

14.2 Classifying Reactions


14.2

READ




Chemical reactions may be classified into different groups according to the reactants and products. The five major groups of chemical reactions are summarized below.


Synthesis reactions - when two or more substances combine to form a new compound.

- *General equation:* $A + B \rightarrow AB$ 
- *Example:* When rust forms, iron reacts with oxygen to form iron oxide (rust).
 $4\text{Fe} (s) + 3\text{O}_2 (g) \rightarrow 2\text{Fe}_2\text{O}_3 (s)$

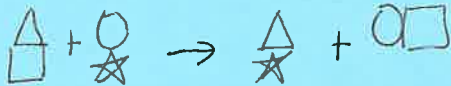
Decomposition reactions - when a single compound is broken down to produce two or more smaller compounds.

- *General equation:* $AB \rightarrow A + B$ 
- *Example:* Water can be broken down into hydrogen and oxygen gases.
 $2\text{H}_2\text{O} (l) \rightarrow 2\text{H}_2 (g) + \text{O}_2 (g)$

Single displacement reactions - when one element replaces a similar element in a compound.

- *General equation:* $A + BX \rightarrow AX + B$ 
- *Example:* When iron is added to a solution of copper chloride, iron replaces copper in the solution and copper falls out of the solution.
 $\text{Fe} (s) + \text{CuCl}_2 (aq) \rightarrow \text{Cu} (s) + \text{FeCl}_2 (aq)$

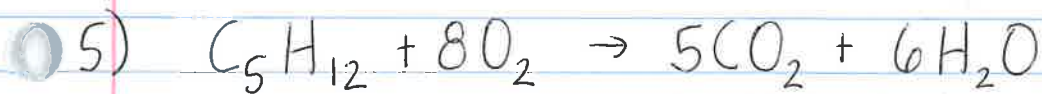
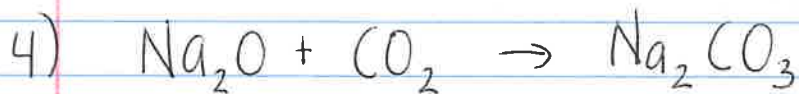
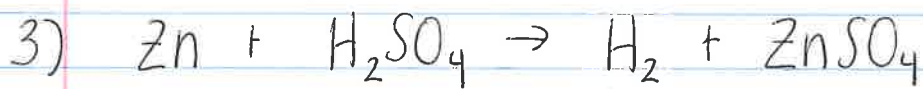
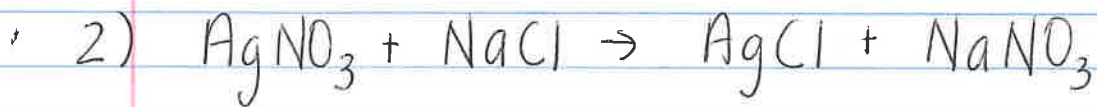
Double displacement reactions - when ions from two compounds in solution exchange places to produce two new compounds.

- *General equation:* $AX + BY \rightarrow AY + BX$ 
- *Example:* When carbon dioxide gas is bubbled into lime water, a precipitate of calcium carbonate is formed along with water.
 $\text{CO}_2 (g) + \text{CaOH}_2 (aq) \rightarrow \text{CaCO}_3 (s) + \text{H}_2\text{O} (l)$

Combustion reactions - when a carbon compound reacts with oxygen gas to produce carbon dioxide and water vapor. Energy is released from the reaction.

- *General equation:* Carbon Compound + $\text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{energy}$
- *Example:* The combustion of methane gas.
 $\text{CH}_4 (g) + 2\text{O}_2 \rightarrow \text{CO}_2 (g) + 2\text{H}_2\text{O} (g)$

● Classify the following reactions:



1) Decomposition

2) Double displacement

3) Single displacement

4) Synthesis

● 5) combustion

Nuclear vs. Chemical Reactions

changes in
of p⁺/n
sub-atomic level

Nuclear reactions involve changes in the nucleus of the atom. The number of protons and/or # of neutrons changes.

Radioactive materials are unstable and the isotopes decay to turn into more stable isotopes.

vs.

changes in
of e⁻

Chemical reactions involve valence electrons and the making or breaking of chemical bonds. This reaction involves the entire atom.

atomic level

* Both reactions happen to achieve stability.