Metathesis Reactions

Wednesday, September 23, 2020 8:22 AM

Strong Acids/ Bases

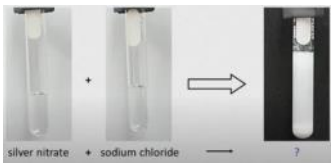
Strong acids: HCl, HBr, HI, HNO_3, $HClO_4$, $HClO_3$, H_2SO_4

Strong Bases: LiOH, NaOH, KOH, RbOH, CsOH, $Ca(OH)_2$, $Sr(OH)_2$, $Ba(OH)_2$

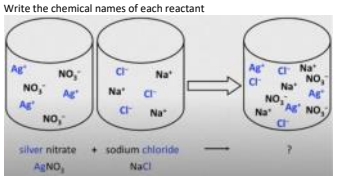
*Remember solubility rules

Precipitation

Example: what precipitate would resolve if we experimentally mixed silver nitrate and sodium chloride together?



1) Write the chemical names of each reactant



2) Perform a double replacement reaction to obtain the products and molecular equation

$AgNO_3 + NaCl \longrightarrow$

silver nitrate + sodium chloride ⟶ sodium nitrate + silver chloride

Molecular Equation (Balanced and State Labels):

$AgNO_3(aq) + NaCl(aq) \longrightarrow NaNO_3(aq) + AgCl(s)$

3) To obtain the ionic equation, write out all the reactants and products with their respective ion charge

Total Ionic Equation:

$Ag^+(aq) + NO_3^-(aq) + Na^+(aq) + Cl^-(aq) \longrightarrow Na^+(aq) + NO_3^-(aq) + AgCl(s)$

Net Ionic Equation:

$Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(s)$

- The net ionic charge will only contain the reactants that make the solid product and the solid product itself

Examples

Match the following to the reactions:

a. $C_{(s)} + O_{2\,(g)} \rightarrow CO_{2\,(g)}$

b. $H_2CO_{3\,(aq)} \rightarrow H_2O_{(l)} + CO_{2\,(g)}$

c. $Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2\,(aq)} + H_{2\,(g)}$

d. $MgCl_{2\,(aq)} + 2KOH_{(aq)} \rightarrow Mg(OH)_{2\,(aq)} + 2KCl_{(aq)}$

Decomposition

Single Displacement

Combination

Double Displacement

Write the total ionic and net ionic equation for the following:

a. $Ba(NO_3)_{2\,(aq)} + NiSO_{4\,(aq)} \rightarrow BaSO_{4\,(s)} + Ni^{+} + 2NO_3$ Balanced Equation

$Ba^{2+} + 2NO_3 + Ni^{2+} + SO_4^{2-} \rightarrow BaSO_{4\,(s)} + Ni^{2+} + 2NO_3^{-}$ Total

$Ba^{2+}_{(aq)} + SO_4^{2-}_{(aq)} \rightarrow BaSO_{4\,(s)}$ Net

b. $CH_3COOH_{(aq)} + NaOH_{(aq)} \rightarrow$ $NaCH_3COO + H_2O$ Balanced

$CH_3COOH + Na^+ + {}^-OH \rightarrow Na^+_{(aq)} + CH_3COO^-_{(aq)} + H_2O_{(l)}$ Total

$CH_3COOH_{(aq)} + {}^-OH_{(aq)} \rightarrow H_2O_{(l)} + CH_3COO^-_{(aq)}$ Net

c. $MgCl_{2\,(aq)} + S(NH_4)_{2\,(aq)} \rightarrow$ $MgS + 2NH_4Cl$ balanced

$Mg^{2+} + 2Cl^- + S^{2-} + NH_4^+ \rightarrow MgS_{(s)} + 2NH_4^+ + 2Cl^-$ Total

$Mg^{2+}_{(aq)} + S^{2-}_{(aq)} \rightarrow MgS_{(s)}$ Net

Answer Key

a. $C_{(s)} + O_{2\,(g)} \rightarrow CO_{2\,(g)}$ Decomposition

b. $H_2CO_{3\,(aq)} \rightarrow H_2O_{(l)} + CO_{2\,(g)}$ Single Displacement

c. $Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2\,(aq)} + H_{2\,(g)}$ Combination

d. $MgCl_{2\,(aq)} + 2KOH_{(aq)} \rightarrow Mg(OH)_{2\,(aq)} + 2KCl_{(aq)}$ Double Displacement

a. $Ba(NO_3)_{2\,(aq)} + NiSO_{4\,(aq)} \rightarrow BaSO_{4\,(s)} + Ni(NO_3)_{2\,(aq)}$

$Ba^{2+}_{(aq)} + 2NO_3^-{}_{(aq)} + Ni^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow BaSO_{4\,(s)} + Ni^{2+}_{(aq)} + 2NO_3^-{}_{(aq)}$ TOTAL

$Ba^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow BaSO_{4\,(s)}$ NET

b. $CH_3COOH_{(aq)} + NaOH_{(aq)} \rightarrow NaCH_3COO_{(aq)} + H_2O_{(l)}$

$CH_3COOH_{(aq)} + Na^+_{(aq)} + OH^-_{(aq)} \rightarrow + Na^+_{(aq)} + CH_3COO^-_{(aq)} + H_2O_{(l)}$ TOTAL

$CH_3COOH_{(aq)} + OH^-_{(aq)} \rightarrow + CH_3COO^-_{(aq)} + H_2O_{(l)}$ NET

c. $MgCl_{2\,(aq)} + S(NH_4)_{2\,(aq)} \rightarrow MgS_{(s)} + 2\,NH_4Cl$

$Mg^{2+}_{(aq)} + 2\,Cl^-_{(aq)} + S^{2-}_{(aq)} + 2\,NH_4^+{}_{(aq)} \rightarrow MgS_{(s)} + 2\,NH_4^+{}_{(aq)} + 2Cl^-_{(aq)}$ TOTAL

$Mg^{2+}_{(aq)} + S^{2-}_{(aq)} \rightarrow MgS_{(s)}$ NET