

Balancing Chemical Equations Review Sheet

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Introduction

Balancing chemical equations is a fundamental skill required in General Chemistry I and II, as well as high school Chemistry. It follows the **Law of Conservation of Mass**, which states that matter cannot be created or destroyed in a chemical reaction. As a result, the number of atoms of each element must be equal on both sides of a balanced equation.

Unfortunately, there is **no single rule or universal order** for balancing equations because there are multiple types of chemical equations. However, a consistent approach can make the process easier. In my experience, most high school and college-level students can balance equations by the time they seek tutoring — although not always quickly! Practice helps refine this skill over time.

Key Tips for Balancing Equations

- **Add Coefficients to Skeleton Equations:**
 - Coefficients are essential for balancing skeleton (unbalanced) equations. They ensure that the number of atoms of each element is the same on both sides of the equation.
- **Balance Standalone Elements Last:**
 - For equations with standalone elements (like O_2 or H_2), balance them **last** to avoid affecting other compounds in the equation.
- **Recognize Combustion Reactions:**
 - Combustion reactions involve burning hydrocarbons in the presence of oxygen to form carbon dioxide and water. These often follow a set pattern and can be approached with specific strategies.

- **Be Aware of Diatomic Gases:**
 - Remember the seven diatomic gases: H₂, N₂, O₂, F₂, Cl₂, Br₂, and I₂. These elements naturally exist as pairs in their gaseous form.
 - **Metals Are Monatomic:**
 - Metals are typically written as monatomic in chemical equations, meaning they do not have subscripts.
 - **Practice, Practice, Practice:**
 - Use Chemistry textbooks and online resources for practice problems. Websites that automatically balance equations can be helpful, but they should only be used in extreme cases when encountering particularly difficult equations.
 - **Double-Check the Balance:**
 - Always recheck that your final equation is properly balanced, even if the question states that it is.
 - **Ignore States of Matter Initially:**
 - While it's convention to include states of matter (solid, liquid, gas, aqueous) in a balanced equation, these are less critical when first learning to balance equations.
 - **Don't change subscripts when balancing:**
 - Once the reactants and products are set and valid molecules, don't change the subscripts. This could render the molecules invalid!
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Practice Problems with Solutions

1. Easy Equation

Unbalanced: $\text{H}_2 + \text{Cl}_2 \rightarrow \text{HCl}$

Balanced:

2. Medium Equation

Unbalanced: $\text{Al} + \text{O}_2 \rightarrow \text{Al}_2\text{O}_3$

Balanced:

3. Difficult Equation (Combustion Reaction)

Unbalanced: $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

Balanced:

Bonus Tip

When equations involve different states of water — solid (s), liquid (l), and gas (g) — take extra care to account for the correct state in the final equation.

Example:

