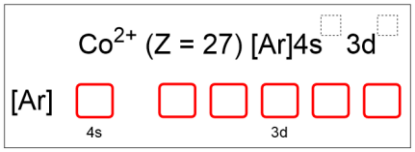
CONCEPT: MAGNETIC PROPERTIES OF COMPLEX IONS: OCTAHEDRAL COMPLEXES

Octahedral Complexes

- For octahedral complexes the type of ligand attached determines how electrons fill their d orbitals.
  - □ _____-field ligands attached = _____ **Δ** = High-spin complex = _____.
  - □ _____-field ligands attached = _____ **Δ** = Low-spin complex.

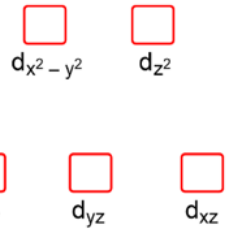
EXAMPLE: Determine the spin and magnetism of the follow complex ion: $[Co(NH_3)_6]^{2+}$.

Step 1: Find the number of d electrons in the transition metal cation.



Step 2: Identify the ligand as strong-field or weak-field.

Step 3: Draw octahedral crystal field splitting diagram.



Step 4: Fill electrons in the split diagram and count the number of unpaired electrons.

PRACTICE: Determine the spin and number of unpaired electrons in the following complex ion: $[Mn(en)_3]^{3+}$.

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PRACTICE: Determine the spin and number of unpaired electrons in the following complex ion: $[Cd(H_2O)_4]^{2+}$.

PRACTICE: Which of the following complex ions is/are diamagnetic in nature?

I. $[Mn(Br_4)]^{2-}$ II. $[V(NO_2)_4]^{4-}$ III. $[Zn(NH_3)_4]^{2+}$ IV. $[Sc(H_2O)_6]^{3+}$