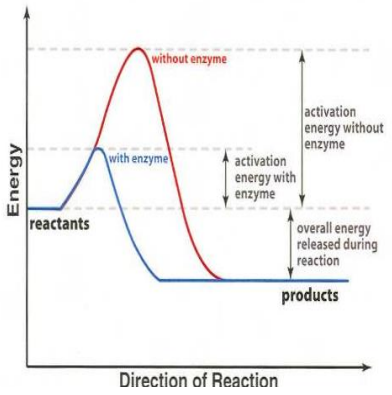
Reading to Learn: The Role of Enzymes – CLASS COPY!!

Class Set – Please return to the tray

Cells are possibly the smallest chemical factories in the world and yet they are exquisitely efficient and productive. They build chemical compounds (anabolism) from imported raw materials and break down larger molecules (catabolism) to access the necessary elements and energy to help maintain proper function. Cellular chemical processes are referred to as **metabolism**.

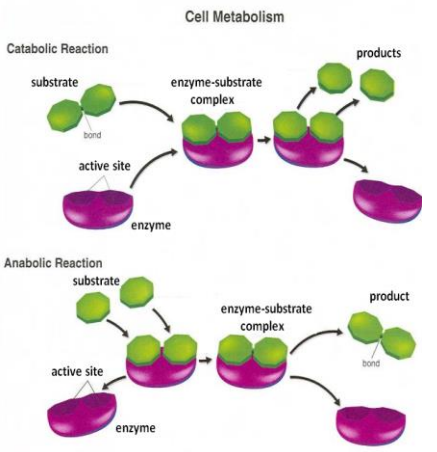
Diagram shows activation energy for a chemical reaction both with and without an enzyme.



Metabolic reactions require a great amount of energy to take place (**activation energy** or **EA**). One way cells manage metabolic reactions is through the presence of enzymes. **Enzymes** are a type of protein that helps control and manage cell metabolism by making chemical reactions happen more efficiently than if the cell functioned without them. Enzymes lower the activation energy normally required for chemical reactions to take place. This allows chemical reactions to take place at a faster rate than without the enzyme.

Enzyme compounds are three-dimensional molecules that have special bonding areas called **active sites**. At the active site of some enzymes, large molecules are broken into smaller molecules (**catabolism**). Other enzymes bond small molecules together to make larger compounds (**anabolism**). The molecules an enzyme metabolizes are known as **substrates**.

Diagram shows two types of cell metabolism.



The shape of an enzyme's active site is matched to the shape of the molecule it metabolizes. The substrate bonds to the active site and the enzyme molecule firms up the attachment. The substrate joined with the enzyme is called the **enzyme-substrate complex.**

Enzymes function best in specific conditions; environmental factors within the cell can affect how well an enzyme functions. High temperatures can **denature** (break down) an enzyme, thus changing its shape. This means the enzyme can no longer function. Cold temperatures can slow an enzyme's reaction rate down. Most enzymes work best in environments where pH range is 6-8. Higher or lower values in cells negatively affect enzyme function and thus cell function. An exception is digestive enzymes in the human stomach, which work best in pH 2. Some enzymes work only in the presence of two other types of compounds, **cofactors** (such as zinc or iron) and **coenzymes** (such as vitamins). Other compounds inhibit enzyme function by either blocking the active site (**competitive inhibitor**) or bonding to the enzyme and changing its shape (**noncompetitive inhibitor**).

Enzymes are often referred to as **catalysts** because they increase efficiency in chemical reactions without being affected. Because of enzymes, cells manage millions of chemical reactions per second without breaking a sweat. Because of enzymes, cells can harvest energy and raw materials from the food you eat to build a better you.

Student Name _____ Period _____

TOPIC: **Enzymes – Reading PreAP** OPTION 2: **Reading**

Reading to Learn: The Role of Enzymes

Student Worksheet

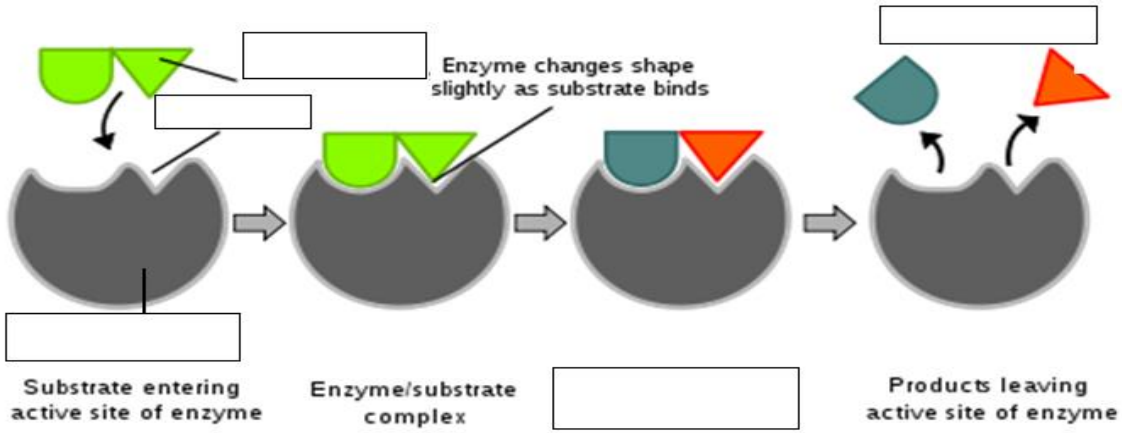
1. What are enzymes?

2. What does it mean when an enzyme denatures? How is enzyme activity affected by this?

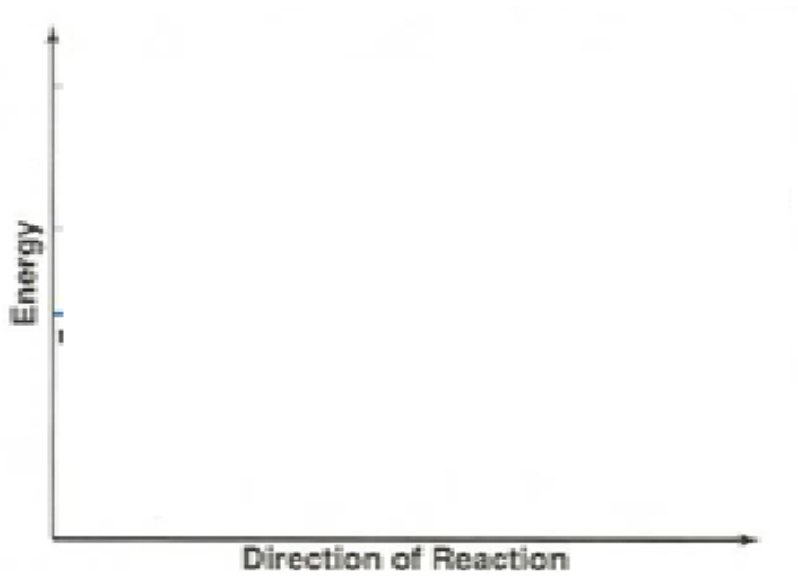
3. Explain the difference between an anabolic reaction versus a catabolic reaction.

4. Why are enzymes labeled as a catalyst? Your answer cannot use the word efficient.

Label the substrate, active site, enzyme, enzyme-substrate complex, and products.



Complete the graph below of a chemical reaction. Draw two curves- one with an enzyme and another without an enzyme. Label the reactants, products, and activation energy. Underneath the curve, in the box summarize the meaning of the graph.



Summary of graph:

Complete the following data table about factors that affect enzyme rate of reaction.

Environmental Factors Affect Enzyme Reaction Rates

Environmental Factors	**Affect on Enzyme Activity**			**Denature enzyme?**
	Increases ⇧	Decreases ⇩	No change ⇔	Y/N
High temperature				
Increasing temperature from cold to warm				
Lowering temperature				
Normal temperature				
Low pH (< 6)				
High pH (> 8)				
Neutral pH (6-8)				
Competitive inhibitor				
Non-competitive inhibitor				