Name: Key
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REVIEW OF CHEMISTRY 11 FOR CHEMISTRY 12
DAY 3: DILUTIONS

The DILUTION EQUATION is: $M_I V_I = M_F V_F$

M_I = initial concentration M_F = final concentration
V_I = initial volume V_F = final volume (usually "total" volume)

Example A:
What is the final concentration for the chloride ion when 50.0 mL of 2.0 M Iron (III) chloride is mixed with 250.0 mL of water?
Step 1. Write out the **balanced equation**:

$$FeCl_3(s) \xrightarrow{H_2O(l)} Fe^{3+}(aq) + 3Cl^-(aq)$$

Step 2. Use the **dilution equation**: if $M_I V_I = M_F V_F$, then $M_F = \frac{M_I V_I}{V_F}$

$$[FeCl_3]_F = \frac{2.0\,M \times 0.0500\,L}{(0.0500 + 0.2500)} = \boxed{0.33\,M\ FeCl_3}$$
$$= 0.300\,L$$

Example B: What is the final concentration for all ions when 50.0 mL of 0.200 M Aluminum chloride is mixed with 25.0 mL of 0.300 M Nickel (II) fluoride?
Step 1. Write out the **balanced equations**:

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

Step 2. Use the **dilution equation** to first solve for the **compound concentrations**.

$$[AlCl_3]_F = \frac{0.200\,M \times 0.0500\,L}{(0.0500 + 0.0250\,L)} = \boxed{0.133\,M\ AlCl_3}$$
$$= 0.0750\,L$$

$$[NiF_2]_F = \frac{0.300\,M \times 0.0250\,L}{0.0750\,L} = \boxed{0.100\,M\ NiF_2}$$

Step 3. Use the **balanced equations** to solve for the **individual ion concentrations**.

$$[Al^{3+}] = \frac{0.133\,mol\,AlCl_3}{L} \times \frac{1\,mol\,Al^{3+}}{1\,mol\,AlCl_3} = \boxed{0.133\,M\,Al^{3+}} \quad \& \quad [Ni^{4}] = 0.100\,M$$

$$[Cl^-] = \frac{0.133\,mol\,AlCl_3}{L} \times \frac{3\,mol\,Cl^-}{1\,mol\,AlCl_3} = \boxed{0.400\,M\,Cl^-} \quad [F^-] = 0.200\,M$$

Example C.
What is the final ion concentrations for all of the ions when 25.0 mL of 2.50 M Aluminum bromide is mixed with 25.0 mL of 0.150 M Calcium bromide?
Step 1. Write out the **balanced equations**:

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

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

Step 2. Use the **dilution equation** to first solve for the **compound concentrations.**

$[AlBr_3]_F = \frac{2.50\,M \times 0.0250\,L}{0.0500\,L}$

$= 1.25\,M\ AlBr_3$

$[CaBr_2]_F = \frac{0.150\,M \times 0.0250\,L}{0.0500\,L}$

$= 0.0750\,M\ CaBr_2$

Step 3. Use the **balanced equations** to solve for the **individual ion concentrations.**

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

1.25 M → 1.25 M, 3.75 M

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

0.0750 M → 0.0750 M, 0.15 M

Step 4. Now **ADD** together the **common ion's concentrations**

$[Br^-] = 3.75\,M$

$0.15\,M$

$3.90\,M\ Br^-$

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