# CH2.4 Chemical Reactions

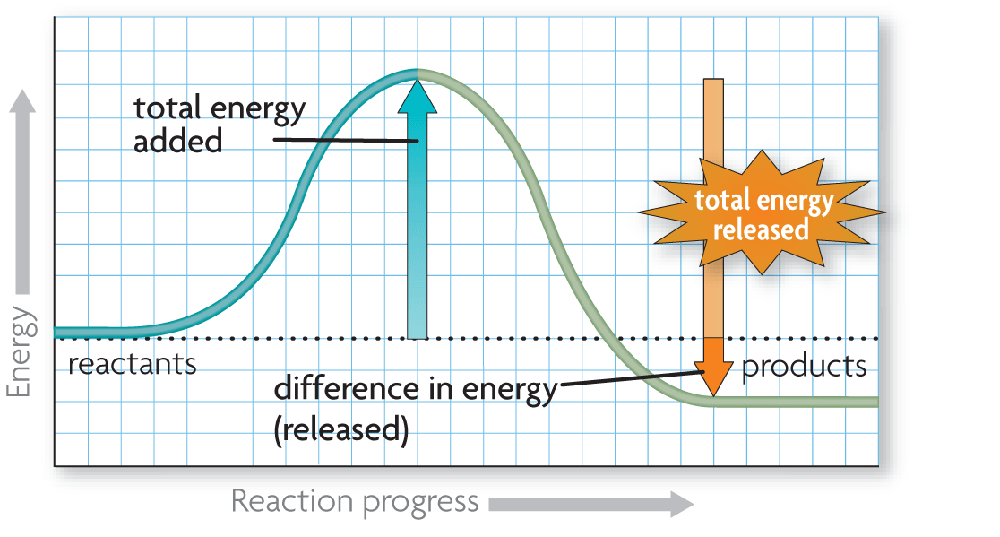
**KEY CONCEPT: Enzymes are catalysts for chemical reactions in living things.**

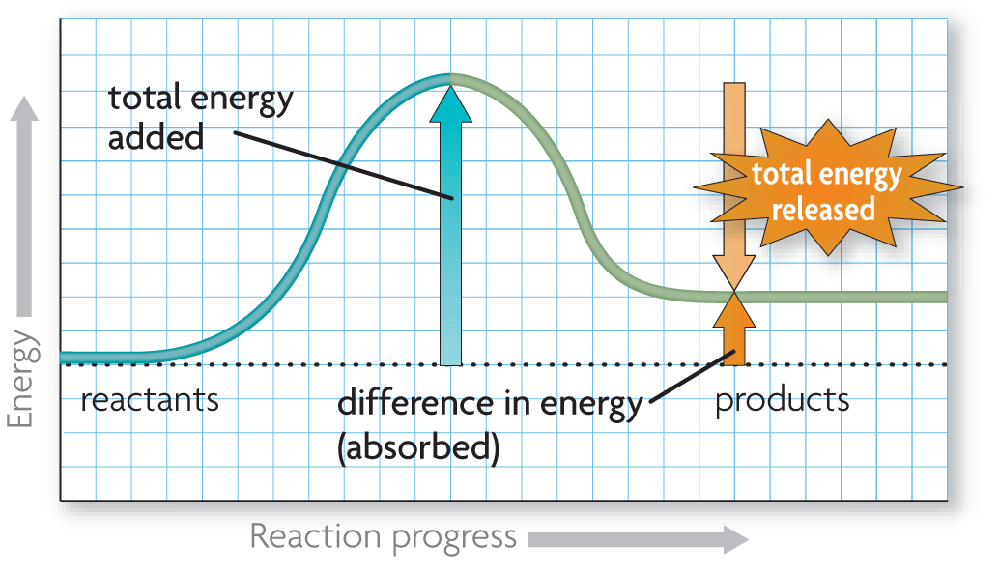
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| **Objectives** | **Vocabulary** | |
| * **Describe how bonds break and reform during chemical reactions** * **Explain why chemical reactions release or absorb energy** * **Explain the effect of a catalyst on activation energy** * **Describe how enzymes regulate chemical reactions** | * **Chemical reaction** * **Reactant** * **Product** * **Bond energy** * **Equilibrium** * **Activation energy** | * **Endothermic** * **Exothermic** * **Catalyst** * **Enzyme** * **Substrate** * **Active site** |

* **Bonds break and form during chemical reactions.**
  + Chemical reactions change substances into different ones by breaking and forming chemical bonds.
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are changed during a chemical reaction.
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are made by a chemical reaction.
  + Bond energy is the amount of energy that breaks a bond.

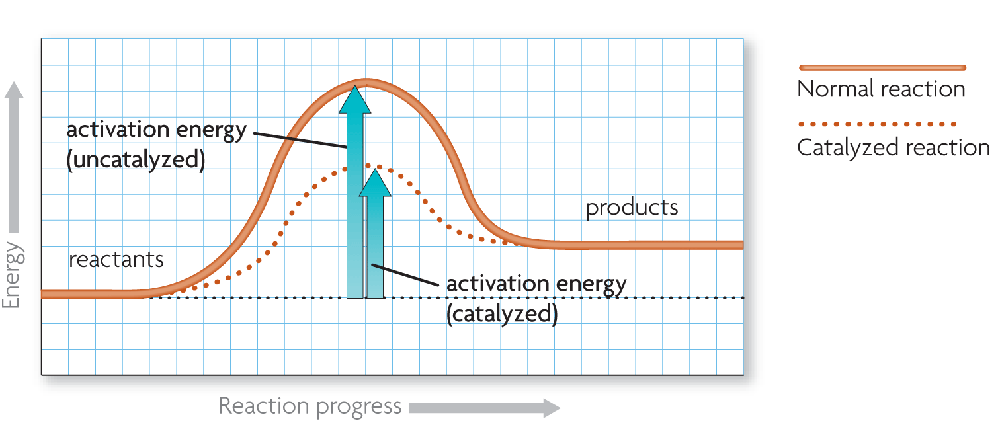
CO2 + H2O H2CO3

* + - Energy is added to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds.
    - Energy is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when bonds form.
  + **Chemical reactions release or absorb energy.**
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the amount of energy that needs to be absorbed to start a chemical reaction.
      * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reactions release more energy than they absorb.
        + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bond energies than products.
        + Excess energy is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by the reaction.

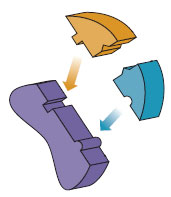




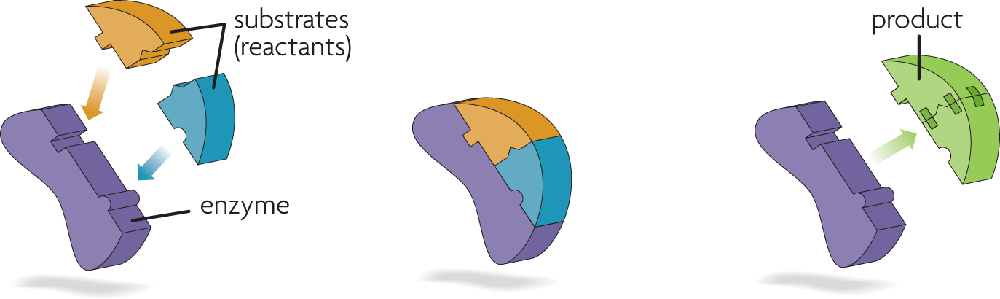
* + - * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reactions absorb more energy than they release.
        + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bond energies than products.
        + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is absorbed by the reaction to make up the difference.
  + **A catalyst lowers activation energy.**
    - Catalysts are substances that speed up chemical reactions.



* + - * decrease activation energy
      * increase reaction rate
  + **Enzymes allow chemical reactions to occur under tightly controlled conditions.**
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in living things.
      * Enzymes are needed for almost all processes.
      * Most enzymes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
    - Disruptions in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can prevent enzymes from functioning.
      * Enzymes function best in a small range of conditions.
      * Changes in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_ can break \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds.
      * An enzyme’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ depends on its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
    - An enzyme’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ allows only certain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to bind to the enzyme.



* + - * substrates
      * active site
    - The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ helps illustrate how enzymes function.
      * substrates brought together
      * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in substrates weakened



**Substrates bind to an  
enzyme at certain places called active sites.**

**The enzyme brings  
substrates together and weakens their bonds.**

**The catalyzed reaction forms a product that is released from the enzyme.**

1. Hydrogen peroxide (H2O2) breaks down into water (H2O) and oxygen (O2). H2O2 🡪 H2O + O2  
   A) Explain why this is a chemical reaction.  
   B) what are the reactants?  
   C) what are the products?
2. How do endothermic and exothermic reactions differ?
3. The process below is exothermic. What must be true about the bond energies of the reactants and the products? Explain.  
   6O2 + C6H12O6 🡪 6CO2 + 6H2O
4. How does a catalyst affect the activation energy and rate of a reaction
5. Describe how the interaction between an enzyme and its substrates changes a chemical reaction
6. Some organisms live in very hot or acidic environments. Would their enzymes function in a persons cells? Why or why not?
7. Suppose that the amino acids that make up an enzymes active site are changed. How might this change affect the enzyme?