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Balancing Chemical Equations

The principle of conservation of mass means that the same number of atoms exists in the products as in the reactants. **To describe a reaction accurately, a chemical equation must show the same number of each type of atom on both sides of the equation.** Chemists say an equation is balanced when it accurately represents conservation of mass. How can you write a balanced chemical equation?

1 Write the Equation Suppose you want to write a balanced chemical equation for the reaction between hydrogen and oxygen that forms water. To begin, write the correct formulas for both reactants and product.

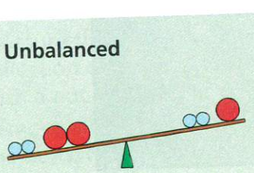
$$H_2 + O_2 \longrightarrow H_2O$$

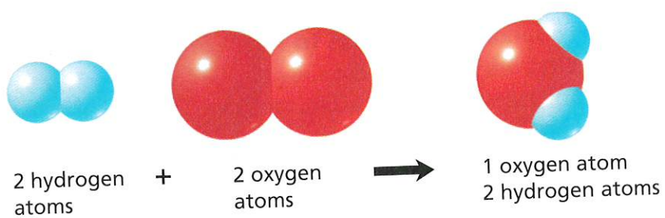
Reactants — Products

Place the reactants, H_2 and O_2, on the left side of the arrow, separated by a plus sign. Then write the product, H_2O, on the right side of the arrow.

2 Count the Atoms Count the number of atoms of each element on each side of the equation. You find two atoms of oxygen in the reactants but only one atom of oxygen in the product.

Unbalanced

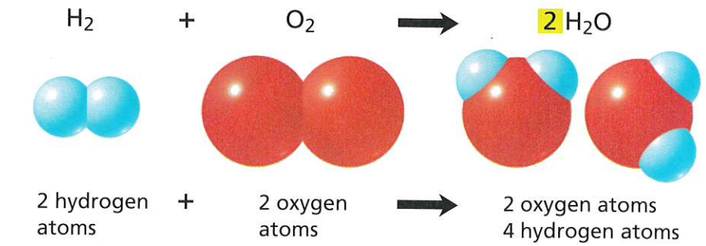




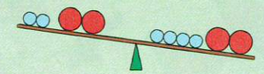
How can you get the number of oxygen atoms on both sides to be the same? You cannot change the formula for water to H_2O_2 because H_2O_2 is the formula for hydrogen peroxide, a completely different compound. So, how can you show that mass is conserved?

3 Use Coefficients to Balance Atoms To balance the equation, use coefficients. A **coefficient** (koh uh FISH unt) is a number placed in front of a chemical formula in an equation. It tells you how many atoms or molecules of a reactant or a product take part in the reaction. If the coefficient is 1, you don't need to write it.

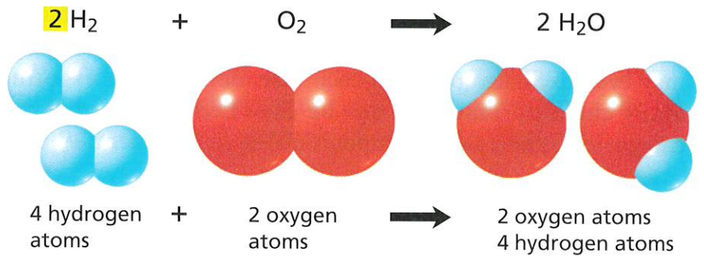
Balance the number of oxygen atoms by writing the coefficient 2 for water. That's like saying "2 × H_2O." Now there are two oxygen atoms—one in each molecule of water.



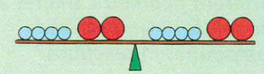
Unbalanced



Balancing the oxygen atoms throws off the hydrogen atoms. There are now two hydrogen atoms in the reactants and four in the product. How can you balance the hydrogen? Try doubling the number of hydrogen atoms on the left side of the equation by writing the coefficient 2 for hydrogen.



Balanced



4 Look Back and Check The equation is balanced. It tells you that two molecules of hydrogen react with one molecule of oxygen to yield two molecules of water. Count the atoms in the balanced equation again to see that the equation is correct.

Math Analyzing Data

Balancing Chemical Equations

Magnesium metal (Mg) reacts with oxygen gas (O_2) forming magnesium oxide (MgO). To write a balanced equation for this reaction, first write the equation using the formulas of the reactants and products. Then, count the number of atoms of each element.

1. **Balancing Chemical Equations** Balance the equation for the reaction of sodium metal (Na) with oxygen gas (O_2), forming sodium oxide (Na_2O).
2. **Balancing Chemical Equations** Balance the equation for the reaction of tin (Sn) with chlorine gas (Cl_2), forming tin chloride ($SnCl_2$).

Balancing Equations

1 Write the Equation
Mg + O_2 → MgO

2 Count the Atoms
Mg + O_2 → MgO
1 2 1 1

3 Use Coefficients to Balance the Atoms
Mg + O_2 → 2 MgO
2 2

2 Mg + O_2 → 2 MgO
2 2 2 2

4 Look Back and Check