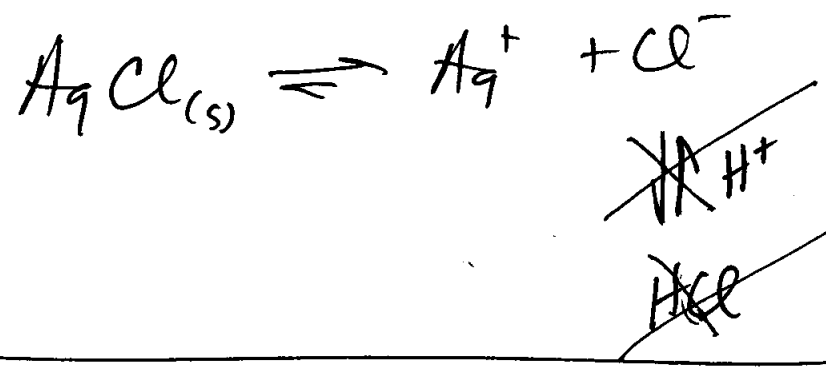
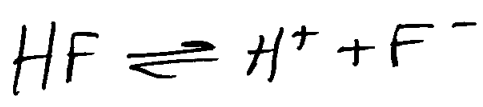


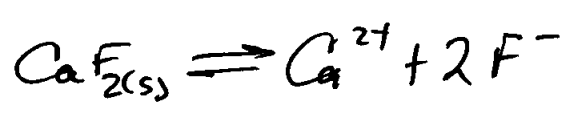
$$K_{sp} = [\text{Ca}^{2+}][\text{F}^-]^2 \quad \begin{array}{l} \sqrt{[\text{H}^+]} \\ \text{HF} \end{array}$$



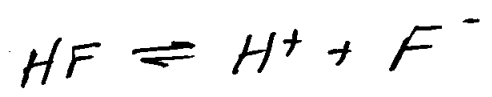
Q9) What is S in pH = 2.00.

for CaF₂?

$$K_{sp} = 3.9 \times 10^{-11}$$



$$K_a = 6.8 \times 10^{-4}$$



equil

$$K_{sp} = [\text{Ca}^{2+}][\text{F}^-]^2$$

$$K_a = \frac{[\text{H}^+][\text{F}^-]}{[\text{HF}]}$$

K_w

mass

$$S^{\circ} = \Sigma [Ca^{2+}] = \frac{1}{2} F = \frac{1}{2} \{ [F^{-}] + [HF] \}$$

chg.

NONE.

ultimately into K_{sp} !

$$[HF] = \frac{[H^{+}][F^{-}]}{K_a}$$

$$S = \frac{1}{2} \left\{ [F^{-}] + \frac{[H^{+}][F^{-}]}{K_a} \right\}$$

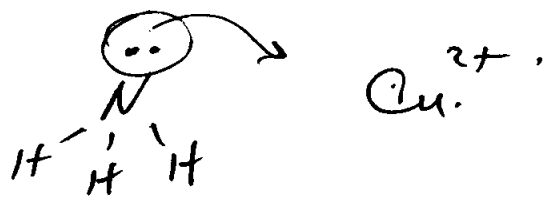
$$2S = \frac{K_a [F^{-}] + [H^{+}][F^{-}]}{K_a} = \frac{[F^{-}] \{ K_a + [H^{+}] \}}{K_a}$$

$$[F^{-}] = \frac{2S K_a}{K_a + [H^{+}]} [Ca^{2+}]$$

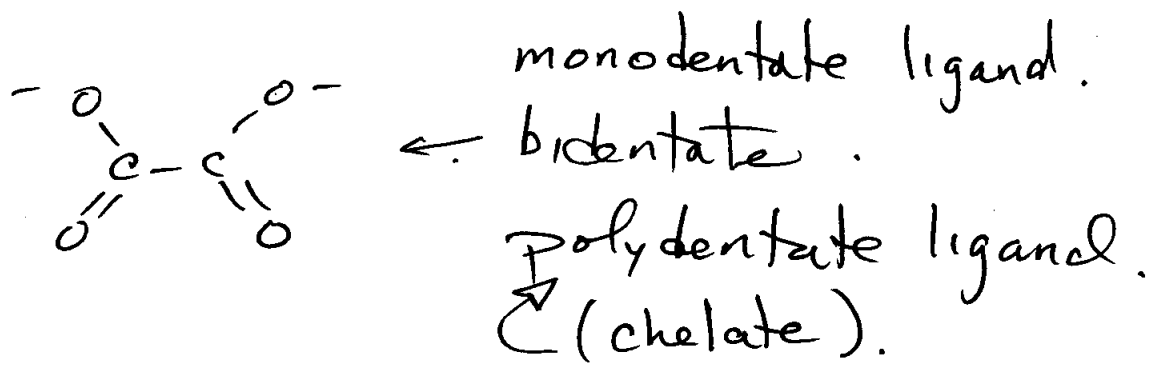
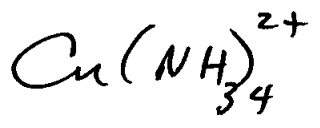
$$K_{sp} = S \left(\frac{2S K_a}{K_a + [H^{+}]} \right)^2$$

Complexation.

metal - ligand.



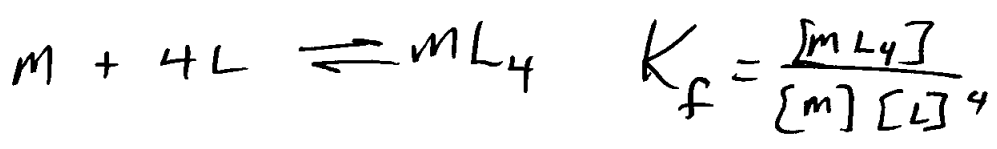
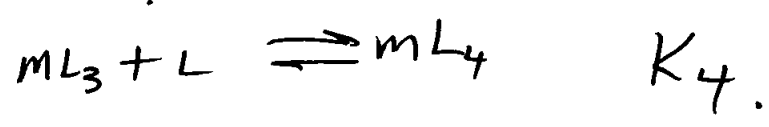
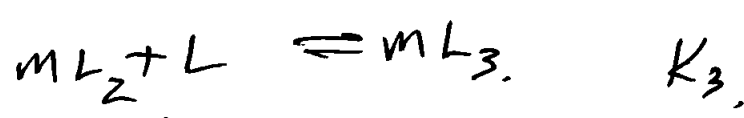
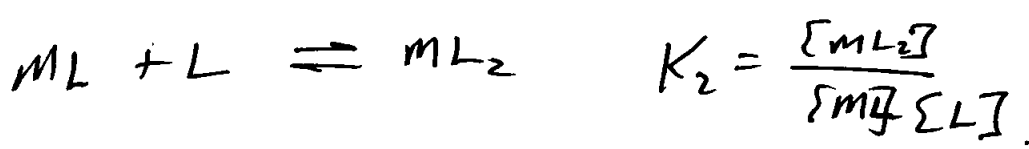
coordination number: (max ligands).



EDTA
↑ ethylene diamine tetraacetic acid.

"chelation effect"

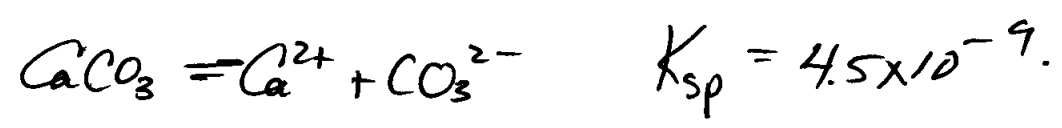
charge?
ML₄ ← charge?



↑
formation
constant

Dissolution of precipitate

eg 0.01 mole CaCO₃ in ^{1 L} water.

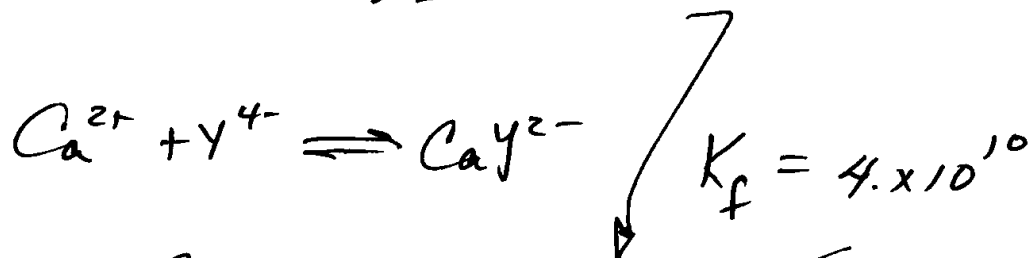


Add EDTA. Will CaCO₃ dissolve?
How much EDTA to add?
What is [Y⁴⁻] when just dissolved?

when dissolved

$$[CO_3^{2-}] = 0.01 \text{ M}$$

$$[Ca^{2+}] = \frac{K_{sp}}{[CO_3^{2-}]} = 4.5 \times 10^{-7} \text{ M}$$



$$[CaY^{2-}] = 0.01 - 4.5 \times 10^{-7}$$

↑ TOTAL of Ca from CaCO₃.

$$K_f = \frac{[CaY^{2-}]}{[Ca^{2+}][Y^{4-}]} = \frac{0.01}{(4.5 \times 10^{-7})[Y^{4-}]}$$

$$[Y^{4-}] = 4.9 \times 10^{-7} \text{ M}$$