Exchange Reactions

Exchange Example 1: Adding together solutions of sodium sulfide & cadmium nitrate

sodium sulfide + cadmium nitrate → sodium nitrate + cadmium sulfide

$Na_2S\ (aq) + Cd(NO_3)_2\ (aq) \rightarrow NaNO_3\ (aq) + CdS\ (s)$

Net ionic reaction:

$S^{2-}\ (aq) + Cd^{2+}\ (aq) \rightarrow CdS\ (s)$

Exchange Example 2: Add ammonia to a solution of copper (II) nitrate

Step 1: ammonia reacts with water (ammonia is a weak base)

$NH_3\ (aq) + H_2O\ (l) \rightarrow NH_4^+\ (aq) + OH^-\ (aq)$

Step 2: copper (II) ions react with hydroxide ions

$Cu^{2+}\ (aq) + OH^-\ (aq) \rightarrow Cu(OH)_2\ (s)$

Overall reaction:

$NH_3\ (aq) + H_2O\ (l) + Cu^{2+}\ (aq) \rightarrow NH_4^+\ (aq) + Cu(OH)_2\ (s)$

Redox Reactions

Redox Example 1: Sodium metal added to aqueous hydrochloric acid

a) sodium + hydrochloric acid → sodium chloride + hydrogen

$Na\ (s) + HCl\ (aq) \rightarrow NaCl\ (aq) + H_2\ (g)$

Net ionic reaction: $Na\ (s) + H^+\ (aq) \rightarrow Na^+\ (aq) + H_2\ (g)$

b) sodium + nitric acid → sodium nitrate + hydrogen

$Na\ (s) + HNO_3\ (aq) \rightarrow NaNO_3\ (aq) + H_2\ (g)$

Net ionic reaction: $Na\ (s) + H^+\ (aq) \rightarrow Na^+\ (aq) + H_2\ (g)$

Redox Example 2: Heating to initiate a reaction between powdered iron (III) oxide and aluminum metal shavings

iron (III) oxide + aluminum → aluminum oxide + iron

$Fe_2O_3\ (s) + Al\ (s) \rightarrow Al_2O_3\ (s) + Fe\ (s)$

Redox Example 3: Adding glycerin to potassium permanganate crystals

glycerin + potassium permanganate → ???

$4\ C_3H_5(OH)_3\ (l) + 14\ KMnO_4\ (s) \rightarrow 7\ K_2CO_3\ (s) + 7\ Mn_2O_3\ (s) + 5\ CO_2\ (g) + 16\ H_2O\ (l)$

Take-home lessons:

1) How are exchange reactions and redox reactions similar?

2) How are exchange reactions and redox reactions different?