

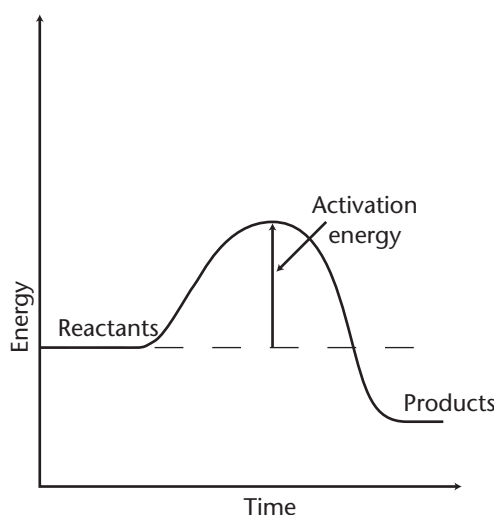
## Chapter 5 Reactions

### Exothermic and Endothermic Reactions

5. c. Students know chemical reactions usually liberate heat or absorb heat.

As matter changes in a chemical reaction, it either absorbs energy or releases energy. Energy is required to break the chemical bonds that hold together reactant atoms. When the new chemical bonds form to yield the products, energy is released. The energy absorbed and released is often in the form of heat.

If the total making and breaking of all bonds in a chemical reaction results in the release of energy, the reaction is called an **exothermic reaction**. This energy is often released as heat and light into the surroundings. Burning wood or other fuel is an exothermic reaction. The graph in Figure 5–3 compares the energy of the reactants to that of the products. In an exothermic reaction, the energy of the products is lower than the energy of the reactants.

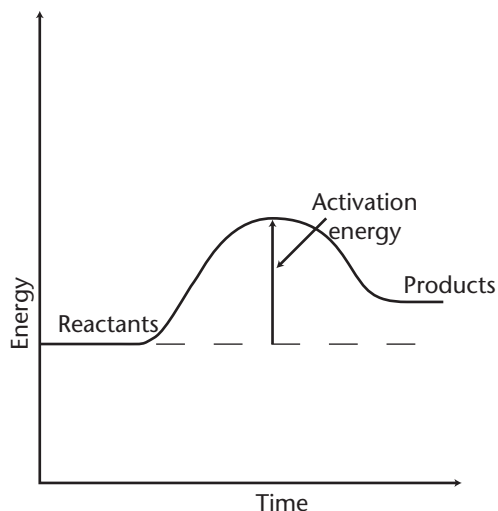


**Figure 5–3 Graph of an exothermic reaction** In an exothermic reaction, the energy of the products is lower than the reactants because the reactants give off energy to form the products.

If the total making and breaking of all bonds in a chemical reaction results in a net absorption of energy, the reaction is called an **endothermic reaction**. The energy for the reaction is usually absorbed from the surroundings, which become cooler. For example, the reaction between baking soda and vinegar is endothermic; the solution feels cooler when the reaction is complete.

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The graph in Figure 5–4 shows the energy change in an endothermic reaction. The energy of the products is higher than the reactants because the reaction must absorb energy in order to occur.



**Figure 5–4 Graph of an endothermic reaction** In an endothermic reaction, the energy of the products is higher than the reactants because the reaction must absorb energy in order to occur.

In the graphs showing the energy changes in endothermic and exothermic reactions, both have an energy “bump” between the reactants and the products. This “bump” represents the **activation energy**, which is the minimum amount of energy required to get the reaction started. All chemical reactions require activation energy to get started. This energy is used to break the chemical bonds of the reactants. Whether or not the reaction still needs more energy from the environment to continue depends on if it is endothermic or exothermic: endothermic reactions require energy to continue while exothermic reactions do not.

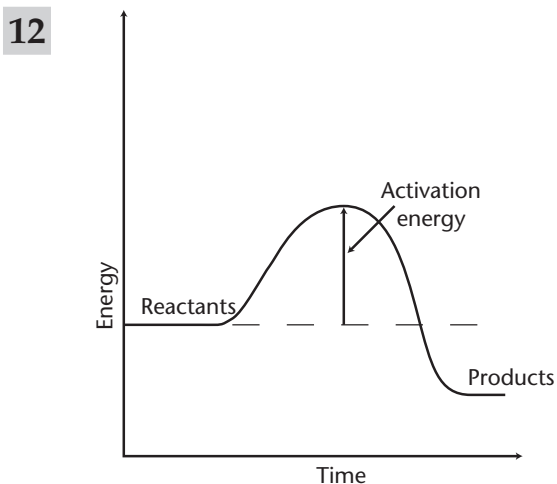
### Standard 5. c. Check

- 9** When new chemical bonds form,
- A there is no change in energy.
  - B energy is absorbed.
  - C energy is released.
  - D electrons are neither shared nor transferred.

- 10** Burning wood is an exothermic reaction because
- A energy is absorbed.
  - B energy is released.
  - C the reaction requires energy to keep going.
  - D activation energy is not required.

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- 11** In an endothermic reaction,
- A** the products give off heat.
  - B** mass is not conserved.
  - C** the products have less energy than the reactants.
  - D** the products have more energy than the reactants.



**This graph represents an exothermic reaction because**

- A** activation energy is required.
- B** the reactants have less energy than the products.
- C** the products have less energy than the reactants.
- D** the reaction absorbs energy.

- 13** An exothermic reaction requires activation energy to

- A** get the reaction started.
- B** keep the reaction going.
- C** stop the reaction.
- D** reform the chemical bonds of the products.