

## CHM 101 – Balancing Chemical Reactions- Tips and Tricks

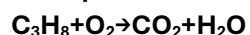


### Step-by-Step Guide to Balancing Chemical Reactions

#### Step 1: Write the Unbalanced Equation

- Start by writing the correct formulas for the reactants and products. Ensure that you have the correct chemical symbols and formulas.

Example:



#### Step 2: Count the Number of Atoms

- Count the number of atoms of each element present in the reactants and products.

Example:

- **Reactants: C: 3, H: 8, O: 2**

- **Products: C: 1, H: 2, O: 3**

#### Step 3: Identify the Elements That Need Balancing

- Determine which elements have unequal numbers of atoms on each side of the equation.

Example:

- **C and H are unbalanced (3 C and 8 H on the left vs. 1 C and 2 H on the right).**

#### Step 4: Use Coefficients to Balance the Elements

- Add coefficients in front of the compounds to balance the number of atoms for each element. Start with the most complex molecule first, if applicable.

Example:

- **To balance carbon (C), place a coefficient of 3 in front of CO<sub>2</sub>:**  
$$\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow 3\text{CO}_2 + \text{H}_2\text{O}$$

#### Step 5: Update Atom Counts After Adding Coefficients

- Recount the number of atoms for each element after adding coefficients.

Example:

- **New Products: C: 3, H: 2, O: 7 (from 3 CO<sub>2</sub> and 1 H<sub>2</sub>O)**

#### Step 6: Balance Hydrogen and Oxygen Last

- Focus on balancing hydrogen (H) and oxygen (O) last, as they often appear in multiple compounds.

Example:

- **To balance hydrogen, place a coefficient of 4 in front of H<sub>2</sub>O:**  
$$\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$$

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### Step 7: Recount Atoms Again

- Count the atoms again after adding the new coefficient to ensure they are balanced.

### Example:

- **New Products: C: 3, H: 8, O: 10 (3 from CO<sub>2</sub> and 4 from H<sub>2</sub>O)**

### Step 8: Balance Oxygen Last

- Adjust the coefficients of O<sub>2</sub> to balance the oxygen atoms.

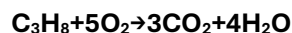
### Example:

- **To balance oxygen, place a coefficient of 5 in front of O<sub>2</sub>:**  
**C<sub>3</sub>H<sub>8</sub>+5O<sub>2</sub>→3CO<sub>2</sub>+4H<sub>2</sub>O**

### Step 9: Verify the Balance

- Ensure all elements have the same number of atoms on both sides of the equation.

### Final Balanced Equation:



### Step 10: Practice with More Examples

### Other Tips and Tricks for Balancing Equations

1. **Start with the Most Complex Compound:** Always balance the equation by starting with the molecule that has the most elements.
2. **Balance One Element at a Time:** Focus on one element at a time, moving from metals to nonmetals and leaving hydrogen and oxygen for last.
3. **Use the Lowest Common Multiple:** When adjusting coefficients, make sure they are the smallest whole numbers possible.
4. **Double-Check Atom Counts:** After balancing, count the number of atoms of each element on both sides to ensure they match.
5. **Practice Common Reaction Types:** Familiarize yourself with combustion, synthesis, decomposition, and replacement reactions.
6. **Use a Pencil:** If doing by hand, use a pencil so you can easily adjust coefficients as needed.
7. **If You See Odd Numbers, Try Doubling Everything:** When oxygen or hydrogen atoms appear as an odd number, doubling the entire equation can help.

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### Let's practice balancing Chemical Reactions:

1. Which of the following are the coefficients for the correctly balanced reaction?  $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$

- A) 1, 1, 1
- B) 2, 1, 2
- C) 1, 2, 1
- D) 2, 2, 2

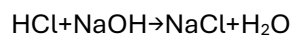
2. Which of the following are the coefficients for the correctly balanced reaction?  $\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3$

- A) 1, 2, 1
- B) 1, 3, 2
- C) 2, 3, 1
- D) 1, 1, 2

3. Which of the following are the coefficients for the correctly balanced reaction?  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$

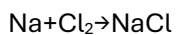
- A) 1, 1, 1
- B) 1, 2, 1
- C) 2, 1, 2
- D) 1, 1, 2

4. Which of the following are the coefficients for the correctly balanced reaction?



- A) 2, 1, 1, 2
- B) 1, 2, 1, 1
- C) 1, 1, 1, 1
- D) 1, 2, 2, 1

5. Which of the following are the coefficients for the correctly balanced reaction?



- A) 1, 2, 1
- B) 2, 2, 2
- C) 1, 1, 1
- D) 2, 1, 2

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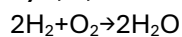
6. Which of the following are the coefficients for the correctly balanced reaction?  $C+H_2\rightarrow CH_4$
- A) 1, 4, 2
  - B) 1, 2, 1
  - C) 1, 1, 2
  - D) 2, 2, 1
7. Which of the following are the coefficients for the correctly balanced reaction?  
 $Fe+O_2\rightarrow Fe_2O_3$
- A) 4, 3, 2
  - B) 2, 2, 3
  - C) 1, 2, 1
  - D) 3, 2, 1
8. Which of the following are the coefficients for the correctly balanced reaction?  $H_2+Cl_2\rightarrow HCl$
- A) 2, 2, 1
  - B) 1, 1, 2
  - C) 2, 1, 1
  - D) 1, 2, 1
9. Which of the following are the coefficients for the correctly balanced reaction?  
 $Mg+O_2\rightarrow MgO$
- A) 1, 1, 1
  - B) 2, 1, 2
  - C) 2, 2, 1
  - D) 1, 2, 2
10. Which of the following are the coefficients for the correctly balanced reaction?  $H_2+Cl_2\rightarrow HCl$
- A) 1, 1, 1
  - B) 3, 1, 2
  - C) 2, 1, 3
  - D) 1, 1, 2

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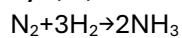


### Answers:

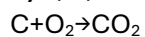
1. **B) 2, 1, 2**



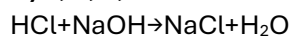
2. **B) 1, 3, 2**



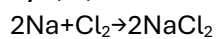
3. **A) 1, 1, 1**



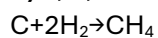
4. **C) 1, 1, 1, 1**



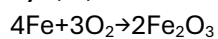
5. **B) 2, 1, 2**



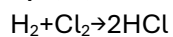
6. **B) 1, 2, 1**



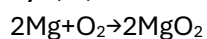
7. **A) 4, 3, 2**



8. **B) 1, 1, 2**



9. **B) 2, 1, 2**



10. **D) 1, 1, 2**

