Name: Key
Blk: ___ Date: ___

Chemistry 11
Lesson #4 Calculating the concentrations of IONS in solutions

Recall:

1. STOICHIOMETRY requires a balanced equation and in lesson #3 we learned about dissociation / ionization equations.
2. The Molarity formula: 

$M = mol \div L$
3. The Dilution formula: $M_I V_I = M_F V_F \rightsquigarrow M_F = \frac{M_I V_I}{V_F}$

Example 1: What is the molar concentration for the **chloride ion** in 0.25 M $AlCl_3$?

i. Write out the Dissociation Equation:

$$AlCl_3(aq) \longrightarrow Al^{3+}(aq) + 3Cl^-(aq)$$

ii. Use the equation to cross the MOLEDENGATE bridge to solve for the individual ion

$$0.25M \rightarrow \frac{0.25 mol\ AlCl_3}{1L} \times \frac{3 mol\ Cl^-}{1 mol\ AlCl_3} = \boxed{0.75\ M\ Cl^-}$$

Example 2. What is the molar concentration (molarity) of EACH ION that is made when mixing 50.0 mL of 0.500 M $AlCl_3$ with 75.0 mL of 0.200 M NiF_2 ?

i. Write out the Dissociation Equations:

$$AlCl_3(aq) \longrightarrow Al^{3+}(aq) + 3Cl^-(aq)$$
$$NiF_2(aq) \longrightarrow Ni^{2+}(aq) + 2F^-(aq)$$

ii. Use the Dilution formula TWICE to solve for the resulting concentrations of each compound:

$$[AlCl_3]_F = \frac{0.500M \cdot 0.0500L}{(0.0500L + 0.0750L)} \quad [NiF_2]_F = \frac{0.200M \cdot 0.0750L}{0.1250L}$$
$$= 0.1250L \qquad = 0.120M\ NiF_2$$
$$= 0.200M\ AlCl_3$$

iii. Use the equation to cross the MOLEDENGATE bridge to solve for the individual ions:

$$[Al^{3+}] = \frac{0.200 mol\ AlCl_3}{1L} \times \frac{1 mol\ Al^{3+}}{1 mol\ AlCl_3} = \boxed{0.200\ M\ Al^{3+}}$$

$$[Cl^-] = \frac{0.200 mol\ AlCl_3}{1L} \times \frac{3 mol\ Cl^-}{1 mol\ AlCl_3} = \boxed{0.600\ M\ Cl^-}$$

$$[Ni^{2+}] = \boxed{0.120\ M\ Ni^{2+}} \quad [F^-] = \frac{0.120 mol\ NiF_2}{1L} \times \frac{2 mol\ F^-}{1 mol\ NiF_2} = \boxed{0.240\ M\ F^-}$$

Example 3. What is the molar concentration of each ion that is made by mixing 50.0 mL of 0.240 M $AlBr_3$ with 25.0 mL of 0.300 M $CaBr_2$?

i. Write out the Dissociation Equations:

$AlBr_3(aq) \longrightarrow Al^{3+}(aq) + 3Br^-(aq)$

$CaBr_2(aq) \longrightarrow Ca^{2+}(aq) + 2Br^-(aq)$

ii. Use the Dilution formula TWICE to solve for the resulting concentrations of each compound:

$[AlBr_3]_F = \frac{0.240M \cdot 0.0500L}{0.0750L}$

$= 0.160\,M\,AlBr_3$

$[CaBr_2]_F = \frac{0.300M \cdot 0.0250L}{0.0750L}$

$= 0.100\,M\,CaBr_2$

iii. Use the equation to cross the MOLEDENGATE bridge to solve for the individual ions:

$[Al^{3+}] = \boxed{0.160\,M\,Al^{3+}}$

$[Ca^{2+}] = \boxed{0.100\,M\,Ca^{2+}}$

$[Br^-]_I = \frac{0.160\,mol\,AlBr_3}{1L} \times \frac{3\,mol\,Br^-}{1\,mol\,AlBr_3} = 0.480\,M\,Br^-$

$[Br^-]_{II} = \frac{0.100\,mol\,CaBr_2}{1L} \times \frac{2\,mol\,Br^-}{1\,mol\,CaBr_2} = 0.200\,M\,Br^-$

iv. Because you have TWO of the SAME ION you must add those two values together to get the FINAL CONCENTRAION:

$0.480\,M\,Br^-$

$0.200\,M\,Br^-$

$\boxed{0.680\,M\,Br^-}$

Seatwork/Homework: Now complete Assignment #4