Redox Reactions

Chapter 4

Oil Rig

- Oxidation
- Is
- Losing an electron

- Reduction
- Is
- Gaining an electron

4 general forms of reactions

- Almost all reactions can fit into one of 4 general forms
- Single replacement
- Double replacement
- Synthesis
- Decomposition

Redox Reactions

- Oxidation-Reduction (Redox) Reactions
- Redox reactions involve an electron transfer.
- These reaction occur between metals and nonmetals.
- Ionic reactions are redox reactions.

What makes this a redox reaction?

- Follow the electron
- $AgCl + Cu \rightarrow Ag + CuCl$
- $Ag^+ + Cl^- + Cu \rightarrow Ag + Cl^- + Cu^+$

- Copper starts out neutral, Ag is +, Cl is -. The compound is neutral but they still have their charges
- Then the reaction.
- Copper gives an electron to silver making silver neutral, and copper positive.

Single Replacement Reaction

- Your book calls this a single displacement reaction.
- ~an atom or group switches its partner
- $AX + B \rightarrow A + BX$

- $AgCl + Zn \rightarrow Ag + ZnCl$
- $CuSO_4 + Fe \rightarrow FeSO_4 + Cu$
- $FeO + Al \rightarrow Al_2O_3 + Fe$

The name

- There are two parties in a redox reaction.
- The one that is gaining electron(s).
- This one gets reduced.
- Think of the charge, it gets lower.

- The one that is losing electron(s).
- It gets oxidized.

Combustion Reaction

- A chemical reaction involving oxygen that produces energy (heat) so rapidly that it produces a flame.
- $CH_4 + O_2 \rightarrow CO_2 + H_2O$
- Natural gas combusting. Used for Bunsen burners, gas stoves, gas furnaces etc.
- $C_8H_{18} + O_2 \rightarrow CO_2 + H_2O$
- Combustion of octane (gasoline)
- $H_2 + O_2 \rightarrow H_2O$
- Combustion of hydrogen, used in a fuel cell

Double Replacement Reaction

- ~two atoms or groups switches their partners
- $AX + BY \rightarrow AY + BX$
- $2NiNO_3 + CaSO_4 \rightarrow Ca(NO_3)_2 + Ni_2SO_4$
- $NaCl + AgI \rightarrow NaI + AgCl$
- All of the precipitation reactions/net ionic equations we have been doing have been double replacement reactions.

Synthesis (combination) Reactions

- ~simpler molecules build together and form more complex molecules
- A + B → X
- 6 CO_2 + 6 H_2O → $C_6H_{12}O_6$ + 6 O_2
- 4 Zn + O_2 → 2 Zn_2O

Identify the form of the reaction

- Mg + 2 HNO_3 → $Mg(NO_3)_2$ + H_2
- Single replacement (Redox)
- C_8H_{18} + O_2 → CO_2 + H_2O
- Decomposition (Combustion)
- FeO + HCl → $FeCl_2$ + H_2O
- Double replacement (Acid Base)
- Fe + O_2 → Fe_2O_3
- Synthesis (combustion)

Decomposition Reactions

- ~more complex molecules break apart to form simpler molecules
- X → A + B
- $C_6H_{12}O_6$ + 6 O_2 → 6 CO_2 + 6 H_2O
- 2 H_2O → 2 H_2 + O_2

Continued

- K_3PO_4 + $Ca(SO_4)$ → K_2SO_4 + $Ca_3(PO_4)_2$
- Double replacement (redox, precipitation)
- Fe + HCl → H_2 + $FeCl_2$
- Single replacement (acid base)
- $C_3H_5(NO_3)_3$ → N_2 + O_2 + CO_2 + H_2O
- Decomposition (redox)
- Cu + O_2 → CuO
- Synthesis (redox)

Reactions don't fit into just one category

- Most fit into several of these.
- 2 H_2 + O_2 → 2 H_2O
- This is a combustion reaction, and a synthesis reaction.

- All reactions be classified as one of the 4 general forms: single replacement, double replacement, synthesis or decomposition