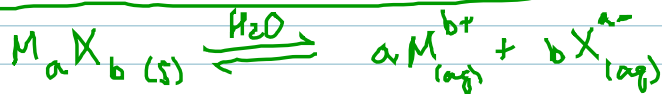


K_{sp} "solubility product" constant

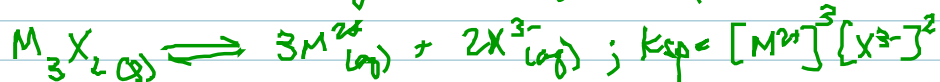
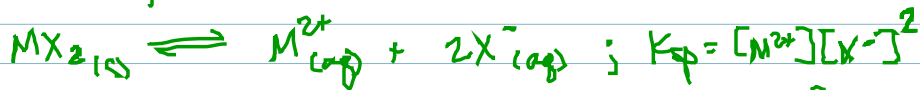
solubility = a measure of the amount of a solid that will dissolve

$$\text{molar solubility (s)} \Rightarrow \frac{\# \text{ moles solid}}{1 \text{ L of sol'n}}$$

$$s \times M_{\text{m}} = \# \text{g/L}$$



$$K_{sp} = [M^{b+}]^a [X^{a-}]^b$$



↓ K_{sp}, the less soluble the solid *only compare "like" salts*

Q ⇒ "ion product"

• NON-EQ SITUATIONS "will a ppt form?"

Q < K_{sp} ⇒ dissolving is favored ⇒ NO PPT

Q = K_{sp} ⇒ saturated solution ⇒ NO PPT ^{NO} additional solid

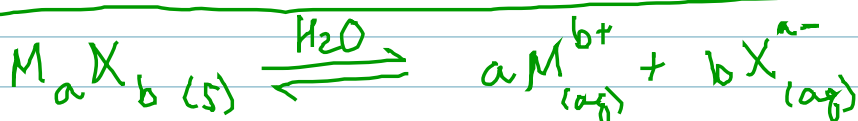
Q > K_{sp} ⇒ forming a solid is favored ⇒ PPT FORM

K_{sp} "solubility product" constant

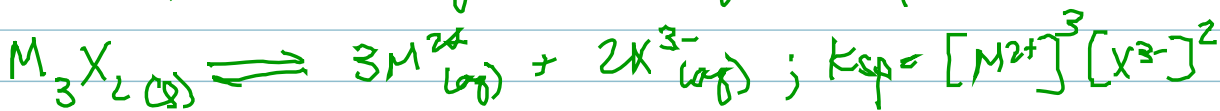
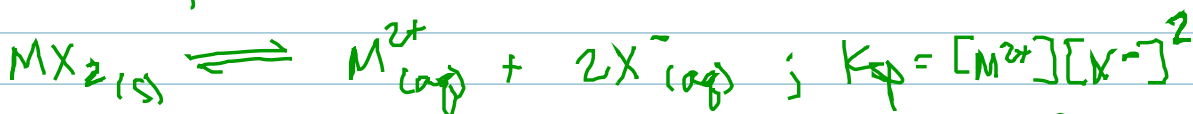
solubility = a measure of the amount of a solid that will dissolve

molar
solubility (s) $\Rightarrow \frac{\# \text{ moles solid}}{1 \text{ L of sol'n}}$

$s \propto M_{\text{molar}} = \frac{\# \text{g}}{\text{L}}$



$$K_{sp} = [M^{b+}]^a [X^{a-}]^b$$



↓ K_{sp}, the less soluble the solid *only compare "like" salts*

Q \Rightarrow "ion product"

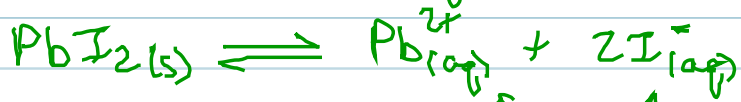
• NON-EQ SITUATIONS "will a ppt form?"

Q < K_{sp} \Rightarrow dissolving is favored \Rightarrow NO PPT

Q = K_{sp} \Rightarrow saturated solution \Rightarrow NO PPT \leftarrow NO additional solid

Q > K_{sp} \Rightarrow forming a solid is favored \Rightarrow PPT FORM

ex1 The solubility of PbI_2 in H_2O is 0.70 g/L , $K_{sp}=?$



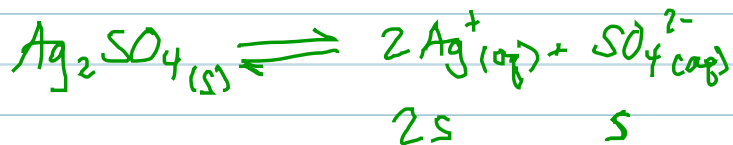
$$K_{sp} = [Pb^{2+}] [I^{-}]^2$$

$$\frac{0.70 \text{ g}}{1 \text{ L}} \times \frac{1 \text{ mole}}{461 \text{ g}} = 1.5 \times 10^{-3} \text{ M} = [PbI_2]$$

$$K_{sp} = (1.5 \times 10^{-3} \text{ M})(3.0 \times 10^{-3} \text{ M})^2 = 1.4 \times 10^{-8}$$

ex2 Ag_2SO_4 $K_{sp} = 1.4 \times 10^{-5}$

What is the solubility of Ag_2SO_4 in g/L in H_2O ?



$$K_{sp} = \frac{1.4 \times 10^{-5}}{4} = [Ag^{+}]^2 [SO_4^{2-}] = (2s)^2 (s) = \frac{4s^3}{4}$$

$$s = [Ag_2SO_4] = 1.5 \times 10^{-2} \text{ M} \times \frac{311.81 \text{ g}}{1 \text{ mole}}$$

$$[Ag^{+}] = 3.0 \times 10^{-2} \text{ M}$$

$$[SO_4^{2-}] = 1.5 \times 10^{-2} \text{ M}$$

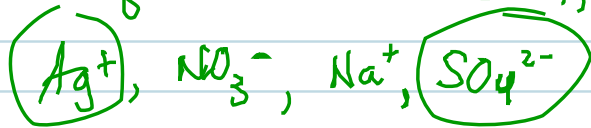
$$= 4.7 \text{ g/L}$$

will it ppt? M^{+}, X^{-} from separate sources

$$Q > K_{sp} \quad \text{DILUTION} \quad M_2 = \frac{M_1 V_1}{V_2}$$

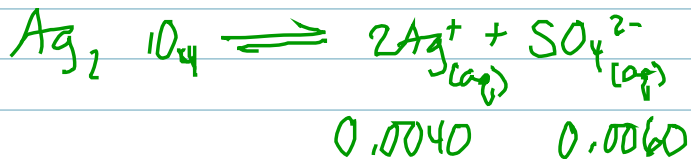
* COEFFICIENT TRAP *

If 10.0 mL of 0.010 M AgNO_3 is added to 15.0 mL of 0.010 M Na_2SO_4 , will a ppt form?



$$M_2 = \frac{M_1 V_1}{V_2} \quad [\text{Ag}^+] = \frac{(0.010\text{M})(0.010\text{L})}{(0.025\text{L})} = 0.0040\text{M}$$

$$[\text{SO}_4^{2-}] = \frac{(0.010\text{M})(0.015\text{L})}{(0.025\text{L})} = 0.0060\text{M}$$



$$Q = [\text{Ag}^+]^2 [\text{SO}_4^{2-}] = (0.0040)^2 (0.0060) = 9.6 \times 10^{-8}$$

$$K_{sp} = 1.4 \times 10^{-5}$$

$$Q < K_{sp}$$

NO PPT