

Unit 10 Part 2: Precipitation Reactions

Precipitation Reactions: a reaction in which aqueous ions in separate solutions are mixed together to form an insoluble compound that settles out of solution as a solid.

- The insoluble compound that settles out is called a precipitate.
- A precipitation reaction is always a double replacement reaction!

→ **Precipitate = Solid = Insoluble (can't dissolve in water)** ←

- Use a reference chart of solubility rules to determine which compounds will form a precipitate.

Based on your solubility chart, which ions will **ALWAYS** be aqueous? (never part of a precipitate/net ionic equation?)

1. alkali metal cations 2. NH_4^+ 3. NO_3^- 4. $\text{C}_2\text{H}_3\text{O}_2^-$ 5. ClO_3^-

Which product will form a precipitate?

1. $\text{KI}(\text{aq}) + \text{Pb}(\text{ClO}_3)_2(\text{aq}) \rightarrow \text{KClO}_3(\text{aq}) + \text{PbI}(\text{s})$ Precipitate? PbI
2. $\text{Cu}(\text{NO}_3)_2(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2(\text{s}) + 2\text{NaNO}_3(\text{aq})$ Precipitate? $\text{Cu}(\text{OH})_2$
3. $3\text{KNO}_3(\text{aq}) + \text{AlPO}_4(\text{aq}) \rightarrow \text{Al}(\text{NO}_3)_3(\text{aq}) + \text{K}_3\text{PO}_4(\text{aq})$ Precipitate? none

Net Ionic Equations: includes **ONLY** compounds and ions that undergo a state change

- $(\text{aq}) \rightarrow (\text{s})$ or $(\text{aq}) \rightarrow (\text{l})$
- Spectator ions: do NOT take part in a chemical reaction and are found in solution both before and after the reaction

Let's Practice Dissociation! The compounds below are written with their states of matter as they are ALREADY dissolved into water. Show what/how many things each compound would dissociate into (if any).

$(\text{NH}_4)_2\text{S}(\text{aq}) \rightarrow 2\text{NH}_4^+(\text{aq}) + \text{S}^{2-}(\text{aq})$	$3\text{Ga}(\text{OH})_3(\text{s}) \rightarrow 3\text{Ga}(\text{OH})_3(\text{s}) \leftarrow \text{insoluble}$
$\text{AgCl}(\text{s}) \rightarrow \text{AgCl}(\text{s}) \leftarrow \text{insoluble}$	$2\text{Al}(\text{NO}_3)_3(\text{aq}) \rightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{NO}_3^-(\text{aq})$
$4\text{Fe}_2\text{O}_3(\text{aq}) \rightarrow 8\text{Fe}^{3+}(\text{aq}) + 12\text{O}^{2-}$	$\text{Na}_2\text{CO}_3(\text{aq}) \rightarrow 2\text{Na}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq})$
$2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{H}_2\text{O}(\text{l}) \leftarrow \text{not aqueous}$	$2\text{NH}_4\text{SO}_4(\text{aq}) \rightarrow 2\text{NH}_4^+(\text{aq}) + 2\text{SO}_4^{2-}(\text{aq})$

Circle the spectator ions

Normal Equation: $\text{Pb}(\text{NO}_3)_2(\text{aq}) + \text{MgBr}_2(\text{aq}) \rightarrow \text{Mg}(\text{NO}_3)_2(\text{aq}) + \text{PbBr}_2(\text{s})$

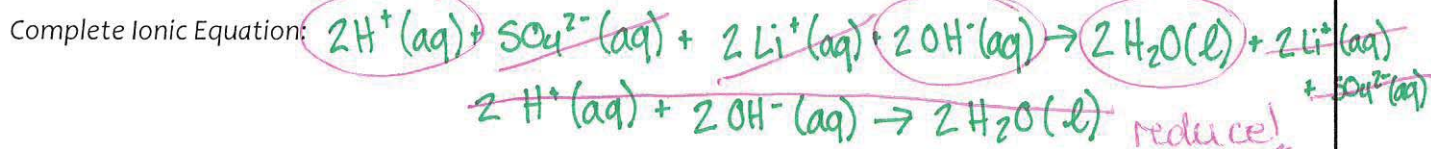
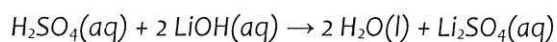
Complete Ionic Equation: $\text{Pb}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + \text{Mg}^{2+}(\text{aq}) + 2\text{Br}^-(\text{aq}) \rightarrow \text{Mg}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + \text{PbBr}_2(\text{s})$

Net ionic Equation:



→ Only the ions which make up the precipitate will show up in the net ionic equation! ←
(Unless water is formed from H^+ and OH^- , because then water will show up. ☺)

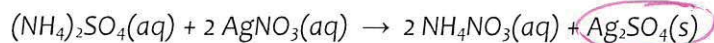
Example 1: Write the complete AND net ionic equation for the following reaction.



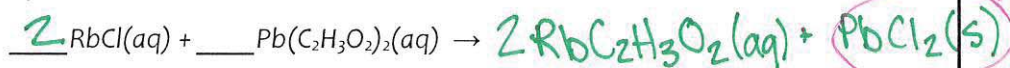
Net Ionic Equation:



Example 2: Let's Try the Shortcut! Write the net ionic equation for the following reaction.

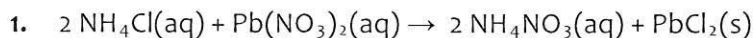


Example 3: All together! Mmm, predict products, balance the reaction AND write the net ionic!

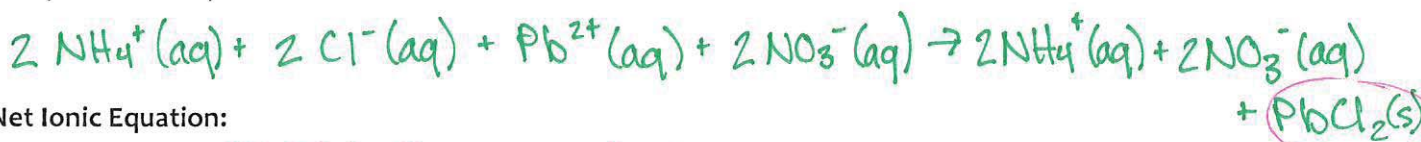


Practice Makes Perfect!

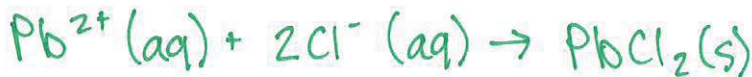
Write the complete AND net ionic equation for the following reaction:



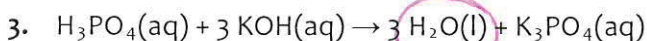
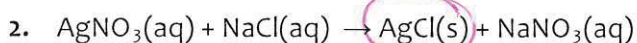
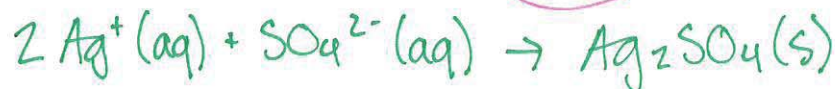
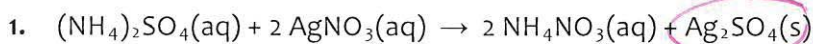
Complete Ionic Equation:



Net Ionic Equation:



Try the Shortcut: Write the net ionic equation for the following reactions.



More Practice!

Directions:

1. Write out the formulas for both reactants, predict the products, and balance the reaction.
2. Identify the state of matter for each product.
3. Write the net ionic equation if applicable; otherwise, write "no reaction".

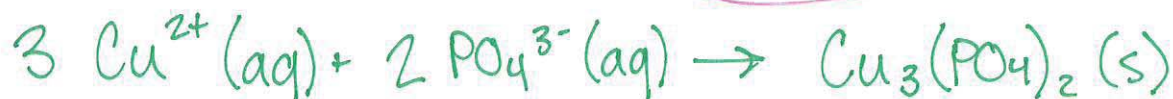
1) sodium carbonate (aq) + ammonium chloride (aq)



NO RXN

(all products are aqueous)

2) copper(II) chloride (aq) + ammonium phosphate (aq)



3) lithium hydroxide (aq) + iron (III) nitrate (aq)



4) potassium nitrate (aq) + magnesium sulfate (aq)



NO RXN

(all products are aqueous)

5) strontium chloride (aq) + potassium sulfate (aq)

