

## 1.5: Chemical Reactions - Examples of Chemical Change

Chemical reactions are the processes by which chemicals interact to form new chemicals with different compositions. Simply stated, a chemical reaction is the process where reactants are transformed into products. How chemicals react is dictated by the chemical properties of the element or compound- the ways in which a compound or element undergoes changes in composition.

Chemical reactions are constantly occurring in the world around us; everything from the rusting of an iron fence to the metabolic pathways of a human cell are all examples of chemical reactions. Chemistry is an attempt to classify and better understand these reactions. One key reaction in modern civilization is combustion



Figure 1.5.1: An ignited lighter showing the combustion of butane. (Public Domain; [Kimmo Palosaari](#) via [Wikipedia](#))

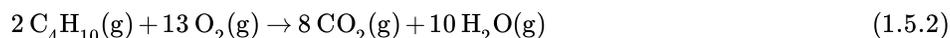
A chemical reaction is typically represented by a **chemical equation**, which represents the change from reactants to products. The left hand side of the equation represents the **reactants**, while the right hand side represents the **products**. A typical chemical reaction is written with stoichiometric coefficients, which show the relative amounts of products and reactants involved in the reaction. Each compound is followed by a parenthetical note of the compound's physical state: (*l*) for liquid, (*s*) for solid, (*g*) for gas. The symbol (*aq*) is also commonly used in order to represent an aqueous solution, in which compounds are dissolved in water.

Butane is a gas at room temperature and atmospheric pressure and is highly flammable, colorless, easily liquefied gas (under light pressure). Butane can be used for gasoline blending, as a fuel gas, fragrance extraction solvent, either alone or in a mixture with propane, and as a feedstock for the manufacture of ethylene and butadiene, a key ingredient of synthetic rubber. The chemical formula of butane is  $C_4H_{10}$ . When oxygen is plentiful, butane burns to form carbon dioxide and water vapor as observed in modern lighters (Figure 1.5.1).

This reaction in words is:



and the corresponding chemical equation for this reaction is:



In the above chemical equation,  $C_4H_{10}$  and  $O_2$  are the **reactants** that reacted to form the **products**:  $CO_2$  and  $H_2O$ ,

### Writing Chemical Equations

To write an accurate chemical equation, two things must occur:

1. Each product and reactant must be written using its chemical formula
2. Coefficients are used in front of the chemical formulas to reflect the ratio species (discussed further in a later chapter)
3. Adding the phase of each chemical in parentheses (although this is often dropped for convenience)

### Key Takeaways

- Chemical reactions are written to represent chemical changes.
- Chemical formulas are used to represent the reactants (starting substance) and the products (the new substances).

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