Enzymes and Energy

To release chemical energy to perform work
cells must have a way to break and form chemical bonds.

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All living cells contain specialized **proteins called enzymes** that **lower the activation energy** required to make a reaction proceed.

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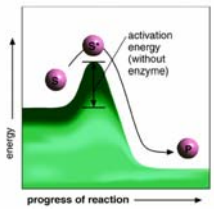
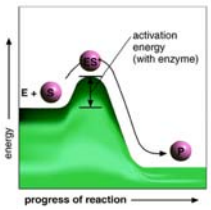
Chemicals, such as enzymes, that lower activation energies are called catalysts.

Enzymes Act As Catalysts

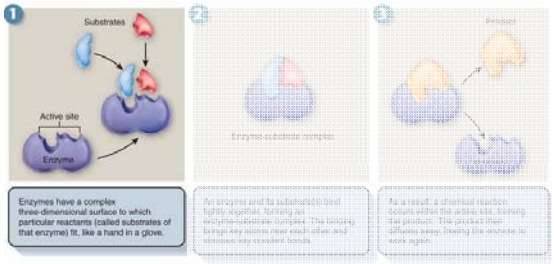


The change the starting molecule S into the product molecule P the chemical reaction requires a high activation energy.



In an enzyme-catalyzed reaction, S combines temporarily with the enzyme E, forming a complex ES*, the reaction now requires less energy to form P (the activation energy is lower).

Each type of enzyme catalyzes only one or a few specific reactions



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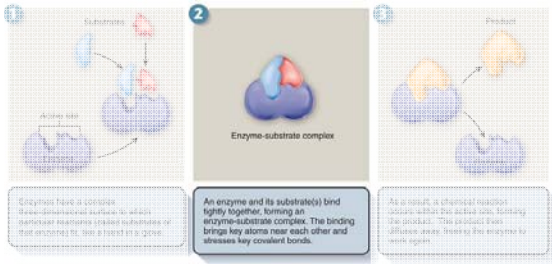

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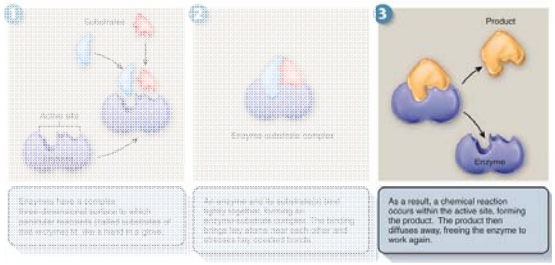

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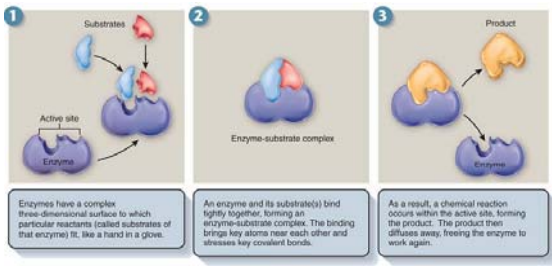
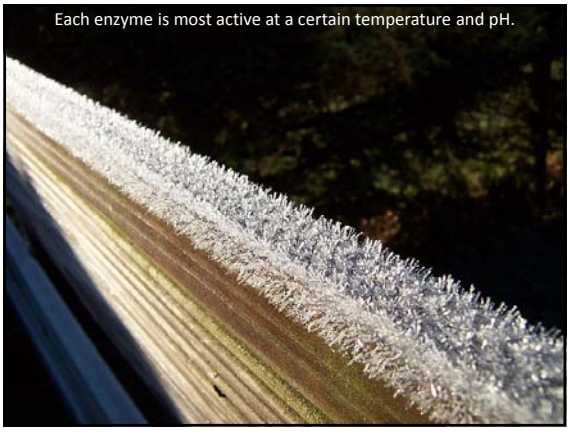


The specific reaction catalyzed by an enzyme depends on a small area of its structure called the active site.

The close fit of the starting molecule, called the substrate, into the active site of the enzyme brings the enzyme and substrate close together.

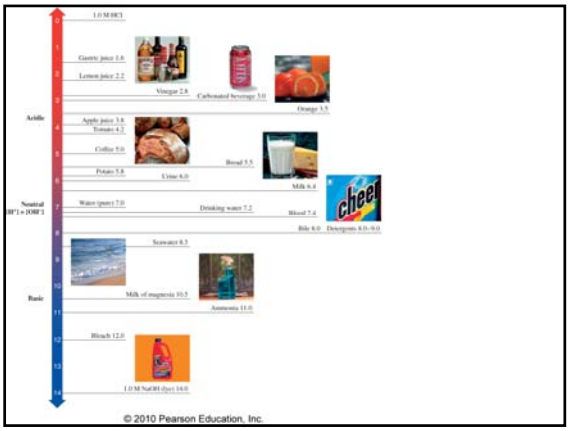
The resulting interaction lowers the activation energy, which allows the chemical reaction from substrate to product to proceed.

Each enzyme is most active at a certain temperature and pH.



The **pH** of a solution

- pH is used to indicate the acidity of a solution
- pH has values that usually range from 0 to 14
- pH is acidic when the values are less than 7
- pH is neutral with a pH of 7
- pH is basic when the values are greater than 7



Learning Check

Identify each solution as A) acidic, B) basic, or N) neutral

___ 1) HCl with a pH = 1.5

___ 2) pancreatic fluid pH = 7.9

___ 3) Sprite pH = 3.0

___ 4) pH = 7.0

Identify each solution as A) acidic, B) basic, or N) neutral

A 1) HCl with a pH = 1.5

B 2) Pancreatic fluid pH = 7.9

A 3) Sprite soft drink pH = 3.0

N 4) pH = 7.0

The pH of solutions can be determined using

- a pH meter
- pH paper
- indicators that have specific colors at different pH values