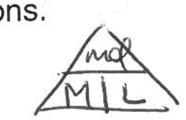
Name: Key
Blk:______Date:______

Chemistry 11
SOLUTION CHEMISTRY + STOICHIOMETRY
CALCULATING THE CONCENTRATION OF IONS IN SOLUTIONS

Recall:
1. STOICHIOMETRY- all stoich problems require a BALANCED EQTN,
last lesson we learned how to write out DISSOCIATION/IONIZATION equations.
2. MOLARITY => mol / L
where M= mol / L   L= mol / M   mol = M × L



3. Dilution =>

$$M_I \times V_I = M_F \times V_F$$

where M_I = initial [ ] M_F = final [ ]
V_I = initial volume (L) V_F = total volume (L)

Example 1. What is the molar concentration of the <u>chloride ion</u> in 0.25 M $AlCl_3$?
Step 1. Write out the balanced equation:

$$AlCl_{3\,(s)} \longrightarrow Al^{3+}_{(aq)} + 3Cl^-_{(aq)}$$

Step 2. Use the balanced equation to get your mole bridge and solve:

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

Example 2.What is the molar concentration of each ion that is made by mixing 50.0 mL of 0.500 M $AlCl_3$ with 75.0 mL of 0.200 M NiF_2 ?
Step 1. Write out the individual balanced equations:

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

Step 2. Use the dilution formula to calculate the diluted concentrations for each compound:

$$[AlCl_3]_F = \frac{0.500M \times 0.0500L}{0.1250L} = 0.200M \qquad [NiF_2]_F = \frac{0.200M \times 0.0750L}{0.125L} = 0.120M$$

Step 3. Use the balanced equations to get your mole bridge and solve for the individual ion concentrations:

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

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

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

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 $CaBr_2$?

Step 1. Write out the individual balanced equations:

$$AlBr_3 \longrightarrow Al^{3+} + 3Br^- \qquad CaBr_2 \longrightarrow Ca^{2+} + 2Br^-$$

Step 2. Use the dilution formula to calculate the diluted concentrations for each compound:

$$[AlBr_3]_F = \frac{0.240\,M \times 0.0500\,L}{0.0750\,L} = 0.160\,M \qquad [CaBr_2]_F = \frac{0.300\,M \times 0.0250\,L}{0.0750\,L} = 0.100\,M$$

Step 3. Use the balanced equations to get your mole bridge and solve for the individual ion concentrations:

$$\boxed{[Al^{3+}] = 0.160\,M\ Al^{3+}} \qquad \boxed{[Ca^{2+}] = 0.100\,M}$$

$$[Br^-] = \frac{0.160\,mol\ AlBr_3}{1\,L} \times \frac{3\,mol\ Br^-}{1\,mol\ AlBr_3} = 0.480\,M\ Br^- \qquad [Br^-] = \frac{0.100\,mol\ CaBr_2}{1\,L} \times \frac{2\,mol}{1\,mol} = 0.200\,M\ Br^-$$

Step 4: Because both compounds have a common ion ADD the two concentrations together to determine it's Final concentration.

$$[Br^-] = 0.480\,M + 0.200\,M = \boxed{0.680\,M\ Br^-}$$