Lesson 9

# CONSERVATION LAW

Chemical Equations

- When two or more chemicals are combined, they may react to form new substances that have **properties** different from the original chemicals

- The initial chemicals are called the **reactants** and the final chemicals are called the **products.**

**Reactants → Products** * the "→" means **yields**

- These chemical reactions can be written two ways

## 1. Word Equation

- Uses the full spelling of each chemical reactant and product
- Example: sodium + oxygen → **sodium oxide**

## 2. Symbolic / Formula Equation

- Uses the chemical formulas for the reactants and products
- Example: $Na + O_2 \rightarrow$ **$Na_2O$**

***Orally:*** *There is a problem with this equation – it's unbalanced! What does that mean?*

<u>The Law of Conservation of Mass</u>

- First stated by French chemist Antoine Lavoisier (1743-1794)
- States that mass is **conserved** in a chemical reaction; the mass of the **reactants** equals the mass of the **products**
- Since matter cannot be **created** nor **destroyed**, then the all of the atoms in the reactants must exist as atoms in the products

<u>Balancing Chemical Equations</u>

***Orally****: Why balance equations??*

- Chemical equations are balanced to show that the total number of each type of atom is **equal** on both sides of the chemical equation.

- Steps to balancing equations

1. Write out the full formula equation (called a **skeleton** equation).

2. Pick an atom on the reactant side to start with and **count** the number of atoms.
3. Use coefficients (numbers in **front** of each element or compound) to increase quantities of a particular element or compound.

   * DO NOT change the subscript number; if you do, you change the **substance**.
4. Repeat steps 2-4 for the rest of the atoms.
5. Double check when finished

Example:

1. $Na + O_2 \rightarrow Na_2O$ (skeleton chemical reaction = **unbalanced**)
2. **$2Na + O_2 \rightarrow Na_2O$**
3. **$2Na + O_2 \rightarrow 2Na_2O$**
4. **$4Na + O_2 \rightarrow 2Na_2O$**
5. Double check from left to right

*https://phet.colorado.edu/en/simulation/balancing-chemical-equations*

*Simulation shows how to properly balance equations.*
*Show the introduction to the simulation, then show the game and have students record the practice examples in their notes. The game has 3 levels with 5 examples of each level. Embed "tips" with appropriate examples.*

**Tips:**

1. Balance pure elements last.
2. Double odd number of atoms if there is an even number on the other side.
3. Balance complex ions by counting groups of that ion. e.g., how many groups of $SO_4^{-2}$ on each side of the equation?
4. When balancing compounds, balance any oxygen and hydrogen last.

Homework: Worksheets for lesson 9 on balancing equations. There are several worksheets attached for additional practice.