

Chemistry 11
Lesson #5 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:



$$M = \text{mol} \div L$$

3. The Dilution formula:

$$\boxed{M_i V_i = M_f V_f} \rightarrow M_f = \frac{M_i V_i}{V_f}$$

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

i. Write out the Dissociation Equation:

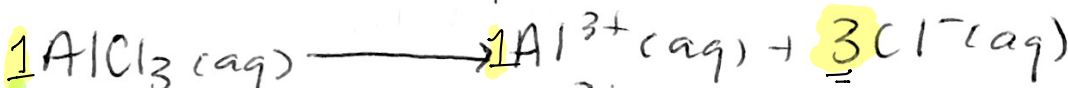


ii. Use the equation to cross the MOLEDENGATE bridge to solve for the individual ion

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

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:

$$[\text{AlBr}_3]_F = \frac{0.240 \text{ M} \cdot 0.0500 \text{ L}}{0.0750 \text{ L}}$$

$$= 0.160 \text{ M AlBr}_3$$

$$[\text{CaBr}_2]_F = \frac{0.300 \text{ M} \cdot 0.0250 \text{ L}}{0.0750 \text{ L}}$$

$$= 0.100 \text{ M CaBr}_2$$

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

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

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

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

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

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

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

ionization eqn



dissociation

charges (product)