# Solubility Constant Hmwk.

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121)

| | $AgCl$ | $\rightarrow$ | $Ag^+$ | + | $Cl^-$ |
|---|---|---|---|---|---|
| I | $1.3\times10^{-5}$ | | 0 | | 0 |
| C | | | $+x$ | | $+x$ |
| E | | | $+x$ | | $+x$ |

$x = 1.3\times10^{-5}$

$K_{sp} = ?$

$K_{sp} = x^2$

$K_{sp} = (1.3\times10^{-5})^2$

$K_{sp} = 1.7\times10^{-10}$

122)

$$MgF_2 \longrightarrow Mg + 2F$$

| | $MgF_2$ | $Mg$ | $2F$ |
|---|---|---|---|
| I | $2.7\times10^{-3}$ | | |
| C | | $+x$ | $+2x$ |
| E | | $x$ | $2x$ |

$$K_{sp} = [Mg][F]^2$$
$$= (x)(2x)^2$$
$$= (x)(4x^2)$$
$$= (2.7\times10^{-3})[(4)(2.7\times10^{-3})]$$
$$= \underline{7.9\times10^{-9}}$$

123)

$$Ag_2S \rightleftharpoons 2Ag + S$$

$$-2x \qquad x$$

$$K_{sp} = (2x)^2(x)$$

$$K_{sp} = (4x^2)(x)$$

$$K_{sp} = 4x^3$$

$$5.6 \times 10^{-49} = 4x^3$$

$$1.4 \times 10^{-49} = x^3$$

$$x = \sqrt[3]{1.4 \times 10^{-49}}$$

$$x = \underline{5.19 \times 10^{-13}}$$

124) $PbBr_{2(s)} \rightleftharpoons Pb^{2+}_{(aq)} + 2Br^-_{(aq)}$

$K_{sp} = 6.6 \times 10^{-6}$

| | | | |
|---|---|---|---|
| I | | 0 | 0 |
| C | $-x$ | $x$ | $2x$ |
| E | | | |

$K_{sp} = [Pb][Br]^2$

$K_{sp} = (x)(2x)^2 = 4x^3$

$6.6 \times 10^{-6} = 4x^3$

$x^3 = 1.65 \times 10^{-6}$

$x = 1.18 \times 10^{-2}$ mol/L

$m = M \times n$

$= 367.0 \text{ g/mol} \times 1.18 \times 10^{-2} \text{ mol/L}$

$= 4.34 \text{ g/L}$

125) $K_{sp}$ AgCl $= 1.77 \times 10^{-10}$ } from chart

$K_{sp}$ CuCl $= 1.72 \times 10^{-9}$

Since CuCl has a higher solubility, it would ionize more.

126) $Ni_3(PO_4)_2 \rightleftharpoons 3Ni^{2+} + 2PO_4^{3-}$

$\$olubility = 7.8\times10^{-5}\ g/L$ → convert to mol/L

$solubility = 7.8\times10^{-5}\ g \div 366.02\ g/mol$

$= 2.13\times10^{-7}$

| | $Ni_3(PO_4)_2$ | $\rightleftharpoons 3Ni^{2+}$ | $+ 2PO_4^{3-}$ |
|---|---|---|---|
| I | $2.13\times10^{-7}$ | 0 | 0 |
| C | | $3x$ | $2x$ |
| E | | | |

$K_{sp} = (3x)^3(2x)^2$

$= 108\ x^5$

$= 108(2.13\times10^{-7})$

$= \underline{4.75\times10^{-32}}$

127) $SrF_2 \rightleftharpoons Sr^{2+} + 2F^-$

$x = 12.2\ mg \times \frac{1\ g}{1000\ mg} \times 10\ (mL \to L)$

$solubility = 0.122\ g/L \div 125.62\ g/mol$

$solubility = 9.71\times10^{-4}\ mol/L$

| | $SrF_2$ | $\rightleftharpoons Sr^{2+}$ | $+ 2F$ |
|---|---|---|---|
| I | $9.71\times10^{-4}$ | 0 | 0 |
| C | | $x$ | $+2$ |
| E | | | |

$K_{sp} = (x)(2x^2)$

$= 4x^3$

$= 4.0\times10^{-9}$

128) $AgNO_{3(aq)} + NaCl \rightleftharpoons AgCl_{(s)} + NaNO_{3(aq)}$

$AgCl_{(s)} \rightleftharpoons Ag^+ + Cl^-$

$n_{Ag} = C \times V = (0.1\,M)(0.001L)$
$= 0.0001\ mol$

$n_{Cl} = C \times V = (1.0 \times 10^{-5}\,M)(1L)$
$= 0.00001\ mol$

$V_T = 1.0L + 1mL = 1.001L$

$C_{Ag} = (0.0001)\,mol / 1.001L$
$= 9.99 \times 10^{-5}\ mol/L$

$C_{Cl} = (0.00001)\,mol / 1.001L$
$= 9.99 \times 10^{-6}\ mol/L$

$AgCl\ K_{sp} = 1.77 \times 10^{-10}$

$Q = [Ag][Cl]$

$Q = (9.99 \times 10^{-5})(9.99 \times 10^{-6})$

$Q = 9.98 \times 10^{-10}$

- since $Q > K_{sp}$, a precipitate will form