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Solubility Rules and Precipitates

Most double displacement reactions occur in water. Most of the time, both reactants are aqueous.

Precipitate is when a solid substance is formed in a solution.

A double displacement reaction that produces a precipitate is called a precipitate reaction.

Solubility guidelines are used to identify precipitates.

Compounds that have low solubility in water will form precipitates.

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Use the solubility guidelines to determine which of these double displacement reactions may form a precipitate.

$Cu_2SO_{4(aq)} + 2NaCl_{(aq)} \rightarrow$

Step 1: Determine the products of the double displacement reaction.

$Cu_2SO_{4(aq)} + 2NaCl_{(aq)} \rightarrow 2CuCl + Na_2SO_4$

Step 2: Determine the state of each of the products using a solubility chart.

$Cu_2SO_{4(aq)} + 2NaCl_{(aq)} \rightarrow 2CuCl_{(s)} + Na_2SO_{4(aq)}$

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A ***total ionic equation*** is a list of all ions that form a chemical are equation.

A ***net ionic equation*** is a list of ions that actually took part in the chemical reaction.

Example:

$$Cu_2SO_{4(aq)} + 2NaCl_{(aq)} \rightarrow 2CuCl_{(s)} + Na_2SO_{4(aq)}$$

Total Ionic Equation

$$Cu^{+}_{(aq)} + SO_4^{2-}{}_{(aq)} + 2Na^{+}_{(aq)} + 2Cl_{(aq)} \rightarrow 2CuCl_{(s)} + Na^{+}_{(aq)} + SO_4^{2-}{}_{(aq)}$$

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Net Ionic Equation

$$Cu^{+}_{(aq)} + SO_4^{2-}{}_{(aq)} + 2Na^{+}_{(aq)} + 2Cl_{(aq)} \rightarrow 2CuCl_{(s)} + Na^{+}_{(aq)} + SO_4^{2-}{}_{(aq)}$$

Note that these ions don't change on either side. That makes them **spectator ions** and can be crossed out.

$$Cu^{+}_{(aq)} + 2Cl_{(aq)} \rightarrow 2CuCl_{(s)}$$