



## Enzyme Structure

### ENE-1.D.1

The structure of enzymes includes the active site that specifically interacts with substrate molecules.

### ENE-1.D.2

For an enzyme-mediated chemical reaction to occur, the shape and charge of the substrate must be compatible with the active site of the enzyme.



**Which macromolecules are enzymes?**

- A. Carbohydrate**
- B. Lipid**
- C. Nucleic Acid**
- D. Protein**

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**Which macromolecules are enzymes?**

**D. Protein**



**Enzymes are a macromolecule made up of amino acids. Recall, the proteins are those macromolecules. All enzymes are proteins but not all proteins are enzymes.**

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**Why can morphine provide the same response as endorphins?**

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**Why can morphine provide the same response as endorphins?**

**Morphine and endorphins have a similar molecular shape. Due to this, it binds to the same active site to result in the same response.**



**Why does the substrate binding activate the enzyme?**

- A. Activates accessory molecules**
- B. Changes shape**
- C. Provides energy**
- D. Transport reaction**

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**Why does the substrate binding activate the enzyme?**

**B. Changes shape**



**When anything binds to a protein, it undergoes the induced fit model. This involves the protein undergoing a conformational shape change which can allow the active site to be more accessible (thus activating the enzyme)**

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**What does osmotic pressure mean?**



**What does osmotic pressure mean?**



**Pressure from the solute**

**The more solute, the higher the osmotic pressure.**

**The less solute, the lower the osmotic pressure.**

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**What is Gibbs free energy and do enzymes affect the Gibbs free energy of a reaction?**

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**What is Gibbs free energy and do enzymes affect the Gibbs free energy of a reaction?**

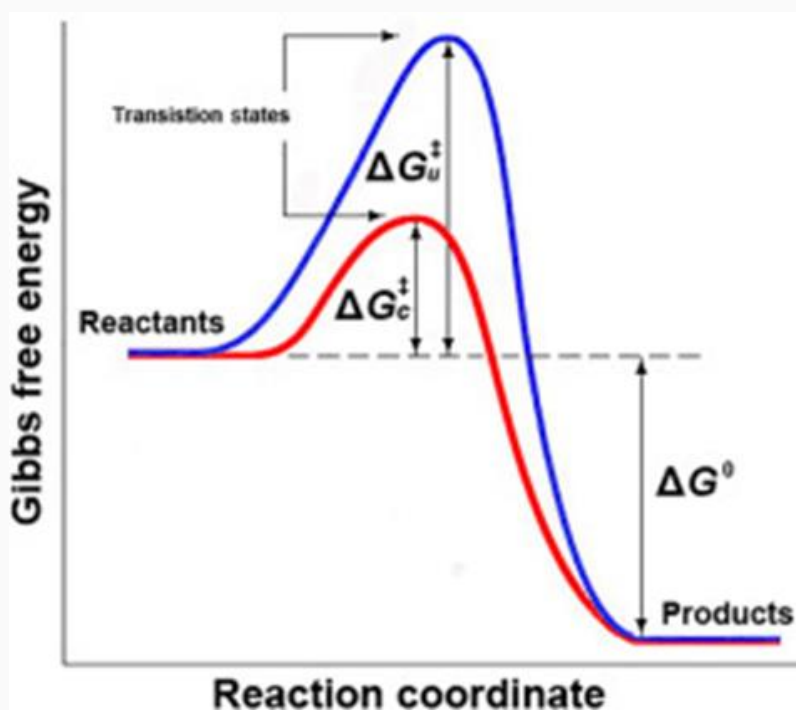
**Gibbs free energy is the energy available to do work. If a reaction releases stored energy, it is available for work. (Water falls from a waterfall releases potential energy as it falls and the water turns a turbine).**

**Enzymes DO NOT AFFECT the Gibbs free energy of a reaction. The reaction must be able to take place with or without the enzyme. The enzyme only makes it faster because the enzyme decreases the activation energy.**



**What is Gibbs free energy and do enzymes affect the Gibbs free energy of a reaction?**

**See the Gibbs free energy is the same between the catalyzed and uncatalyzed reaction.**



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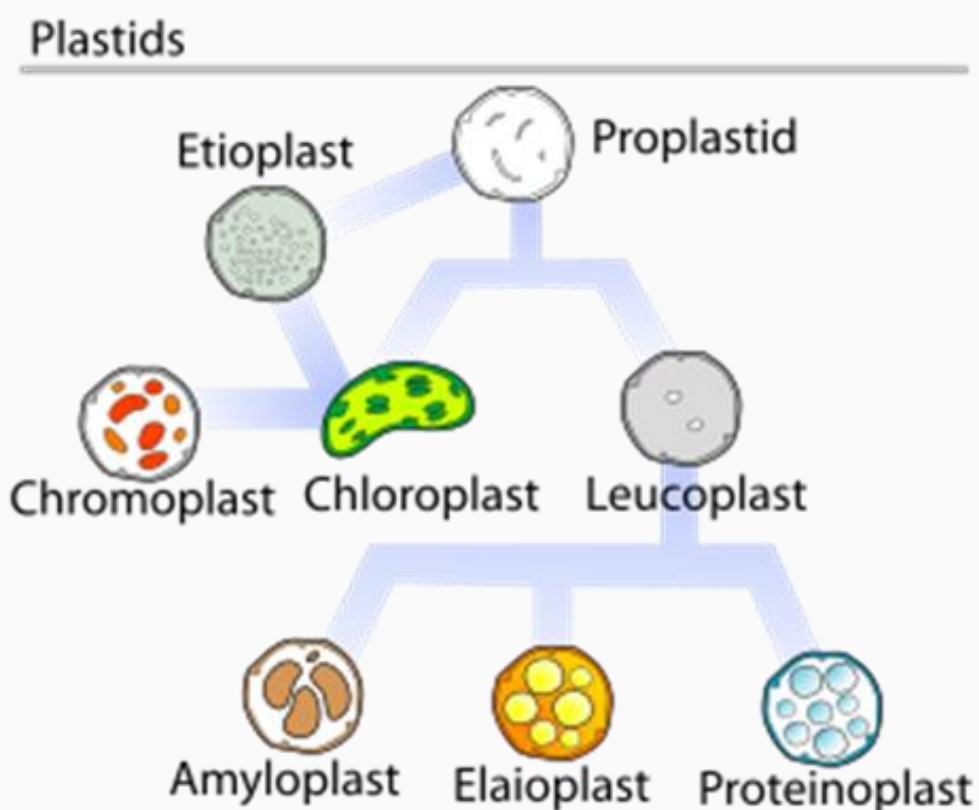


**What are plastids?**

## What are plastids?



## Family of organelles... for example: ChloroPLAST



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**What is the function of enzymes?**

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**What is the function of enzymes?**



**Enzymes act as a biological catalyst, which speeds up chemical reactions**





**How does an enzyme speed up the chemical reaction?**

- A. Decrease the activation energy required**
- B. Decrease the change in free energy**
- C. Increase the activation enzyme required**
- D. Increase the change in free energy**

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**How does an enzyme speed up the chemical reaction?**

**A. Decrease the activate energy required**



**By decreasing the activation energy, it makes the reaction more favorable. The reaction can reach the intermediate phase sooner which will increase the reaction rate (aka speed up the chemical reaction)**

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**Where does the substrate bind on an enzyme?**

- A. Active site**
- B. Enhancer**
- C. Promoter**
- D. TATA box**

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**Where does the substrate bind on an enzyme?**

**A. Active site**



**The active site is the location on the enzyme where the substrate binds. Once this binds, it is called the substrate/enzyme complex.**

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**How does an enzyme affect  $\Delta G$  (change in Gibbs free energy)?**

- A. Decrease**
- B. Increase**
- C. No effect**

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**How does an enzyme affect  $\Delta G$  (change in Gibbs free energy)?**

**C. No effect**



**The enzyme can decrease the activation energy by binding to the substrate to strain bonds or orient reactants. This will not affect the amount of free energy available in the products nor reactants.**

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**Describe what happens when the substrate binds to the active site.**

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**Describe what happens when the substrate binds to the active site.**

**The enzyme undergoes a conformational shape change.**

**Recall, enzymes are proteins. Whenever something binds to a protein, the protein changes shape.**

**When the enzyme changes shape, the bonds are strained (to break bonds) or reactants are closer together (to form a bond).**