6:5 A Classifying Reactions

Single Replacement

During single replacement, one element replaces another element in a compound. There are two different possibilities:

1. One cation (positive ion) replaces another. Written using generic symbols, it is:

AX + Y ---> YX + A

Element Y has replaced A (in the compound AX) to form a new compound YX and the free element A. Remember that A and Y are both cations (positively-charged ions) in this example.

An example is:

$Cu + AgNO_3 \text{ ---> } Ag + Cu(NO_3)_2$

6:5 B Classifying Reactions

Double Replacement

During double replacement, the cations and anions of two different compounds switch places.

Written using generic symbols, it is:

AB + XY ---> AY + XB

A and X are the cations (positively-charged ions) in this example, with B and Y being the anions (negatively-charged ions).

An example is:

$KOH + H_2SO_4 \text{ ---> } K_2SO_4 + H_2O$

Limestone reacts with acids in double displacement reaction.

Decomposition

During decomposition, one compound splits apart into two (or more pieces). These pieces can be elements or simpler compounds

Written using generic symbols, it is usually shown as:

AB ---> A + B

6:5 C Classifying Reactions

Decomposition can also split one compound into two simpler compounds (or compound and an element) as in these examples:

$CaCO_3$ ---> $CaO + CO_2$
Na_2CO_3 ---> $Na_2O + CO_2$
$KClO_3$ ---> $KCl + O_2$
$Ba(ClO_3)_2$ ---> $BaCl_2 + O_2$

Notice how, in every case so far, there is only one substance on the left-hand (reactant) side. This is always the case in a decomposition reaction. Rotting is a form of decomposition reaction.

Synthesis

Synthesis is, at this introductory level, almost always the reverse of a decomposition reaction. That means that two pieces join together to produce one, more complex compound. These pieces can be elements or simpler compounds. Complex simply means that the product compound has more atoms than the reactant molecules. Usually!!

Written using generic symbols, it is usually shown as:

A + B ---> AB

6:5 D Classifying Reactions

These are some examples:

$Mg + O_2 \text{ ---> } MgO$
$H_2 + O_2 \text{ ---> } H_2O$
$K + Cl_2 \text{ ---> } KCl$
$Fe + O_2 \text{ ---> } Fe_2O_3$

Combustion

Combustion, at its most general, can mean the reaction of oxygen gas (O_2) with anything.

However, we will understand combustion to mean the reaction of oxygen with a compound containing carbon and hydrogen. A common synonym for combustion is burn.

Written using generic symbols, it is usually shown as:

$C_xH_y + O_2 \text{ ---> } CO_2 + H_2O$

These are some examples:

$CH_4 + O_2 \text{ ---> } CO_2 + H_2O$
$C_2H_6 + O_2 \text{ ---> } CO_2 + H_2O$
$C_6H_{12}O_6 + O_2 \text{ ---> } CO_2 + H_2O$
$C_2H_5OH + O_2 \text{ ---> } CO_2 + H_2O$