Classifying Chemical Reactions

Types of chemical reactions:

1. Synthesis
2. Decomposition
3. Combustion
4. Single-Replacement
5. Double-replacement

*Classifying how atoms rearrange during a chemical reaction

1. **Synthesis reaction**: 2 or more substances react to produce a single product

$A + B \rightarrow AB$

Example:

$2Na_{(s)} + Cl_{2(g)} \longrightarrow 2NaCl_{(s)}$

$CaO_{(s)} + H_2O_{(l)} \longrightarrow Ca(OH)_{2(s)}$

2.**Decomposition Reaction:** A single compound breaks down into two or more substances. (opposite of synthesis)

$AB \longrightarrow A + B$

Example:

$NH_4NO_{3(s)} \longrightarrow N_2O_{(g)} + 2H_2O_{(g)}$

Car air bags!: $2NaN_{3(s)} \longrightarrow 2Na_{(s)} + 3N_{2(g)}$

3. **Combustion reaction**: Oxygen combines with a substance and releases energy in the form of heat and light.

Always need O_2!

Example:

$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(g)}$

$2C_2H_{6(g)} + 7O_{2(g)} \longrightarrow 4CO_{2(g)} + 6H_2O_{(g)}$

Balancing Combustion Reactions:

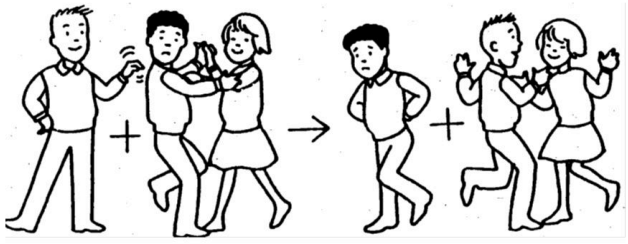
- Always balance C and H first.
- Then use O_2 to balance out oxygen
  - > If you have an ODD number of oxygen that need to be balanced (X), put the coefficient X/2 in front of O_2, then multiply the entire equation by 2 to get integers for coefficients.

- Example: Combustion of butane

$$C_4H_{10} + O_2 \longrightarrow CO_2 + H_2O$$

4. **Single Replacement Reaction:** A reaction in which the atoms of one element replaces the atoms of another element in a compound.

$A + BX \longrightarrow B + AX$



A + BC ⟶ B + AC

Single Replacement Reaction

Ex:

$2Li_{(s)} + 2H_2O_{(l)} \longrightarrow 2LiOH_{(aq)} + H_{2(g)}$

$Zn_{(s)} + CuCl_{2(aq)} \longrightarrow$

5. **Double Replacement Reaction:** Reaction in which there is an exchange of ions between compounds.

$AX + BY \longrightarrow AY + BX$

*Cations switch places

*Always produce a precipitate, a gas, or water

Double Replacement:

E

+

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+

Practice: Classify each of the following reactions

1. $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$
2. $2Al(s) + 3S(s) \rightarrow Al_2S_3(s)$
3. $H_2O(l) + N_2O_5(g) \rightarrow 2HNO_3(aq)$
4. $Ni(OH)_2(s) \rightarrow NiO(s) + H_2O(l)$
5. $3Ni + 2AuBr_2 \rightarrow 3NiBr_2 + 2Au$
6. $2HI(g) \rightarrow H_2(g) + I_2(g)$
7. $FeO(s) + O_2(g) \rightarrow Fe_2O_3(s)$
8. $Fe(s) + Sn(NO_3)_4(aq) \rightarrow Fe(NO_3)_3 + Sn(s)$
9. $LiCrO_4(aq) + BaCl_2(aq) \rightarrow LiCl(aq) + Ba(CrO_4)_2(s)$

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