Conservation of Energy in Chemical Reactions

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Printed: January 28, 2017

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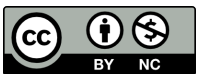


CHAPTER 1

Conservation of Energy in Chemical Reactions

The blue flame in this photo is burning inside a home furnace. The fuel is natural gas, and it combines with oxygen when it burns. This chemical reaction, called a combustion reaction, gives off a lot of energy.

Energy and Chemical Reactions

All chemical reactions involve energy. Energy is used to break bonds in reactants, and energy is released when new bonds form in products. Like the combustion reaction in a furnace, some chemical reactions require less energy to break bonds in reactants than is released when bonds form in products. These reactions, called exothermic reactions, release energy. In other chemical reactions, it takes more energy to break bonds in reactants than is released when bonds form in products. These reactions, called endothermic reactions, absorb energy.

Conservation of Energy

Whether a chemical reaction absorbs or releases energy, there is no overall change in the amount of energy during the reaction. That's because energy cannot be created or destroyed. This is the **law of conservation of energy**. Energy may change form during a chemical reaction—for example, from chemical energy to heat energy when gas burns in a furnace—but the same amount of energy remains after the reaction as before. This is true of all chemical reactions.

Q: If energy can't be destroyed during a chemical reaction, what happens to the energy that is absorbed in an endothermic reaction?

A: The energy is stored in the bonds of the products as chemical energy. In an endothermic reaction, the products have more stored chemical energy than the reactants. This is represented by the graph on the left in the **Figure** 1.1.

In an exothermic reaction, the opposite is true. The products have less stored chemical energy than the reactants. You can see this in the graph on the right in the **Figure** 1.1.

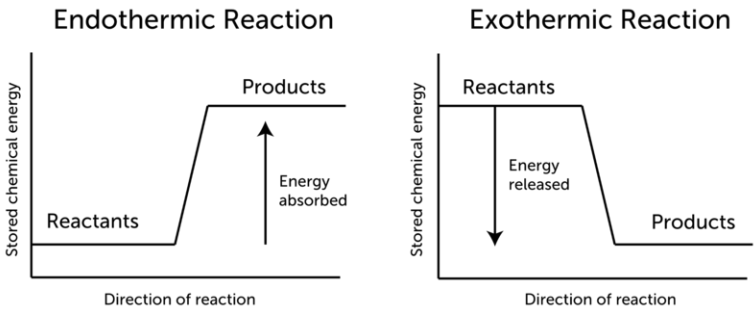


FIGURE 1.1

Note: ΔH represents the change in energy.

Q: What happens to the excess energy in the reactants of an exothermic reaction?

A: The excess energy is generally released to the surroundings when the reaction occurs. In a home heating system, for example, the energy that is released during combustion in the furnace is used to heat the home.

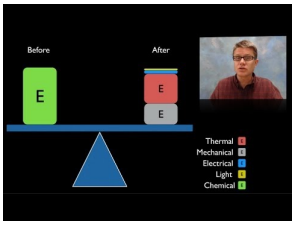
Summary

- All chemical reactions involve energy. Energy is used to break bonds in reactants, and energy is released when new bonds form in products. Endothermic reactions absorb energy, and exothermic reactions release energy.
- The law of conservation of energy states that matter cannot be created or destroyed. Whether a chemical reaction absorbs or releases energy, there is no overall change in the amount of energy during the reaction.

Review

1. Summarize the role of energy in chemical reactions.
2. What is the law of conservation of energy?
3. Explain how energy is conserved in an endothermic reaction.

Resources



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References

1. Christopher Auyeung. Comparing change in energy between exothermic and endothermic reactions . CC BY-NC 3.0