The 5 Types of Chemical Reactions (Chapter 11)

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6th period
1) Combination Reactions

- Is also referred to as a synthesis reaction

- It is a chemical change in which two or more substances react to form a new singular substance

- The product is a compound in this form of reaction

- You can tell this reaction has occurred because on the reactant side there are multiple substances, while on the product side there is only one product
Synthesis (combination)

\[ A + B \rightarrow AB \]
2) Decomposition Reactions

- This is a chemical change where a single compound (the reactant) breaks down into two or more simpler products.

- This type of reaction is easily identifiable, because:
  - It is the exact opposite of synthesis; if you know one you know them both
  - There is always one reactant. If you see one reactant that’s a compound and several products, a decomposition reaction occurred.
Decomposition

$AB \rightarrow A + B$
3) Single-Replacement Reactions

- A chemical change where one element replaces a second element in a compound.
- It is identifiable by its symmetry. On the reactant side there is a single element and a compound, as there is on the product side.
- No reaction will occur if the most reactive element is already in the compound.
- The image on the next slide should help to visualize.
Notice that the couple in white are a compound on the reactant side. However, on the compound side, the man in orange steals the man in white's date. So, a part of one of the reactants trades places and is in a different place among the products.
4) Double-Replacement Reactions

• A chemical change where there is an exchange of positive ions between two compounds

• May also be called double-displacement reactions

• Generally take place in aqueous solution

• Often produce a precipitate, a gas, or a molecular compound (i.e. water)
• Notice here that there are all of the same aspects on both side of the equation, however the two men traded hats. This should help you visualize what a double-replacement reaction will look like.
5) Combustion Reaction

- A chemical change where an element or a compound reacts with oxygen
- This will often yield energy in the form of heat and light
- Oxygen is ALWAYS going to be on the reactant side
  - This is the main indicator that a combustion reaction has occurred
\[
\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}
\]

Methane \hspace{1cm} \text{Oxygen} \hspace{1cm} \text{Carbon Dioxide} \hspace{1cm} \text{Water}

Combustion Reaction
Practice Problem #1

- What type of reaction is this?
- AgNO\textsubscript{3}(aq) + KCl\textsubscript{(aq)} \rightarrow AgCl\textsubscript{(s)} + KNO\textsubscript{3}(aq)

- The answer is double-replacement. We can tell that it is double replacement because there are two compounds on each side of the equation. Also note that the compounds have swapped the latter of the 2 elements.
Practice Problem #2

• Fill in the blank:
• \( \text{CH}_4 + \_ \rightarrow \text{CO}_2 + \text{H}_2\text{O} \)
• The answer is \( \text{O}_2 \)
• We can tell this is a combustion reaction because:
  1. Oxygen is on the product side, so it most likely had a place on the reactant side
  2. Carbon dioxide was formed, a common product in combustion reactions
Practice Problem #3

- What type of reaction has occurred here?:

  \[ \text{Br}_2 (l) + 2\text{NaI} (s) \rightarrow 2\text{NaBr} (s) + \text{I}_2 (s) \]

- The answer is single-replacement reaction.

- Notice that the single element on the reactant side, \( \text{Br}_2 (l) \), becomes part of the compound on the product side \( 2\text{NaBr} (s) \).
Practice Problem #4

- What type of reaction will the following be:

- \( \text{Br}_2(\text{aq}) + \text{NaCl} (\text{aq}) \rightarrow \)

- Trick question! There will be no reaction. Bromine is less reactive than Chlorine, so there will be no reaction. Remember, if the most reactive element is already in the compound, there will be NO chemical reaction.
Pop Quiz, Part 1

Answer the following with always, frequently, or never:

1. In a combustion reaction, oxygen is ______ on the reactant side.

2. In a synthesis reaction, there are ______ two or more products.

3. A decomposition reaction ______ requires energy in the form of heat, light, or electricity.
Answers, Part 1

1. ALWAYS

2. NEVER

3. FREQUENTLY
Pop Quiz, Part 2

What types of reactions are the following?

1. $\text{Zn}_{(s)} + \text{H}_2\text{SO}_4_{(aq)} \rightarrow \text{ZnSO}_4_{(aq)} + \text{H}_2_{(g)}$

2. $2 \text{KCl}_{(s)} \rightarrow 2 \text{K}_{(s)} + \text{Cl}_2_{(g)}$

3. $\text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$
Answers, Part 2

1. Single-replacement Reaction

2. Decomposition Reaction

3. Double-Replacement Reaction