9. Use the $K_{sp}$ for calcium fluoride to calculate its solubility in grams per liter. ($CaF_2$: $K_{sp} = 4.0 \times 10^{-11}$)

| | $CaF_{2(s)}$ | $Ca^{+2}_{(aq)}$ | $2F^{-}_{(aq)}$ |
|---|---|---|---|
| I | | 0 | 0 |
| C | x = solubility | x | 2x |
| E | | x | 2x |

$K_{sp} = [x][2x]^2 = 4x^3 = 4.0 \times 10^{-1}$

$x = \sqrt[3]{(1.0 \times 10^{-1})} = 0.000215\ldots$mol/L

multiply by molar mass:

x = 0.017 g/L

10. a) What is the solubility in moles/L of $AlPO_4$ in 0.050 M $Na_3PO_4$?
Ksp of $AlPO_4$ = **$9.84 \times 10^{-21}$**

| | $AlPO_{4\,(s)}$ | $Al^{+3}_{(aq)}$ | $PO_4{}^{-3}_{(aq)}$ |
|---|---|---|---|
| I | | 0 | 0.050 |
| C | x = solubility | x | x |
| E | | x | x + 0.050 |

$K_{sp} = [x]\,[x + 0.050] =$ **$9.84 \times 10^{-21}$**

$x = 1.97 \times 10^{-19}$ mol/L

(if you are getting an answer of x = 0 it's because in the conventional form of the quadratic formula, $b^2 >> 4ac$. So in such a case how do you get the correct answer of $1.97 \times 10^{-19}$ mol/L? If you rationalize the denominator, you get an alternate form of the quadratic formula:

$$x = \frac{2c}{-b \pm \sqrt{b^2 - 4ac}}$$

This will give the correct answer.

b) If it wasn't for the 0.050M $Na_3PO_4$, how would the solubility have compared?

It would have been higher. The equilibrium is being shifted to the left(creating more solid) by increasing the amount of phosphate.

11. Determine the oxidation number for each atom in the following molecules and calculate the total contribution by the atom.

a) $AlCl_3$

When Cl is attached to only a metal, each atom will have an oxidation number of -1. It makes a total contribution of -3.

Al is +3

b) $OCl^-$

Oxygen is -2, so
-2 + Cl = -1
Cl = 1
This high oxidation state is what makes OCl- (bleach) an electron thief.

c) $Mg^{2+}$

For any monoatomic ion, the charge is its oxidation number. Answer +2

d) $KClO_3$

K in any compound is +1
O is -2

$^{+}1 + Cl + 3(-2) = 0$
Cl = 6-1 = 5.
This high oxidation state is what makes $KClO_3$ an electron thief and for that reason it is used in matches.