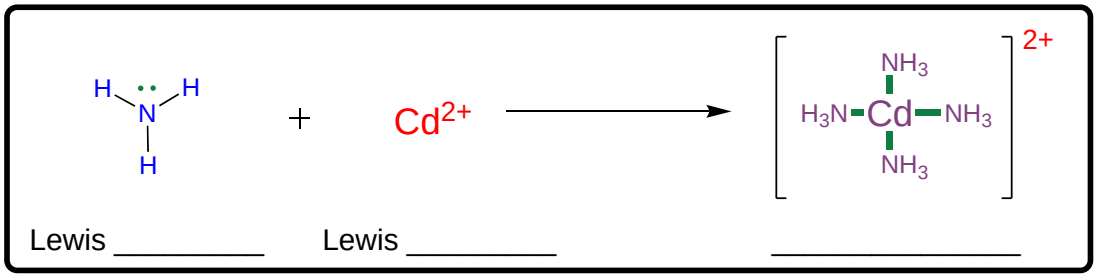
CONCEPT: COMPLEX IONS: FORMATON CONSTANT

- A **complex ion** is a structure containing a metal cation that acts as a Lewis _____ and covalently bonded to a *ligand*.
  - □ **Ligand:** a molecule or ion that acts as a Lewis _____ and donates a lone pair to the metal cation.



Formation Constant

- The **Formation Constant** (___) is a _____ of product to reactant concentrations that deals with complex ions.
  - □ Like other equilibrium constants it can be calculated by setting up an expression and ignoring ____ and ____.

EXAMPLE: The formation of the complex ion created from the combining of silver ion and cyanide ion is given below:

$$Ag^+ (aq) + 2\ CN^- (aq) \rightleftharpoons Ag(CN)_2^- (aq) \quad K_f = 1.0 \times 10^{21}$$

If 100.0 mL of 0.0120 M $AgClO_4$ is mixed with 220.0 mL of 0.25 M CN^-, what is the $[Ag^+]$ once equilibrium has been reached?

STEP 1: Setup an ICE Chart with the given _____ equation.

ICE Chart (Complex Ion)

	$Ag^+ (aq)$	+	$CN^- (aq)$	⇌	$Ag(CN)_2^- (aq)$
I_____					
C_____					
E_____					

STEP 2: Determine the _____ of the metal cation and the ligand anion.

- □ Divide by the _____ volume used in the chemical reaction to determine their initial concentrations.

STEP 3: Using the **INITIAL ROW**, place the initial concentrations of the metal cation and ligand anion.

STEP 4: Using the **CHANGE ROW**, looking at the reactants subtract from their initial amounts by the _____ mole amount.

- □ Using the Law of Conservation of Mass, whatever you lose as a reactant you _____ that amount to products.

STEP 4: Using the **EQUILIBRIUM ROW**, setup the equilibrium constant expression and solve for ____.

- □ The amount of the metal cation in reality will not reach __ so set it to the x variable.

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PRACTICE: If your equilibrium constant K is equal to the product of K_{sp} and K_f, find the solubility of AgCl in 2.0 M NH_3. K_{sp} of AgCl = 1.77×10^{-10}; K_f of $Ag(NH_3)_2^+$ = 1.7×10^7.

PRACTICE: A solution is composed of 3.20×10^{-4} M $Co(NO_3)_3$ mixed with 0.200 M NH_3. Determine the $[Co^{3+}]$ that remains once the solution reaches equilibrium in the formation of $Co(NH_3)_6^{3+}$.