Types of Chemical Reactions

Classifying Reactions

There are 5 general types of reactions

- combination
- decomposition
- single-replacement
- double-replacement
- combustion

Combination Reactions

A combination reaction is a chemical change in which two or more substances react to form a single new substance.

Ex: $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

Decomposition Reaction

A decomposition reaction is a chemical change in which a single compound breaks down into two or more simpler products.

Decomposition reactions involve only one reactant and two or more products.

Ex. $2HgO(s) \dashrightarrow 2Hg(l) + O_2(g)$

Single-Replacement Reactions

A single-replacement reaction is a chemical change in which one element replaces a second element in a compound.

Ex. $2K(s) + 2H_2O(l) \rightarrow 2KOH(aq) + H_2(g)$

$Zn(s) + Cu(NO_3)_2(aq) \rightarrow Cu(s) + Zn(NO_3)_2(aq)$

Note that both the reactants and the products consist of an element and a compound.

Whether one metal will displace another metal from a compound depends on the relative reactivities of the two metals.

The activity series of metals lists metals in order of decreasing reactivity. A reactive metal will replace any metal listed below it in the activity series.

Table 11.2
Activity Series of Metals

	Name	Symbol
Decreasing reactivity ↓	Lithium	Li
	Potassium	K
	Calcium	Ca
	Sodium	Na
	Magnesium	Mg
	Aluminum	Al
	Zinc	Zn
	Iron	Fe
	Lead	Pb
	(Hydrogen)	(H)*
	Copper	Cu
	Mercury	Hg
	Silver	Ag

*Metals from Li to Na will replace H from acids and water; from Mg to Pb they will replace H from acids only.

Pg. 333

A halogen can also replace another halogen from a compound. The activity of the halogen group (Group 7A) decreases as you go down the periodic table.

If an element does not displace another element, then no reaction will occur.

Double-Replacement Reaction

A double-replacement reaction is a chemical change involving an exchange of positive ions between two compounds. They are also referred to as 'double-displacement' reactions.

They generally take place in a aqueous solution and often produce a precipitate, a gas, or a molecular compound like water.

3 things to look for

- a precipitate is formed (solid in products)

$Na_2S(aq) + Cd(NO_3)_2(aq) \rightarrow CdS(s) + 2NaNO_3(aq)$

- one of the products is a gas

$2NaCN(aq) + H_2SO_4(aq) \rightarrow 2HCN(g) + Na_2SO_4(aq)$

- One of the products is a molecular compound like water.

$Ca(OH)_2(aq) + 2HCl(aq) \rightarrow CaCl_2(aq) + 2H_2O(l)$

Combustion Reaction

A combustion reaction is a chemical change in which an element or a compound reacts with oxygen, often producing energy in the form of heat and light.

Ex. $2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(l)$

Try questions #13-27 on pages 331-339