

BC Science CONNECTIONS 10

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Unit 2: Chemical processes require energy change as atoms are rearranged.

Topic 2.3: How is energy involved in chemical processes?

- Matter and energy interact in physical and chemical changes.
- There is a transfer of energy between chemical reactions and the surroundings.



Concept 1: Matter and energy interact in physical and chemical changes.

- Energy is needed for everyday processes.
- **Activation energy:** minimum amount of energy needed for a reaction to happen
- Reactants must collide with enough energy to break bonds for a chemical reaction to occur.

Figure 2.16: Many common events at home require an input of energy.



Concept 2: Energy is transferred between chemical reactions and the surroundings.

- Energy changes occur with all chemical reactions.
- Photosynthesis is a process that captures sunlight to produce sugar molecules for plants
- Animals that eat the plants can use the energy stored in the sugar through cellular respiration.

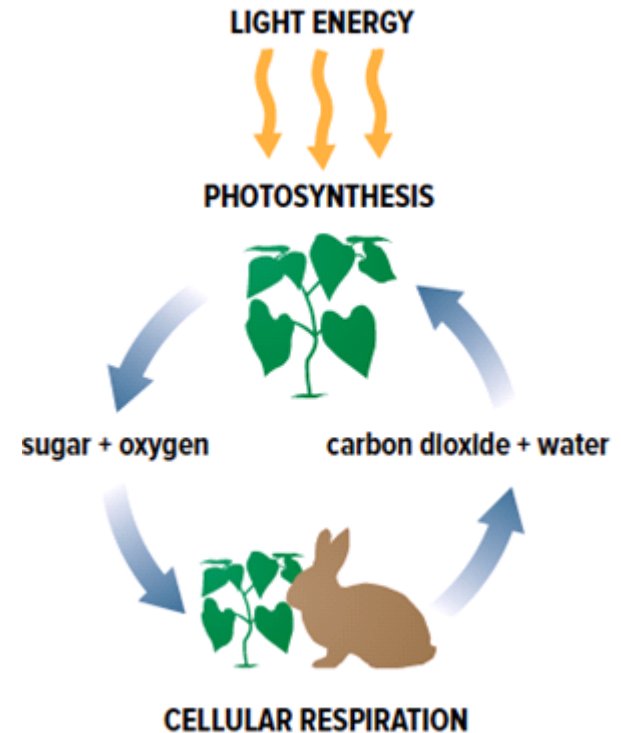


Figure 2.18: Energy stored in the chemical bonds of molecules used to fuel our bodies is released through the chemical reactions of cellular respiration.

The System and the Surroundings

- Energy transfers between the *system* and the *surroundings*.
 - Energy that leaves the system enters the surroundings.
 - Energy that enters the system came from the surroundings.

Exothermic and Endothermic Reactions

- **Exothermic reaction:** a chemical reaction in which there is net release of energy to the surroundings
- **Endothermic reaction:** a chemical reaction in which there is net absorption of energy from the surroundings

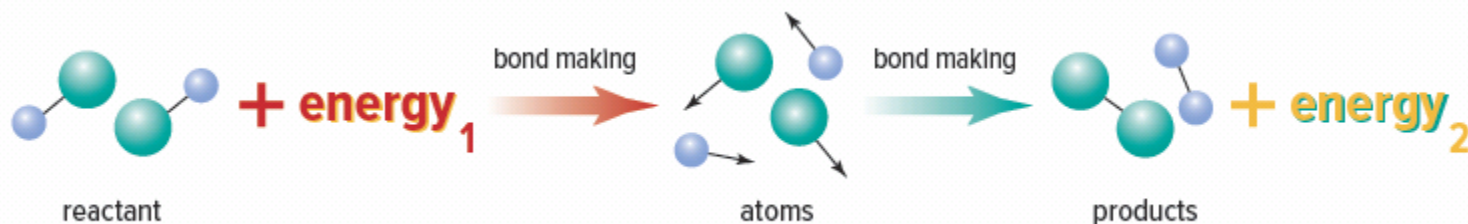


Figure 2.20: When the energy_2 term is greater than the energy_1 term, the overall process is exothermic. When energy_1 is greater than energy_2 , the overall process is endothermic.

Measuring Energy Changes

- In an exothermic reaction, temperature increases as energy is released into the surroundings.
- In an endothermic reaction, temperature decreases as energy is absorbed by the system.

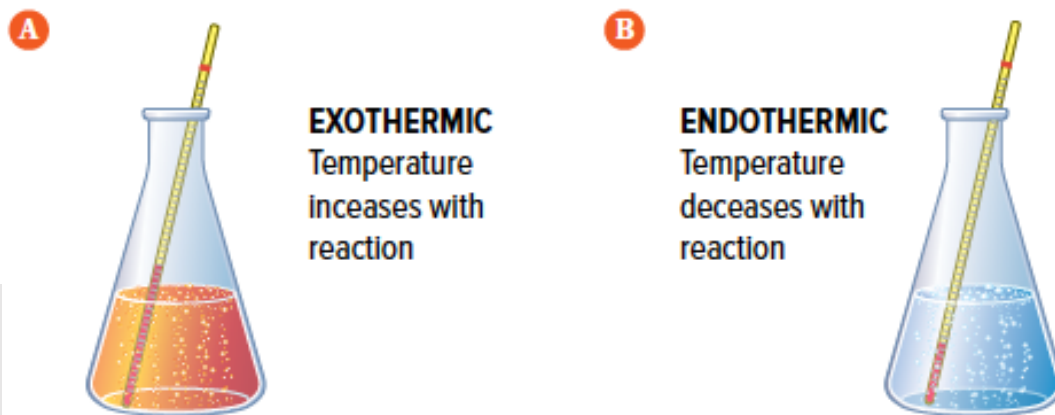


Figure 2.21: Comparing the temperature of reactions occurring in solution.

Representing Energy Changes

- *Energy-level diagrams* show energy changes in a reaction.
- In an endothermic reaction, the energy of the products is greater than that of the reactants.
- In an exothermic reaction, the energy of the products is less than that of the reactants.

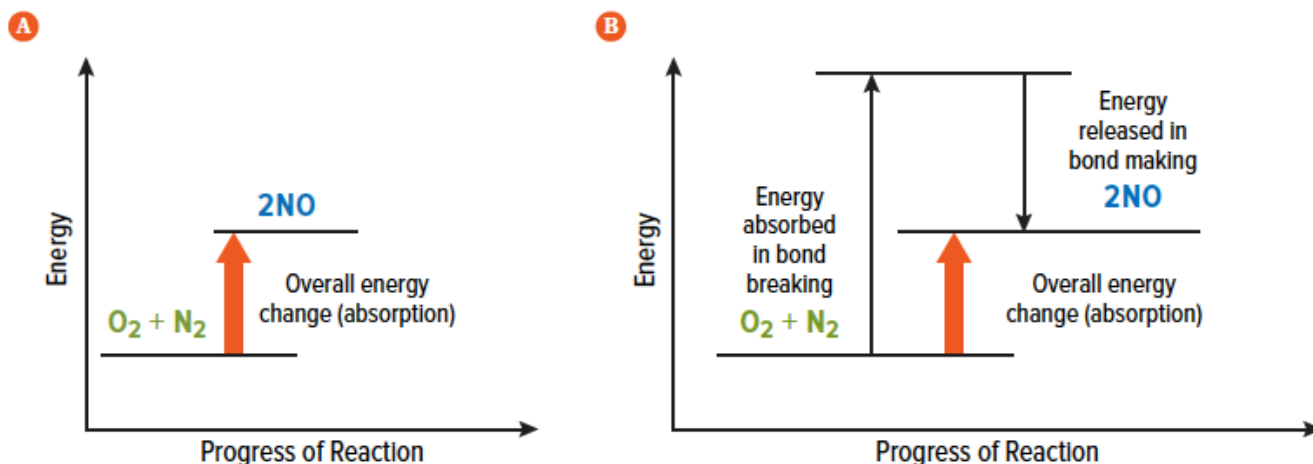


Figure 2.23: (A) This diagram shows the overall absorption of energy. Notice that the products have more energy than the reactants. (B) This diagram shows how the overall energy change is the net result of energy absorbed to break bonds and energy released in the forming of bonds.

Discussion Questions

1. What is an endothermic reaction?
2. Describe the relative energies of reactants and products in an endothermic reaction.
3. If there is a decrease in energy of the system, what happens to the energy of the surroundings?

Topic 2.3 Summary: How is energy involved in chemical processes?

- Matter and energy interact in physical and chemical changes.
- There is a transfer of energy between chemical reactions and the surroundings.

