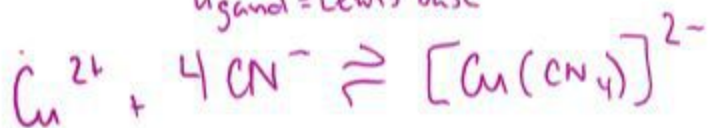
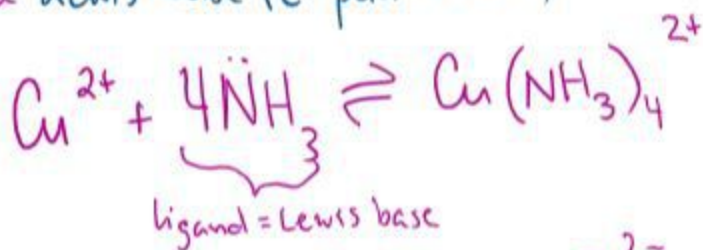
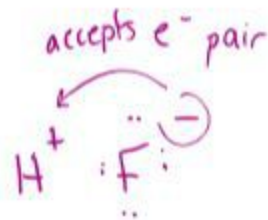


Complex formation

↳ a complex is formed between a Lewis acid (electron pair acceptor/metal cation) and a Lewis base (e^- pair donor)



$$K_f = \frac{[\text{Cu}(\text{NH}_3)_4^{2+}]}{[\text{Cu}^{2+}][\text{NH}_3]^4} = 5 \times 10^{12}$$

→ have large values, meaning formation of complexes are favoured

↳ reduces concentration of free metal ion, so more solid dissolves

↳ Increases solubility

Ex: First, we have insoluble AgCl ($K_{sp} = 1.6 \times 10^{-10}$)



Add ammonia $\rightleftharpoons$

It will use the Ag^+ from rxn 1

$\therefore$ Rxn 1 will shift right to compensate the Ag^+ being used by rxn 2

$\rightarrow$ solubility of AgCl increases



Notice that this rxn uses Ag^+ (Lewis acid)



$$K = K_{sp} \cdot K_f = 1.6 \times 10^{-10} \cdot 1.7 \times 10^7$$

$$K = 2.72 \times 10^{-3}$$

Solubility of Amphoteric Compounds

- Amphoteric oxides and hydroxides can act as either acid/base
↳ are soluble in either strong acid or base



$\text{Al}(\text{OH})_3$ dissolves in stronger acidic soln
due to acid-base rxn



$\text{Al}(\text{OH})_3$ dissolves in strongly basic
solutions due to complex ion formation

Precipitation

↳ if we mix 2 things, will we form an insoluble precipitate?

• Calc. reaction quotient, Q , and compare it to the solubility-product constant, K_{sp}

- ① If $Q = K_{sp}$, then soln @ equilibrium and saturated
- ② If $K_{sp} > Q$, no precipitate
- ③ If $Q > K_{sp}$, precipitate will form

Ex: Mix 275 mL of 0.134 M $\text{Pb}(\text{NO}_3)_2$
125 mL of 0.0339 M NaCl

Will PbCl_2 precipitate? $K_{sp} = 1.6 \times 10^{-5}$



$$K_{sp} = [\text{Pb}^{2+}][\text{Cl}^-]^2$$

$$\text{Pb}^{2+} = (0.275 \text{ L})(0.134 \text{ M}) = 0.03685 \text{ mol Pb}^{2+}$$

$$\text{Cl}^- = (0.125 \text{ L})(0.0339 \text{ M}) = 0.004238 \text{ mol Cl}^-$$

$$\text{Vol} = 0.275 \text{ L} + 0.125 \text{ L} = 0.400 \text{ L}$$

$$Q = [\text{Pb}^{2+}][\text{Cl}^-]^2$$

$$= (0.03685/0.400)(0.004238/0.400)^2$$

$$Q = (0.0921 \text{ M})(0.0106 \text{ M})^2 = 1.03 \times 10^{-5}$$

$$K_{sp} = 1.6 \times 10^{-5} \quad Q = 1.03 \times 10^{-5}$$

$K_{sp} > Q$, $\therefore$ precipitate will not form