ and d_{xy} orbitals. The d_{xz} and d_{yz} orbitals have no electron density in the plane and should be lowest in energy.