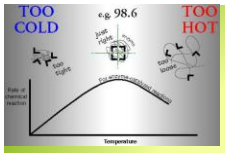
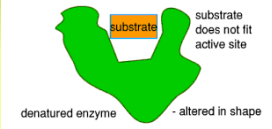
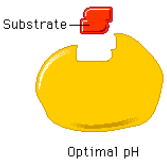
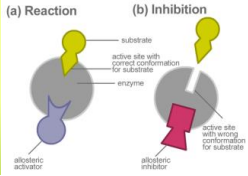




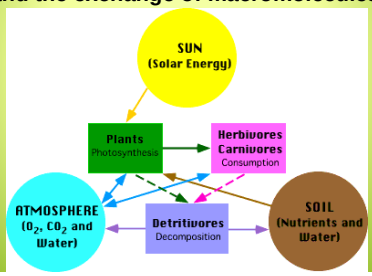
3.3 Environmental Impacts on Enzyme Function





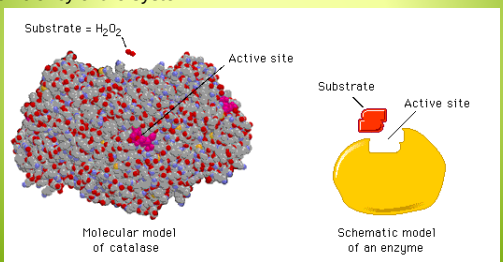
ENDURING UNDERSTANDING

ENE-1 The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules



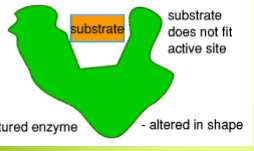
ENE-1.F Explain how changes to the structure of an enzyme may affect its function.

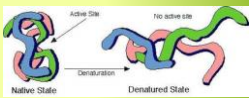
- Change to the molecular structure of a component in an enzymatic system may result in a change of the function or efficiency of the system

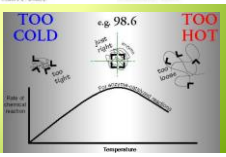


ENE-1.F Explain how changes to the structure of an enzyme may affect its function.

- Denaturation of an enzyme occurs when the protein structure is disrupted, eliminating the ability to catalyze reactions.
- Environmental temperatures and pH outside the optimal range for a given enzyme will cause changes to its structure, altering the efficiency with which it catalyzes reactions.

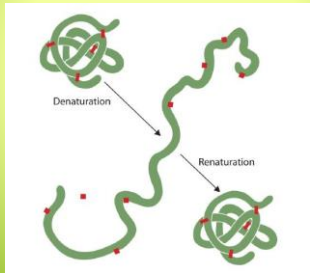






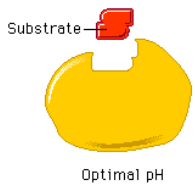
ENE-1.F Explain how changes to the structure of an enzyme may affect its function.

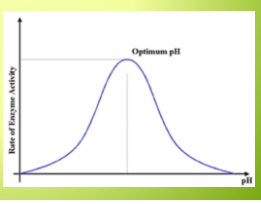
- In some cases, enzyme denaturation is reversible, allowing the enzyme to regain activity.



ENE-1.G Explain how the cellular environment affects enzyme activity.

- Environmental pH can alter the efficiency of enzyme activity, including through disruption of hydrogen bonds that provide enzyme structure.
  - Each enzyme has optimal pH that maintains its normal configuration.
  - A change in pH alters ionization of side chains, eventually resulting in denaturation.
  - Optimal in humans is pH 6-8





ENE-1.G Explain how the cellular environment affects enzyme activity.

- RELEVANT EQUATION

$pH = -\log[H^+]$

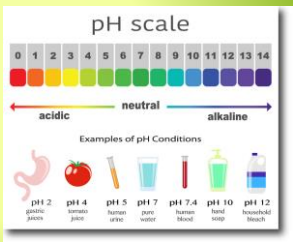
Sample calculation

Lets say that the [H+] value is .0001

To calculate the pH, you use the formula -log{H+} = pH

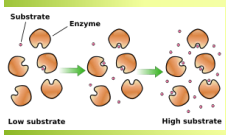
So, -log(.0001) = 4

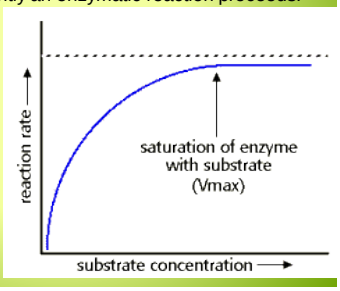
This means the pH of the solution is 4



ENE-1.G Explain how the cellular environment affects enzyme activity.

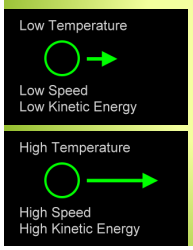
- The relative concentrations of substrates and products determine how efficiently an enzymatic reaction proceeds.

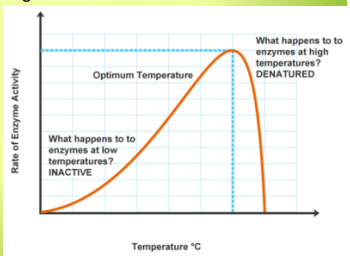




ENE-1.G Explain how the cellular environment affects enzyme activity.

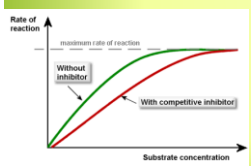
- Higher environmental temperatures increase the speed of movement of molecules in a solution, increasing the frequency of collisions between enzymes and substrates and therefore increasing the rate of reaction.

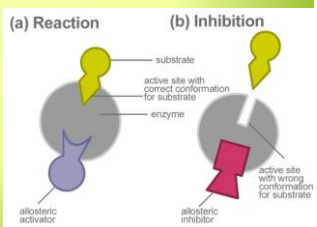




ENE-1.G Explain how the cellular environment affects enzyme activity.

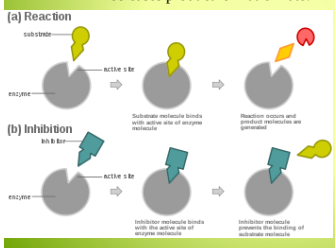
- Competitive inhibitor molecules can bind reversibly or irreversibly to the active site of the enzyme. Noncompetitive inhibitors can bind allosteric sites, changing the activity of the enzyme.

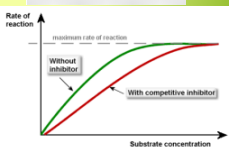




ENE-1.G Explain how the cellular environment affects enzyme activity.

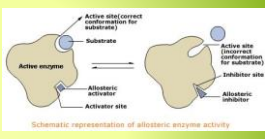
- Competitive Inhibition
  - Another molecule is similar to enzyme's substrate
  - Competes with substrate for enzyme's active site
  - Decreases product formation rate.

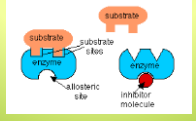


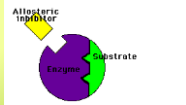


ENE-1.G Explain how the cellular environment affects enzyme activity.

- Allosteric Interactions
  - Noncompetitive Inhibition
    1. A molecule binds to an allosteric site (a site other than active site)
    2. Changes the three-dimensional structure of the enzyme
    3. Cannot bind to its substrate.
  - Allosteric Activation







ENE-1.G Explain how the cellular environment affects enzyme activity.

- Feedback Inhibition
  - Regulates activity of most enzymes
  - Product binds to enzyme's active or allosteric site
  - Concentrations of products can be kept within narrow ranges.