

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

Recall:

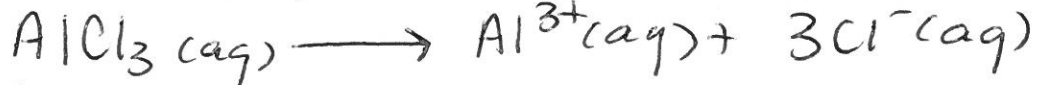
1. STOICHIOMETRY requires a balanced equation and in lesson #3 we learned about dissociation/ionization equations.

2. The Molarity formula: $M = \frac{\text{mol}}{\text{L}}$

3. The Dilution formula: $M_i V_i = M_f V_f \rightarrow M_f = \frac{M_i V_i}{V_f}$

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

i. Write out the Dissociation Equation:

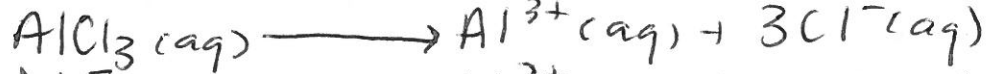


ii. Use the equation to cross the MOLEDENGATE bridge to solve for the individual ion

$$0.25\text{M} \rightarrow \frac{0.25\text{mol AlCl}_3}{1\text{L}} \times \frac{3\text{mol Cl}^{-}}{1\text{mol AlCl}_3} = \boxed{0.75\text{M Cl}^{-}}$$

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:



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

$$[\text{AlCl}_3]_f = \frac{0.500\text{M} \cdot 0.0500\text{L}}{(0.0500\text{L} + 0.0750\text{L})} = 0.200\text{M AlCl}_3$$

$$[\text{NiF}_2]_f = \frac{0.200\text{M} \cdot 0.0750\text{L}}{0.1250\text{L}} = 0.120\text{M NiF}_2$$

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

$$[\text{Al}^{3+}] = \frac{0.200\text{mol AlCl}_3}{1\text{L}} \times \frac{1\text{mol Al}^{3+}}{1\text{mol AlCl}_3} = \boxed{0.200\text{M Al}^{3+}}$$

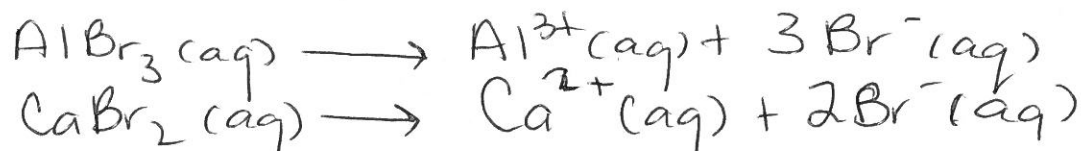
$$[\text{Cl}^{-}] = \frac{0.200\text{mol AlCl}_3}{1\text{L}} \times \frac{3\text{mol Cl}^{-}}{1\text{mol AlCl}_3} = \boxed{0.600\text{M Cl}^{-}}$$

$$[\text{Ni}^{2+}] = \boxed{0.120\text{M Ni}^{2+}}$$

$$[\text{F}^{-}] = \frac{0.120\text{mol NiF}_2}{1\text{L}} \times \frac{2\text{mol F}^{-}}{1\text{mol NiF}_2} = \boxed{0.240\text{M F}^{-}}$$

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:



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

$$\begin{aligned} [\text{AlBr}_3]_F &= \frac{0.240\text{M} \cdot 0.0500\text{L}}{0.0750\text{L}} & [\text{CaBr}_2]_F &= \frac{0.300\text{M} \cdot 0.0250\text{L}}{0.0750\text{L}} \\ &= 0.160\text{M AlBr}_3 & &= 0.100\text{M CaBr}_2 \end{aligned}$$

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

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

$$[\text{Br}^{-}]_I = \frac{0.160\text{mol AlBr}_3}{1\text{L}} \times \frac{3\text{mol Br}^{-}}{1\text{mol AlBr}_3} = 0.480\text{M Br}^{-}$$

$$[\text{Br}^{-}]_{II} = \frac{0.100\text{mol CaBr}_2}{1\text{L}} \times \frac{2\text{mol Br}^{-}}{1\text{mol CaBr}_2} = 0.200\text{M Br}^{-}$$

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

$$\begin{array}{r} 0.480\text{M Br}^{-} \\ 0.200\text{M Br}^{-} \\ \hline \boxed{0.680\text{M Br}^{-}} \end{array}$$