LESSON MAKER PRO

Ions in Action

Predict precipitates and track the ions that form them.

HIGH SCHOOL · CHE.3.b

CHE.3.b "Use qualitative and quantitative reasoning to classify chemical reactions, predict the products of single replacement and double replacement reactions, and represent chemical reactions using ionic equations."

NAME _____ DATE _____

FROM PRODUCTS TO IONS

In double replacement, dissolved ions exchange partners. Balance the equation, then split dissolved compounds into ions and cancel ions unchanged on both sides. Nitrates and sodium or potassium salts dissolve. AgCl, $BaSO_4$, $CaCO_3$, $Fe(OH)_3$, $Cu(OH)_2$, and $Mg(OH)_2$ form solids.

WORKED EXAMPLE

Predict the products of $Fe(NO_3)_3(aq) + NaOH(aq)$. Write the balanced and net ionic equations.

1. Exchange partners: $Fe(OH)_3(s)$ and $NaNO_3(aq)$.
2. Balance: $Fe(NO_3)_3(aq) + 3NaOH(aq) \rightarrow Fe(OH)_3(s) + 3NaNO_3(aq)$.
3. Split dissolved compounds into ions. Cancel Na^+ and NO_3^-.

Answer: $Fe^{3+}(aq) + 3OH^-(aq) \rightarrow Fe(OH)_3(s)$

PRACTICE 4 problems

1 Predict the products of $AgNO_3(aq) + NaCl(aq)$. Write the balanced and net ionic equations.

ANSWER _____

2 Predict the products of $Ba(NO_3)_2(aq) + K_2SO_4(aq)$. Write the balanced and net ionic equations.

ANSWER _____

3 Predict the products of $Ca(NO_3)_2(aq) + Na_2CO_3(aq)$. Write the balanced and net ionic equations.

ANSWER _____

4 Predict the products of $Cu(NO_3)_2(aq) + KOH(aq)$. Write the balanced and net ionic equations.

ANSWER _____

APPLY IT Show your work

1 A water-quality club tests a stream sample containing dissolved $MgCl_2$ by adding $AgNO_3$(aq). Predict the products. Write the balanced and net ionic equations.

WORK SPACE

ANSWER _____

2 In a wastewater cleanup model, students add KOH(aq) to water containing $Mg(NO_3)_2$(aq). Predict the products. Write the balanced and net ionic equations.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A water lab mixes 0.030 mol $Ba(NO_3)_2$(aq) with 0.020 mol K_2SO_4(aq). How many moles of $BaSO_4$(s) form, and how many moles of the excess reactant remain? Write the net ionic equation.

WORK SPACE AND ANSWER

Ions in Action

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Predict the products of $AgNO_3(aq) + NaCl(aq)$. Write the balanced and net ionic equations.	**$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$; $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$**
2	Predict the products of $Ba(NO_3)_2(aq) + K_2SO_4(aq)$. Write the balanced and net ionic equations.	**$Ba(NO_3)_2(aq) + K_2SO_4(aq) \rightarrow BaSO_4(s) + 2KNO_3(aq)$; $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$**
3	Predict the products of $Ca(NO_3)_2(aq) + Na_2CO_3(aq)$. Write the balanced and net ionic equations.	**$Ca(NO_3)_2(aq) + Na_2CO_3(aq) \rightarrow CaCO_3(s) + 2NaNO_3(aq)$; $Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s)$**
4	Predict the products of $Cu(NO_3)_2(aq) + KOH(aq)$. Write the balanced and net ionic equations.	**$Cu(NO_3)_2(aq) + 2KOH(aq) \rightarrow Cu(OH)_2(s) + 2KNO_3(aq)$; $Cu^{2+}(aq) + 2OH^-(aq) \rightarrow Cu(OH)_2(s)$**

PART 2 · APPLY IT

1. **$MgCl_2(aq) + 2AgNO_3(aq) \rightarrow 2AgCl(s) + Mg(NO_3)_2(aq)$; $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$** Two chloride ions require two silver ions. Cancel Mg^{2+} and NO_3^- from the ionic equation.
2. **$Mg(NO_3)_2(aq) + 2KOH(aq) \rightarrow Mg(OH)_2(s) + 2KNO_3(aq)$; $Mg^{2+}(aq) + 2OH^-(aq) \rightarrow Mg(OH)_2(s)$** Two hydroxide ions combine with each magnesium ion. Cancel K^+ and NO_3^- from the ionic equation.

CHALLENGE

0.020 mol $BaSO_4$ forms; 0.010 mol $Ba(NO_3)_2$ remains. $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$.

Accept balanced equations with reactants in either order. Net ionic equations must omit spectator ions and show the solid product.