

What Is Balancing a Chemical Equation?

Worksheet

To balance a chemical equation, add whole-number coefficients in front of formulas (never change subscripts) until the number of atoms of each element is equal on the reactant and product sides.

Questions

1. What can you change to balance a chemical equation?
 - A) Subscripts
 - B) Coefficients
 - C) Element symbols
 - D) Reaction arrow
2. Balanced form of $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$ is:
 - A) $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$
 - B) $2\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$
 - C) $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$
 - D) $2\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$
3. Why must equations be balanced?
 - A) To make them shorter
 - B) To satisfy conservation of mass
 - C) To change the products formed
 - D) To speed up the reaction
4. In $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$, what is wrong before balancing?
 - A) Nothing, it's balanced
 - B) Oxygen atoms don't match (2 left, 1 right)
 - C) Hydrogen atoms don't match
 - D) There are too many reactants
5. Balance: $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
6. Balance: $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$
7. Balance: $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ (propane combustion)
8. Define: What does 'balancing' a chemical equation mean?
9. Define: Can you change subscripts to balance an equation?
10. Define: What law requires balanced equations?

Answer Key

1. B) Coefficients - Only coefficients (multipliers in front of formulas) may be changed; subscripts define the substance.
2. C) $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$ - $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$ gives 4 Fe and 6 O on each side.
3. B) To satisfy conservation of mass - Balancing ensures atoms are conserved, matching the Law of Conservation of Mass.
4. B) Oxygen atoms don't match (2 left, 1 right) - Left side has 2 O atoms, right side has only 1 O atom - unbalanced.
5. Count atoms: left 2H,2O; right 2H,1O O is unbalanced - add coefficient 2 to H₂O: $\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ Now right side has 4H,2O - rebalance H: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ Check: left 4H,2O; right 4H,2O
6. Count atoms: left 1Fe,2O; right 2Fe,3O Balance Fe and O using coefficients: $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$ Check: left 4Fe,6O; right 4Fe,6O
7. Balance C first: $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow 3\text{CO}_2 + \text{H}_2\text{O}$ Balance H: $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$ Count O on right: $3 \times 2 + 4 \times 1 = 10$, so use 5O₂: $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$ Check: left 3C,8H,10O; right 3C,8H,10O
8. Adjusting coefficients so the number of atoms of each element is equal on both sides.
9. No - changing subscripts changes the substance itself. Only coefficients can be adjusted.
10. The Law of Conservation of Mass - atoms are neither created nor destroyed.

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