AP BIO INSTA-REVIEW

TOPIC 3.1

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.

AP BIO INSTA-REVIEW

TOPIC

3.1

Which macromolecules are enzymes?

A. Carbohydrate

B. Lipid

C. Nucleic Acid

D. Protein

AP BIO INSTA-REVIEW

TOPIC 3.1

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.

AP BIO INSTA-REVIEW

TOPIC

3.1

Why can morphine provide the same response as endorphins?

AP BIO INSTA-REVIEW

TOPIC 3.1

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.

AP BIO INSTA-REVIEW

TOPIC 3.1

Why does the substrate binding activate the enzyme?

A. Activates accessory molecules

B. Changes shape

C. Provides energy

D. Transport reaction

AP BIO INSTA-REVIEW

TOPIC 3.1

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)

AP BIO INSTA-REVIEW

TOPIC

3.1

What does osmotic pressure mean?

AP BIO INSTA-REVIEW

TOPIC 3.1

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.

AP BIO INSTA-REVIEW

TOPIC

3.1

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

AP BIO INSTA-REVIEW

TOPIC 3.1

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).

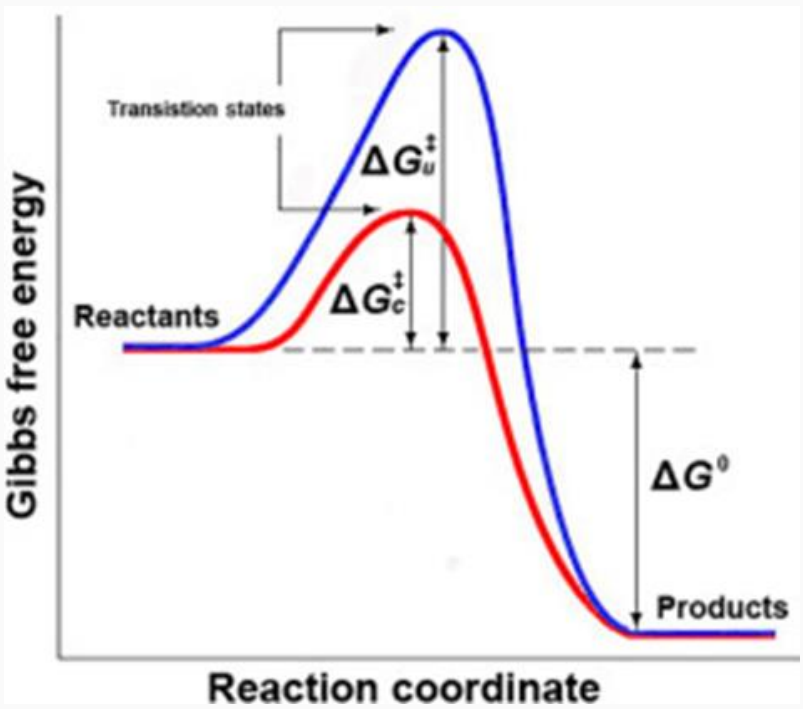
Enzymes DO NOT AFFECT the Gibbs free energy of a reaction. The reaction must be able to take place with or without the enzyme. The enzyme only makes it faster because the enzyme decreases the activation energy.

AP BIO INSTA-REVIEW

TOPIC 3.1

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.



AP BIO INSTA-REVIEW

TOPIC

3.1

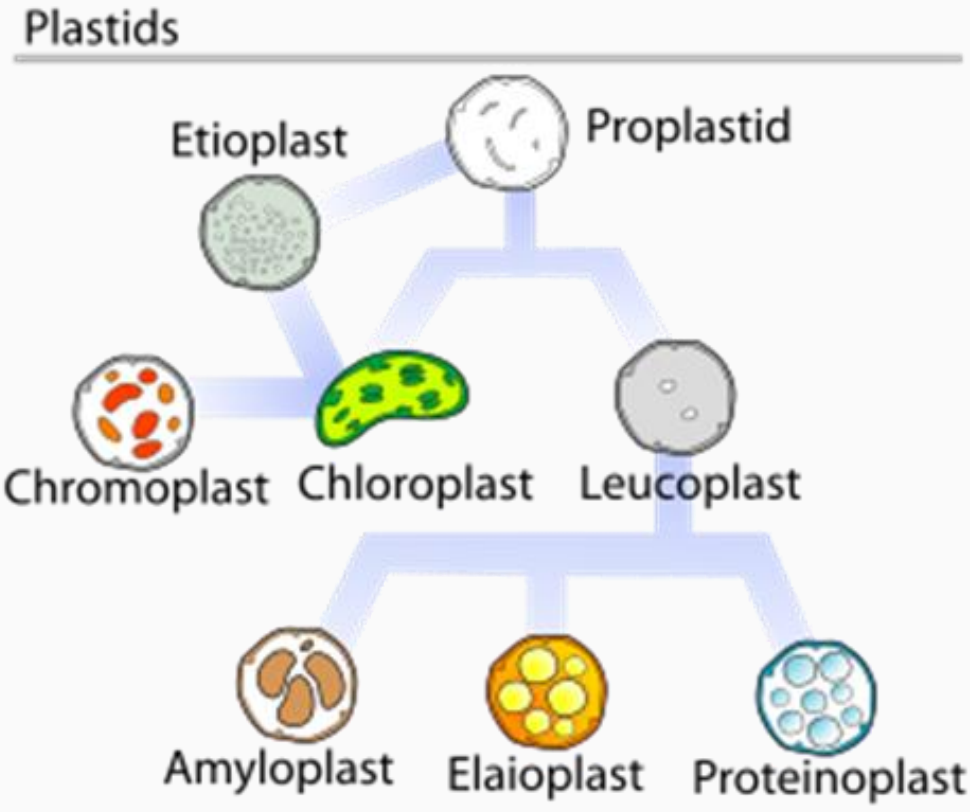
What are plastids?

AP BIO INSTA-REVIEW

TOPIC 3.1

What are plastids?

Family of organelles... for example: ChloroPLAST



AP BIO INSTA-REVIEW

TOPIC

3.1

What is the function of enzymes?

AP BIO INSTA-REVIEW

TOPIC 3.1

What is the function of enzymes?

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

AP BIO INSTA-REVIEW

TOPIC

3.1

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

AP BIO INSTA-REVIEW

TOPIC 3.1

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)

AP BIO INSTA-REVIEW

TOPIC 3.1

Where does the substrate bind on an enzyme?

A. Active site

B. Enhancer

C. Promoter

D. TATA box

AP BIO INSTA-REVIEW

TOPIC 3.1

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.

AP BIO INSTA-REVIEW

TOPIC

3.1

How does an enzyme affect ΔG (change in Gibbs free energy)?

A. Decrease

B. Increase

C. No effect

AP BIO INSTA-REVIEW

TOPIC 3.1

How does an enzyme affect ΔG (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.

AP BIO INSTA-REVIEW

TOPIC

3.1

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

AP BIO INSTA-REVIEW

TOPIC 3.1

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).

AP BIO INSTA-REVIEW

TOPIC 3.2

Enzyme Catalysis

ENE-1.E.1

The structure and function of enzymes contribute to the regulation of biological processes–

a. Enzymes are biological catalysts that facilitate chemical reactions in cells by lowering the activation energy.

AP BIO INSTA-REVIEW

TOPIC

3.2

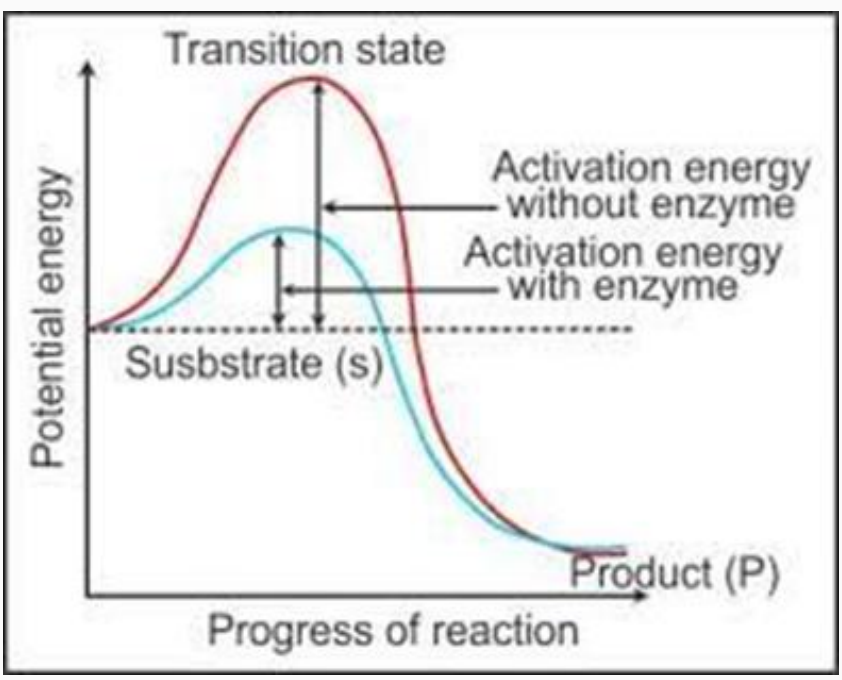
What is activation energy?

AP BIO INSTA-REVIEW

TOPIC 3.2

What is activation energy?

The energy required to start the reaction. It is the energy that must be added to get the reactants into their transition state.



AP BIO INSTA-REVIEW

TOPIC 3.2

How does an enzyme affect activation energy?

A. Decrease

B. Increase

C. Stays the Same

AP BIO INSTA-REVIEW

TOPIC 3.2

How does an enzyme affect activation energy?

A. Decrease

Enzymes will decrease the activation energy of a reaction by orienting the reactants or straining the bonds.

AP BIO INSTA-REVIEW

TOPIC 3.2

Due to lower activation energy, how is the reaction rate affected?

A. Decrease

B. Increase

C. Stays the Same

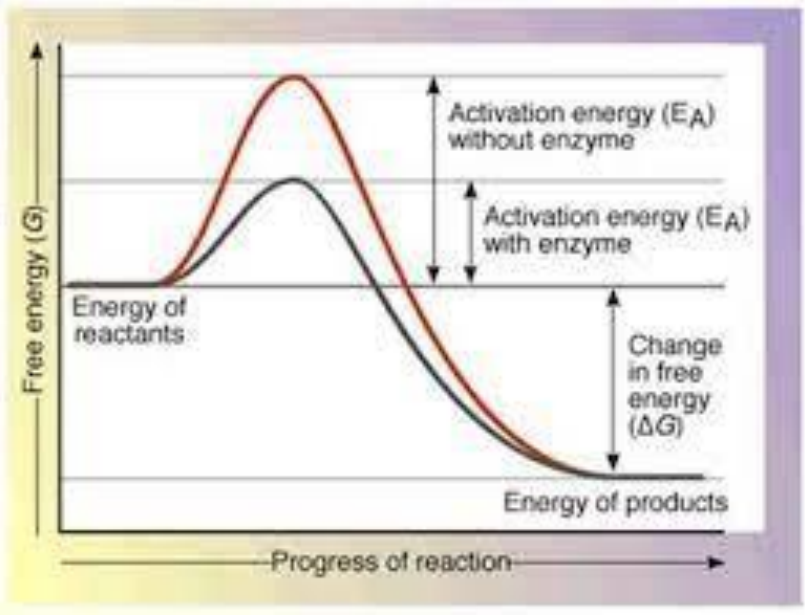
AP BIO INSTA-REVIEW

TOPIC 3.2

Due to lower activation energy, how is the reaction rate affected?

B. Increase

Since less activation energy is required, it allows the reaction to occur more frequently. This means that there is an increase in the reaction rate.



AP BIO INSTA-REVIEW

TOPIC 3.2

What does an enzyme do to reaction rate?

A. Decrease

B. Increase

C. Stays the Same

AP BIO INSTA-REVIEW

TOPIC 3.2

What does an enzyme do to reaction rate?

B. Increase

Due to the decrease activation energy, the reaction can proceed more frequently as it reaches the intermediate state sooner. If it can react more frequently, this is the definition of an increase in reaction rates.

AP BIO INSTA-REVIEW

TOPIC

3.2

How is the activation energy different with an enzyme?

A. Decrease

B. Increase

C. Stays the Same

AP BIO INSTA-REVIEW

TOPIC 3.2

How is the activation energy different with an enzyme?

A. Decrease

An enzyme will decrease the activation energy. It does this by orienting the reactions to faciliate forming bonds or by straining the bonds in a structure to facilitate breaking bonds.

AP BIO INSTA-REVIEW

TOPIC 3.2

Gibbs Free Energy (Explanation)

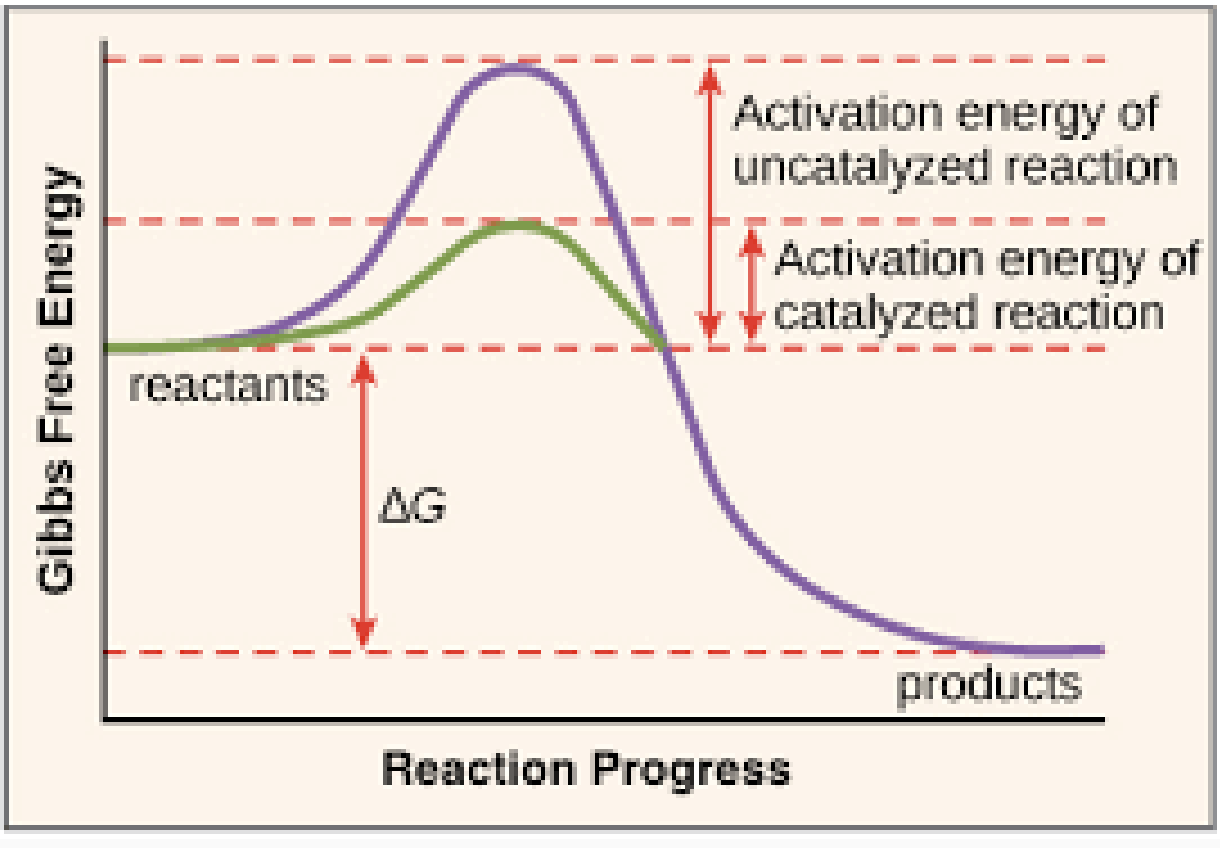
Gibbs Free Energy is the energy available to do work. There's an advanced definition if you want to someone in AP Chemistry but that's all you need for AP Biology.

Everything has a certain amount of potential energy. Notice on the reactants. This means there is a higher amount of energy in the molecules. After the reaction, the ΔG is the change in free energy. This diagram shows that free energy is released (exergonic).

AP BIO INSTA-REVIEW

TOPIC 3.2

Gibbs Free Energy (Explanation)



AP BIO INSTA-REVIEW

TOPIC 3.2

How does the enzyme affect the change in Gibbs?

A. Decrease

B. Increase

C. Stays the Same

AP BIO INSTA-REVIEW

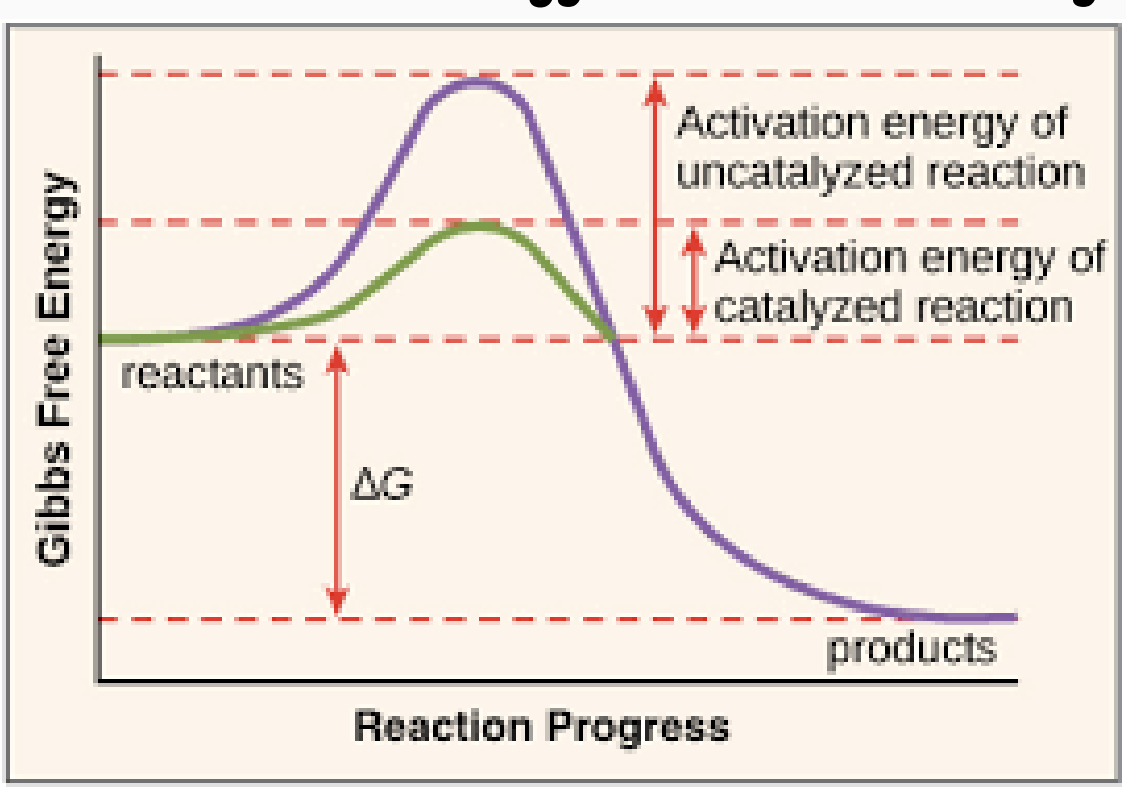
TOPIC 3.2

How does the enzyme affect the change in Gibbs?

C. Stays the Same

See the ΔG is the same with and without the enzyme.

See the activation energy is less with an enzyme.



AP BIO INSTA-REVIEW

TOPIC 3.3

Environmental Impacts on Enzyme Function

ENE-1.F.1

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–

a. Denaturation of an enzyme occurs when the protein structure is disrupted, eliminating the ability to catalyze reactions.

AP BIO INSTA-REVIEW

TOPIC 3.3

Environmental Impacts on Enzyme Function

ENE-1.F.1

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–

b. 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.

AP BIO INSTA-REVIEW

TOPIC 3.3

Environmental Impacts on Enzyme Function

ENE-1.F.2

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

ENE-1.G.1

RELEVANT EQUATION

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

Environmental pH can alter the efficiency of enzyme activity, including through disruption of hydrogen bonds that provide enzyme structure.

AP BIO INSTA-REVIEW

TOPIC 3.3

Environmental Impacts on Enzyme Function

ENE-1.G.2

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

ENE-1.G.3

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.

AP BIO INSTA-REVIEW

TOPIC 3.3

Environmental Impacts on Enzyme Function

ENE-1.G.4

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.

AP BIO INSTA-REVIEW

TOPIC 3.3

What happens to an enzyme if the temperature increases too high?

A. No effect

B. Enzyme increases rate

C. Enzyme decreases rate

D. Enzyme denatures

AP BIO INSTA-REVIEW

TOPIC 3.3

What happens to an enzyme if the temperature increases too high?

D. Enzyme denatures

Recall: Enzymes are proteins. Proteins are made up of amino acids and are folded into a three dimensional structure due to bonds. If the temperature increases, the bonds break and the enzyme/protein denatures.

AP BIO INSTA-REVIEW

TOPIC 3.3

What happens to an enzyme if the temperature decreases too low?

A. No effect

B. Enzyme increases rate

C. Enzyme decreases rate

D. Enzyme denatures

AP BIO INSTA-REVIEW

TOPIC 3.3

What happens to an enzyme if the temperature decreases too low?

C. Enzyme decreases rate

Enzymes are proteins. The bonds will not break if the temperature decreases. This decrease in temperature will affect the kinetic energy of the system which will decrease the reaction rate as the collisions would have decreased energy nor collide as often.

AP BIO INSTA-REVIEW

TOPIC 3.3

If the enzyme is denatured...

A. No effect

B. Reaction rate increases

C. Reaction rate decreases

D. Reaction stops

AP BIO INSTA-REVIEW

TOPIC 3.3

If the enzyme is denatured...

C. Reaction rate decreases

Enzymes increase the reaction rate, but do not affect the Gibbs free energy. This means that the reaction will take place with or without the enzyme present.

If the enzyme is absent/denatures the reaction will still take place, just slower.

AP BIO INSTA-REVIEW

TOPIC 3.3

Enzymes get consumed by reaction and must be re-added

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 3.3

Enzymes get consumed by reaction and must be re-added

B. False

Enzymes are the worker horses of the cell. After they participate in the reaction, their structure returns back which allows for another substrate to bind for another reaction.

AP BIO INSTA-REVIEW

TOPIC 3.3

Describe what happens when the enzyme is denatured

AP BIO INSTA-REVIEW

TOPIC 3.3

Describe what happens when the enzyme is denatured

The secondary structure and up are disrupted.

The bonds between the R groups (tertiary / quaternary) and hydrogen bond between the backbone (secondary) will break, but the peptide bonds (primary) will stay intact.

AP BIO INSTA-REVIEW

TOPIC
3.3

If the pH increases, why does the enzyme denature?

A. pH causes the polar R groups to be nonpolar

B. pH affects the charge on the carboxyl & amine groups

C. pH affects the charged R groups

D. pH causes hydrogen ions to act as competitive inhibitor

AP BIO INSTA-REVIEW

TOPIC 3.3

If the pH increases, why does the enzyme denature?

C. pH affects the charged R groups

If the R group is charged and it releases or absorbs a hydrogen in the solution which will affect the bonding of the R group. If the R group bonding is affected, the three dimensional structure will be affected thus the protein will denature.

AP BIO INSTA-REVIEW

TOPIC

3.3

What is reaction rate?

AP BIO INSTA-REVIEW

TOPIC 3.3

What is reaction rate?

rate = change in x over time

Reaction rate is the amount of product formed over time. If there is an increase in reaction rate, then there is an increase in product formed over time.

AP BIO INSTA-REVIEW

TOPIC 3.3

Inhibitor that binds to the active site

A. Competitive inhibitor

B. Noncompetitive inhibitor

AP BIO INSTA-REVIEW

TOPIC 3.3

Inhibitor that binds to the active site

A. Competitive inhibitor

The competitive inhibitor will COMPETE with substrate for the active site.

AP BIO INSTA-REVIEW

TOPIC 3.3

How does a noncompetitive inhibitor block binding of substrate?

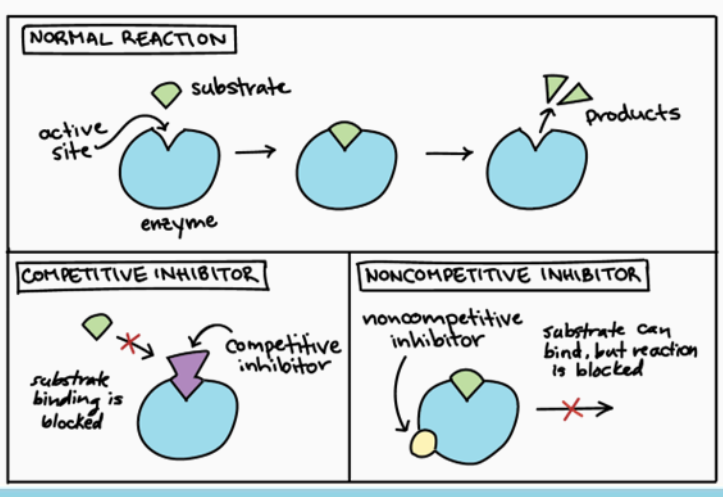
AP BIO INSTA-REVIEW

TOPIC 3.3

How does a noncompetitive inhibitor block binding of substrate?

As you can see, the competitive inhibitor binds to the same site as the substrate/ligand to block it from binding.

As you can see, the noncompetitive inhibitor causes a conformational change which blocks the substrate/ligand from binding.



AP BIO INSTA-REVIEW

TOPIC 3.3

Any increase in heat will denature enzyme

A. False

B. True

AP BIO INSTA-REVIEW

TOPIC 3.3

Any increase in heat will denature enzyme

A. False

An increase in heat will increase the kinetic energy of the molecules, but as long as it is within the optimal range of the enzyme, it will not denature. This will speed up the chemical reaction as the molecules absorb the energy increasing collision frequency and collision energy.

AP BIO INSTA-REVIEW

TOPIC 3.3

What happens with a small increase in temperature?

AP BIO INSTA-REVIEW

TOPIC 3.3

What happens with a small increase in temperature?

As the temperature increases, the particles will move faster. This increases the kinetic energy of substrate which increases the interactions with the enzyme. As the enzyme has more interactions, it will cause an increase in reaction rate. Also, the increased temperature can provide energy for activation of the reaction.

AP BIO INSTA-REVIEW

TOPIC 3.3

As pH increases, what happens to the hydrogen ion concentration?

A. Decreases

B. Increases

AP BIO INSTA-REVIEW

TOPIC 3.3

As pH increases, what happens to the hydrogen ion concentration?

A. Decreases

The formula for pH = -log (concentration of H^+). So, as the pH increases, the concentration of H^+ will decrease.

Example: If solution has a pH of 3, there are $1x10^{-3}$ H^+ ions versus if solution has a pH of 6, there are $1x10^{-6}$ H^+ ions.

AP BIO INSTA-REVIEW

TOPIC 3.3

During cellular respiration, protons are pumped from the matrix to the intermembrane space. What happens to the pH of the matrix?

A. Decreases

B. Increases

AP BIO INSTA-REVIEW

TOPIC 3.3

During cellular respiration, protons are pumped from the matrix to the intermembrane space. What happens to the pH of the matrix?

B. Increases

As the protons are pumped from the mitochondrial matrix into the intermembrane (IM) space, then the pH of the matrix will increase. There will be a decrease in the H^+ ions, so there will be an increase in the pH.

AP BIO INSTA-REVIEW

TOPIC 3.3

How do you overcome a competitive inhibitor?

A. Add more ATP

B. Add more inhibitor

C. Add more products

D. Add more reactants

AP BIO INSTA-REVIEW

TOPIC 3.3

How do you overcome a competitive inhibitor?

D. Add more reactants

Competitive inhibitors will bind to the active site which is the SAME site as the substrate. In order to overcome this, you can increase the number of reactants (aka substrates) so there's a higher probability of a substrate binding over an inhibitor.

AP BIO INSTA-REVIEW

TOPIC
3.3

What happens to the reaction rate as the reaction proceeds? Why?

AP BIO INSTA-REVIEW

TOPIC 3.3

What happens to the reaction rate as the reaction proceeds? Why?

Reaction rate will decrease.

As the reaction proceeds, there is less reactants to bind to the enzyme for the reaction and more products that act as a competitive inhibitor.

AP BIO INSTA-REVIEW

TOPIC
3.3

What conditions will affect the structure of an enzyme?

AP BIO INSTA-REVIEW

TOPIC 3.3

What conditions will affect the structure of an enzyme?

Environmental condition changes of pH and temperature outside of optional range (directly from CED)

But also, salinity and chemical binding

AP BIO INSTA-REVIEW

TOPIC 3.3

When an enzyme denatures, which structure is not affected?

A. Primary

B. Secondary

C. Tertiary

D. Quaternary

AP BIO INSTA-REVIEW

TOPIC 3.3

When an enzyme denatures, which structure is not affected?

A. Primary

When the protein/enzyme denatures, it does not break the covalent (peptide) bonds between the amino acids. This means that the primary structure is not affected when the enzyme denatures. I like to think of denaturation as the process where the protein/enzymes unravels.

AP BIO INSTA-REVIEW

TOPIC 3.3

When the structure changes, how is the function affected?

A. Does not affect function

B. Gains new function

C. Nonfunctional

D. All of the above

AP BIO INSTA-REVIEW

TOPIC 3.3

When the structure changes, how is the function affected?

D. All of the above
(Does not affect function, Gains new function, Nonfunctional)

When the structure changes, the function can change (gain function or lose function) or there could be no change.

It all depends where the structure changes. If it affects the active site or how it is able to transfer a signal, then there will be a change in function.

AP BIO INSTA-REVIEW

TOPIC 3.3

When a protein/enzyme is denatured, it is sometimes reversible.

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 3.3

When a protein/enzyme is denatured, it is sometimes reversible.

A. True

Example:

The gelatin dessert "Jello" gels due to the presence of a protein. When Jello is heated, its structure is altered so that it is no longer a gel but a liquid. If the denaturing conditions reversed by cooling in the refrigerator, the protein reforms into its original gel structure.

-Lumen Learning

AP BIO INSTA-REVIEW

TOPIC 3.3

A decrease in temperature will denature an enzyme.

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 3.3

A decrease in temperature will denature an enzyme.

B. False

Decreasing the temperature will decrease the kinetic energy. This will not break any bonds in the structure thus the enzyme does NOT denature when the temperature decreases.

AP BIO INSTA-REVIEW

TOPIC 3.3

What happens to reaction rate if temperatures decrease?

A. Decrease

B. Increase

C. Stays the Same

AP BIO INSTA-REVIEW

TOPIC 3.3

What happens to reaction rate if temperatures decrease?

A. Decrease

If the temperature decreases, the molecules move slower as the kinetic energy has decreased. This decrease causes a decrease in the reaction rate.

AP BIO INSTA-REVIEW

TOPIC 3.3

If the concentration of hydrogen ions increases?

A. pH decreases

B. pH increases

AP BIO INSTA-REVIEW

TOPIC 3.3

If the concentration of hydrogen ions increases?

A. pH decreases

The formula for pH = -log (concentration of H^+). So, as the concentration increases the pH will decrease.

Example: If there are $1x10^{-3}$ H^+ ions it would have a pH of 3 versus if there are $1x10^{-6}$ H^+ ions it would have a pH of 6.

AP BIO INSTA-REVIEW

TOPIC 3.3

If the pH increases, what happened to the hydrogen ion concentration?

A. Decreases

B. Increases

AP BIO INSTA-REVIEW

TOPIC 3.3

If the pH increases, what happened to the hydrogen ion concentration?

A. Decrease

The formula for pH = -log (concentration of H^+). So, as the pH increases, the hydrogen ion concentration decreases.

<u>Example:</u> If the pH is 3, then there are $1x10^{-3}$ H^+ ions. If the pH is 6, then there are $1x10^{-6}$ H^+ ions. Notice that pH of 6 has less hydrogen ions than pH of 3.

AP BIO INSTA-REVIEW

TOPIC 3.3

How does an increase in substrate affect reaction rate?

A. Decrease forever

B. Increase forever

C. Decrease until enzyme saturated

D. Increase until enzyme saturated

AP BIO INSTA-REVIEW

TOPIC 3.3

How does an increase in substrate affect reaction rate?

D. Increase until enzyme saturated

The substrate binds to the enzyme and is the starting material for the reaction. If there is an increase in the substrate, then there will be more material to react which will increase the reaction rate until the enzyme is saturated and working as fast as it possibly can.

AP BIO INSTA-REVIEW

TOPIC 3.3

As the product concentration increases, reaction rate ____?

A. Decrease

B. Increase

C. Stays the Same

AP BIO INSTA-REVIEW

TOPIC 3.3

As the product concentration increases, reaction rate ____?

A. Decrease

As the product increases, it will be more likely to enter the active site. Since it will enter the active site, it can act as a competitive inhibitor which will decrease the reaction rate. As the product will inhibit the reactant from binding to the enzyme.

AP BIO INSTA-REVIEW

TOPIC
3.3

What is a competitive inhibitor?

A. Binds to the same site as the substrate
B. Binds to a different site than substrate
C. Binds to substrate to inhibit reaction
D. Binds to product to inhibit reaction

AP BIO INSTA-REVIEW

TOPIC 3.3

What is a competitive inhibitor?

A. Binds to the same site as the substrate

Competitive inhibitors will bind to the same active site as the substrate. This is why we call them COMPETITIVE because they will COMPETE for the active site.

AP BIO INSTA-REVIEW

TOPIC 3.4

Cellular Energy

ENE-1.H.1

All living systems require constant input of energy.

ENE-1.H.2

Life requires a highly ordered system and does not violate the second law of thermodynamics—

a. Energy input must exceed energy loss to maintain order and to power cellular processes.

AP BIO INSTA-REVIEW

TOPIC 3.4

Cellular Energy

ENE-1.H.2

Life requires a highly ordered system and does not violate the second law of thermodynamics–

b. Cellular processes that release energy may be coupled with cellular processes that require energy.

c. Loss of order or energy flow results in death.

AP BIO INSTA-REVIEW

TOPIC 3.4

Cellular Energy

ENE-1.H.3

Energy-related pathways in biological systems are sequential to allow for a more controlled and efficient transfer of energy. A product of a reaction in a metabolic pathway is generally the reactant for the subsequent step in the pathway

AP BIO INSTA-REVIEW

TOPIC 3.4

Which describes an endergonic reaction?

A. Positive ΔG, nonspontaneous

B. Negative ΔG, nonspontaneous

C. Positive ΔG, spontaneous

D. Negative ΔG, spontaneous

AP BIO INSTA-REVIEW

TOPIC 3.4

Which describes an endergonic reaction?

A. Positive ΔG, nonspontaneous

Endergonic reactions will ABSORB energy. EN- makes you think of something ENtering, so the energy is ENtering the reaction. Due to the products having a higher amount of free energy, the ΔG is positive.

AP BIO INSTA-REVIEW

TOPIC 3.4

Which describes an exergonic reaction?

A. Positive ΔG, nonspontaneous

B. Negative ΔG, nonspontaneous

C. Positive ΔG, spontaneous

D. Negative ΔG, spontaneous

AP BIO INSTA-REVIEW

TOPIC 3.4

Which describes an exergonic reaction?

D. Negative ΔG, spontaneous

Exergonic reactions will RELEASE energy. EX- makes think of something EXiting. So, the energy is EXiting the reaction. Since the products have less free energy than the reactions, the ΔG will be negative.

AP BIO INSTA-REVIEW

TOPIC

3.4

What is energy coupling?

AP BIO INSTA-REVIEW

TOPIC 3.4

What is energy coupling?

Energy coupling is pairing an exergonic reaction with an endergonic reaction. The exergonic reaction releases the energy that is used to fuel the endergonic reaction.

Example:
Hydrolysis of ATP (exergonic) & move Na against concentration gradient (endergonic)

AP BIO INSTA-REVIEW

TOPIC

3.4

What is the first law of thermodynamics?

AP BIO INSTA-REVIEW

TOPIC 3.4

What is the first law of thermodynamics?

Energy cannot be created or destroyed but can be transformed or transferred.

All of the energy on Earth comes from the solar radiation that was released that was released by reactions on sun from its creation. That energy was transformed from stored potential chemical energy to solar energy to heat energy, chemical energy, etc.

Then all of the energy leaves Earth in the form of heat.

AP BIO INSTA-REVIEW

TOPIC 3.4

What does the second law of thermodynamics state about disorder?

A. Every reaction increases the entropy

B. Every reaction decreases the entropy

AP BIO INSTA-REVIEW

TOPIC 3.4

What does the second law of thermodynamics state about disorder?

A. Every reaction increases the entropy

In the second law of thermodynamics, every reaction will increase the entropy of the universe.

Think about it like a puzzle. You are assembling a puzzle, you will release more CO_2 and H_2O creating more disorder than the unassembled puzzle pieces originally.

AP BIO INSTA-REVIEW

TOPIC 3.4

Loss of energy results in...

A. Death

B. Eating

C. Hibernation

D. Metabolism

AP BIO INSTA-REVIEW

TOPIC 3.4

Loss of energy results in...

A. Death

If there is no energy, the cells will be unable to perform many functions which will result in death of the cell.

AP BIO INSTA-REVIEW

TOPIC

3.4

What is the function of B in the metabolic pathway?

A → B → C

AP BIO INSTA-REVIEW

TOPIC 3.4

What is the function of B in the metabolic pathway?

A → B → C

B is an intermediate. It is the product of the A → reaction AND the reactant for the B → C reaction

AP BIO INSTA-REVIEW

TOPIC 3.4

A → B → C → D

Enzyme B is inhibited. What happens to the concentration of C?

A. C increases

B. C decreases

C. C stays the same

AP BIO INSTA-REVIEW

TOPIC 3.4

A → B → C → D

Enzyme B is inhibited. What happens to the concentration of C?

B. C decreases

Enzymes will speed up reactions. Enzyme B is responsible to catalyzing the conversion of B to C. If the enzyme is inhibited, the conversion of B to C will be inhibited. There will be less C produced.

AP BIO INSTA-REVIEW

TOPIC 3.4

Every reaction increases the entropy of the universe...

A. First law of thermodynamics
B. Second law of thermodynamics
C. Third law of thermodynamics

AP BIO INSTA-REVIEW

TOPIC 3.4

Every reaction increases the entropy of the universe...

B. Second law of thermodynamics

This is the definition of the second law of thermodynamics. Every reaction will increase the entropy of the universe.

AP BIO INSTA-REVIEW

TOPIC

3.4

What is entropy?

AP BIO INSTA-REVIEW

TOPIC 3.4

What is entropy?

Entropy is the disorder or chaos.

For example, 1 glucose is broken down to 6 carbon dioxide and 6 water molecules. Think about how organized glucose is, but how much disorder is in those gas molecules.

AP BIO INSTA-REVIEW

TOPIC 3.4

Energy cannot be created or destroyed, but transferred or transformed...

A. First law of thermodynamics
B. Second law of thermodynamics
C. Third law of thermodynamics

AP BIO INSTA-REVIEW

TOPIC 3.4

Energy cannot be created or destroyed, but transferred or transformed...

A. First law of thermodynamics

This is the definition of the first law of thermodynamics. Energy cannot be created or destroyed, but it can be transferred or transformed.

AP BIO INSTA-REVIEW

TOPIC 3.4

What molecule is responsible for powering cellular processes?

A. ATP

B. Glucose

C. Membrane Potential

D. Sucrose

AP BIO INSTA-REVIEW

TOPIC 3.4

What molecule is responsible for powering cellular processes?

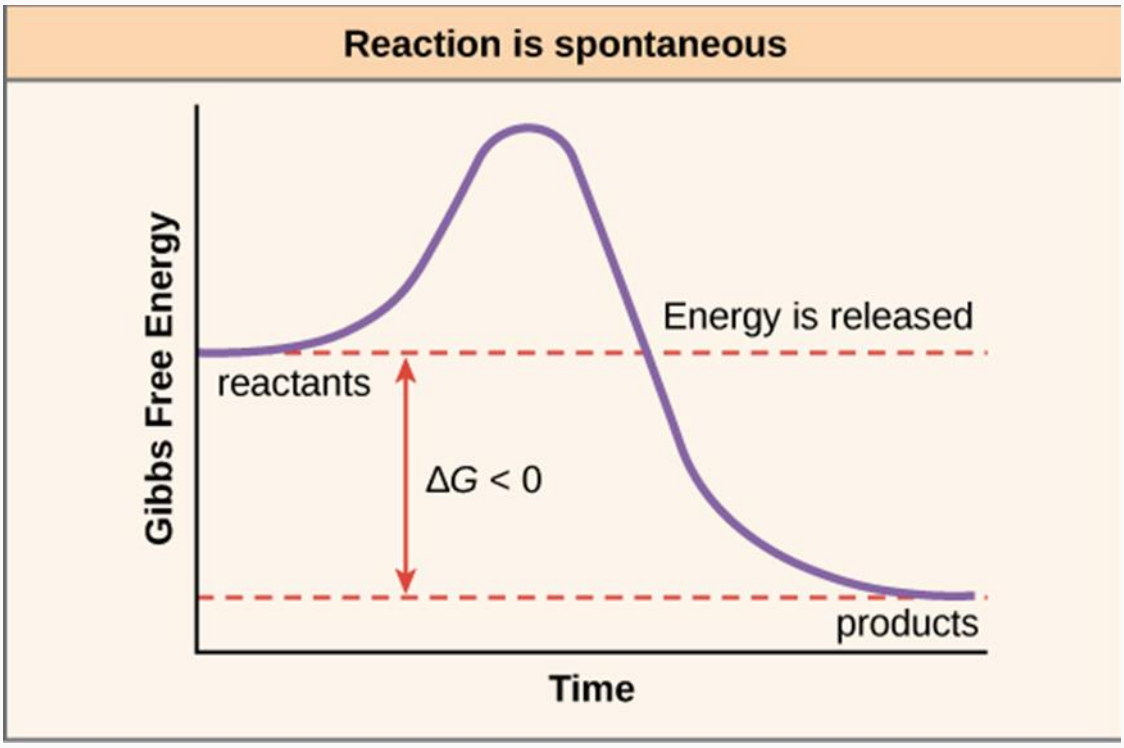
A. ATP

ATP has an higher free energy than ADP. The third phosphate will be added to power cellular processes, because when things are phosphorylated, they are primed to do work.

AP BIO INSTA-REVIEW

TOPIC 3.4

This reaction is...



A. Endergonic

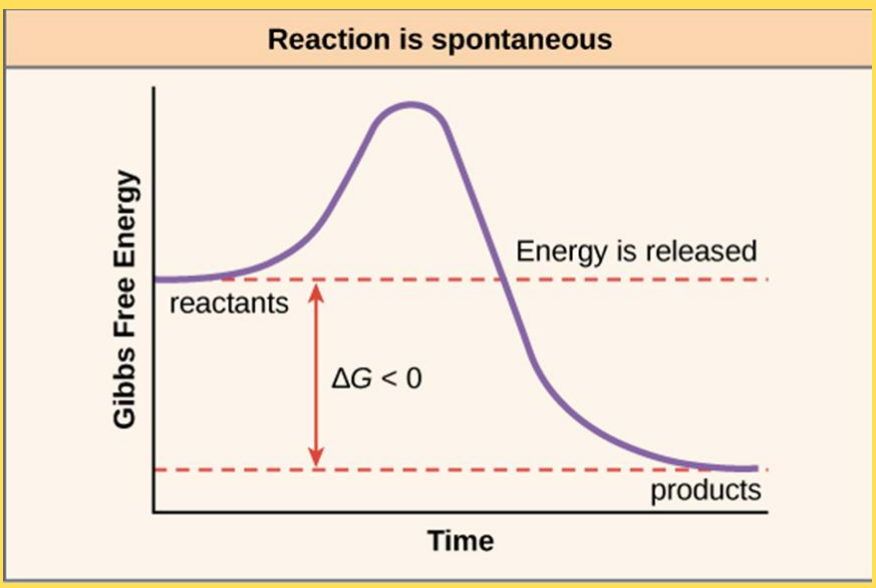
B. Exergonic

AP BIO INSTA-REVIEW

TOPIC 3.4

This reaction is...

B. Exergonic

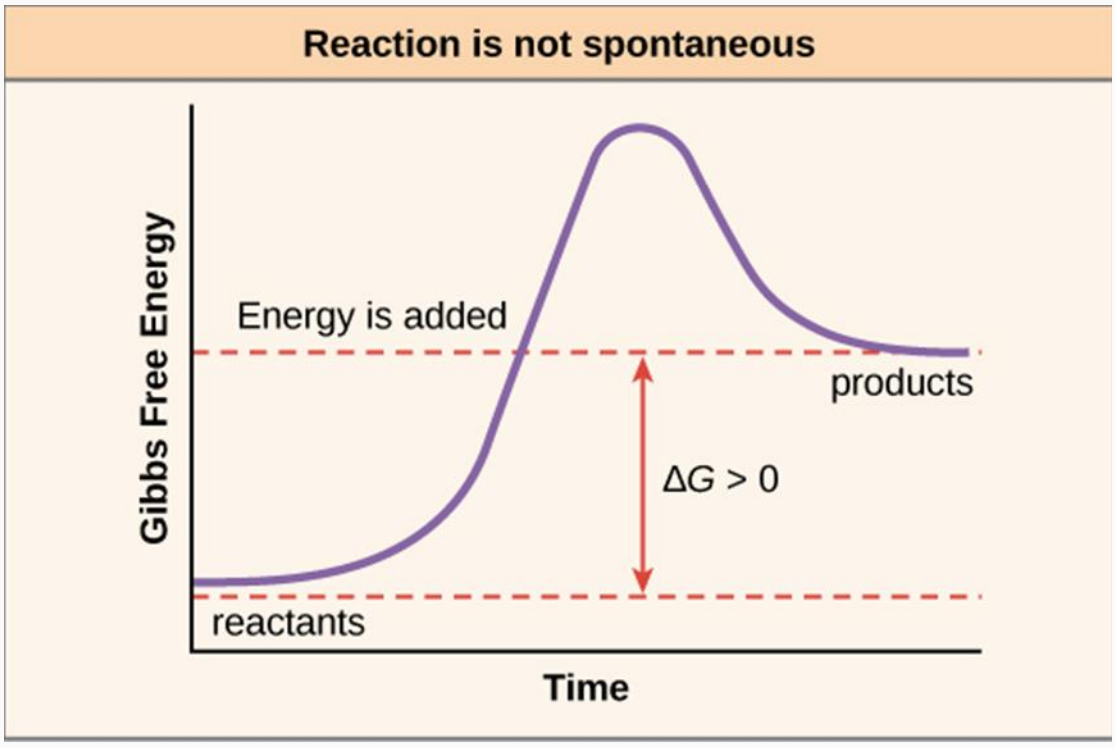


There is a release of free energy that can be used to power an endergonic reaction (requires input of energy)

AP BIO INSTA-REVIEW

TOPIC 3.4

This reaction is...



A. Endergonic

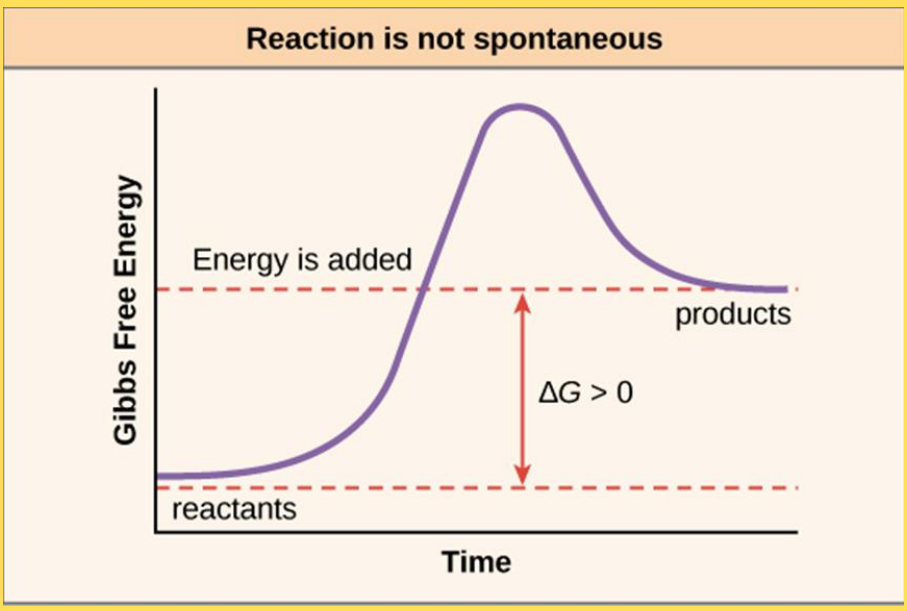
B. Exergonic

AP BIO INSTA-REVIEW

TOPIC 3.4

This reaction is...

A. Endergonic



There is an absorption of free energy that is released by an exergonic reaction (requires input of energy)

AP BIO INSTA-REVIEW

TOPIC 3.5

Photosynthesis

ENE-1.I.1

Organisms capture and store energy for use in biological processes–

a. Photosynthesis captures energy from the sun and produces sugars.

i. Photosynthesis first evolved in prokaryotic organisms.

ii. Scientific evidence supports the claim that prokaryotic (cyanobacterial) photosynthesis was responsible for the production of an oxygenated atmosphere.

iii. Prokaryotic photosynthetic pathways were the foundation of eukaryotic photosynthesis.

AP BIO INSTA-REVIEW

TOPIC 3.5

Photosynthesis

ENE-1.I.2

The light-dependent reactions of photosynthesis in eukaryotes involve a series of coordinated reaction pathways that capture energy present in light to yield ATP and NADPH, which power the production of organic molecules.

ENE-1.J.1

During photosynthesis, chlorophylls absorb energy from light, boosting electrons to a higher energy level in photosystems I and II.

AP BIO INSTA-REVIEW

TOPIC 3.5

Photosynthesis

ENE-1.J.2

Photosystems I and II are embedded in the internal membranes of chloroplasts and are connected by the transfer of higher energy electrons through an electron transport chain (ETC).

ENE-1.J.3

When electrons are transferred between molecules in a sequence of reactions as they pass through the ETC, an electrochemical gradient of protons (hydrogen ions) is established across the internal membrane.

AP BIO INSTA-REVIEW

TOPIC 3.5

Photosynthesis

ENE-1.J.4

The formation of the proton gradient is linked to the synthesis of ATP from ADP and inorganic phosphate via ATP synthase.

ENE-1.J.5

The energy captured in the light reactions and transferred to ATP and NADPH powers the production of carbohydrates from carbon dioxide in the Calvin cycle, which occurs in the stroma of the chloroplast.

AP BIO INSTA-REVIEW

TOPIC 3.5

Where did photosynthesis originate?

A. Algae

B. Cyanobacteria

C. Plants

D. Protists

AP BIO INSTA-REVIEW

TOPIC 3.5

Where did photosynthesis originate?

B. Cyanobacteria

Photosynthesis originated in the cyanobacteria in the oceans. This is observed by the iron oxide banding patterns in the fossil evidence.

AP BIO INSTA-REVIEW

TOPIC 3.5

Earth included oxygen when it was first formed

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 3.5

Earth included oxygen when it was first formed

B. False

Oxygen gas was not available in Early Earth. Oxygen was generated as a by-product of photosynthesis. The oxygen atom was involved in CO_2, and H_2O among other molecules.

AP BIO INSTA-REVIEW

TOPIC

3.5

What evidence do scientists have to determine when O_2 came?

AP BIO INSTA-REVIEW

TOPIC 3.5

What evidence do scientists have to determine when O_2 came?

Iron oxide (rust) layers in the rock layers of fossils

AP BIO INSTA-REVIEW

TOPIC 3.5

Where was oxygen initially formed?

A. Atmosphere

B. Land

C. Meteorite

D. Ocean

AP BIO INSTA-REVIEW

TOPIC 3.5

Where was oxygen initially formed?

D. Ocean

The cyanobacteria lived in the oceans so the process of photosynthesis took place in the oceans. The by-product of photosynthesis is oxygen, so therefore the oxygen was initally formed in the oceans.

AP BIO INSTA-REVIEW

TOPIC

3.5

Based on endosymbiotic theory, where did chloroplasts come from?

AP BIO INSTA-REVIEW

TOPIC 3.5

Based on endosymbiotic theory, where did chloroplasts come from?

Engulfed photosynthetic prokaryotes

AP BIO INSTA-REVIEW

TOPIC 3.5

Which step of photosynthesis stores solar energy as ATP?

A. Calvin Cycle

B. Glycolysis

C. Krebs Cycle

D. Light Reactions

AP BIO INSTA-REVIEW

TOPIC 3.5

Which step of photosynthesis stores solar energy as ATP?

D. Light Reactions

The light reactions use solar energy. The photosystems involve pigments that absorb the energy which is used to pump protons across a membrane creating a proton gradient that is used by ATP Synthase to synthesize ATP.

AP BIO INSTA-REVIEW

TOPIC
3.5

Which step of photosynthesis stores high energy electrons as NADPH?

A. Calvin Cycle

B. Glycolysis

C. Krebs Cycle

D. Light Reactions

AP BIO INSTA-REVIEW

TOPIC 3.5

Which step of photosynthesis stores high energy electrons as NADPH?

D. Light Reactions

The electron transport chain after photosystem I ends with $NADP^+$ accepting the electrons to become NADPH. The NADPH will carry the électrons to the Calvin Cycle for the reduction phase.

AP BIO INSTA-REVIEW

TOPIC 3.5

Which step of photosynthesis synthesizes G3P?

A. Calvin Cycle

B. Glycolysis

C. Krebs Cycle

D. Light Reactions

AP BIO INSTA-REVIEW

TOPIC 3.5

Which step of photosynthesis synthesizes G3P?

A. Calvin Cycle

The by-product of the Calvin Cycle is G3P. After the reduction phase of the Calvin Cycle, there are six G3P molecules. One is removed to be used to synthesize sugars and the other five will undergo rearrangement to make the RuBP that started the cycle.

AP BIO INSTA-REVIEW

TOPIC 3.5

Which step of photosynthesis takes place in stroma?

A. Calvin Cycle

B. Glycolysis

C. Krebs Cycle

D. Light Reactions

AP BIO INSTA-REVIEW

TOPIC 3.5

Which step of photosynthesis takes place in stroma?

A. Calvin Cycle

Calvin cycle takes place in the stroma (cytosol of the chloroplast) while the Light Reactions take place on the thylakoid membrane.

AP BIO INSTA-REVIEW

TOPIC 3.5

Which step of photosynthesis takes place in the thylakoid?

A. Calvin Cycle

B. Glycolysis

C. Krebs Cycle

D. Light Reactions

AP BIO INSTA-REVIEW

TOPIC 3.5

Which step of photosynthesis takes place in the thylakoid?

D. Light Reactions

The light reactions take place on the thylakoid membrane while the Calvin Cycle takes place in the stroma.

AP BIO INSTA-REVIEW

TOPIC

3.5

In a plant cell, where is ATP synthesized?

AP BIO INSTA-REVIEW

TOPIC 3.5

In a plant cell, where is ATP synthesized?

In the electron transport chain...

Chloroplast has an ETC in the light reactions of the thylakoid.

Mitochondria has an ETC in oxidative phosphorylation on the cristae.

Don't get tripped up on this type of question. ATP synthesized by mitochondria is for cellular energy vs. ATP synthesized by chloroplast is for synthesis of G3P.

AP BIO INSTA-REVIEW

TOPIC 3.5

Where does photolysis take place?

A. Cytosol

B. Photosystem I

C. Photosystem II

D. Stroma

AP BIO INSTA-REVIEW

TOPIC 3.5

Where does photolysis take place?

C. Photosystem II

Photolysis is the process where the water molecule is broken into oxygen gas, hydrogen ions, and electrons. This takes place at the first photosystem in the linear electron flow called Photosystem II.

AP BIO INSTA-REVIEW

TOPIC

3.5

What is photolysis?

AP BIO INSTA-REVIEW

TOPIC 3.5

What is photolysis?

The process of using light energy to split a water molecule.

The water molecule is split into oxygen and hydrogen and electrons. These electrons replace the ones that were taken from the reaction center complex.

AP BIO INSTA-REVIEW

TOPIC

3.5

Describe the flow of electrons through the light reactions.

AP BIO INSTA-REVIEW

TOPIC 3.5

Describe the flow of electrons through the light reactions.

Electrons are taken from the reaction center complex in Photosystem II, travel down an electron transport chain to Photosystem I, then down another electron transport chain to be stored in NADPH.

AP BIO INSTA-REVIEW

TOPIC 3.5

Which direction are hydrogen ions pumped for the electron transport chain in photosynthesis?

A. Into the cytosol

B. Into the intermembrane space

C. Into the stroma

D. Into the thylakoid space

AP BIO INSTA-REVIEW

TOPIC 3.5

Which direction are hydrogen ions pumped for the electron transport chain in photosynthesis?

D. Into the thylakoid space

The hydrogen ions need to be pumped into a small space to increase the concentration gradient quickly and efficiently. The hydrogen ions are pumped INTO the thylakoid space.

AP BIO INSTA-REVIEW

TOPIC
3.5

What is synthesized in the light reactions for use in the Calvin Cycle?

AP BIO INSTA-REVIEW

TOPIC 3.5

What is synthesized in the light reactions for use in the Calvin Cycle?

ATP & NADPH

AP BIO INSTA-REVIEW

TOPIC 3.5

Where does Calvin Cycle take place?

A. Cristae

B. Cytosol

C. Stroma

D. Thylakoid

AP BIO INSTA-REVIEW

TOPIC 3.5

Where does Calvin Cycle take place?

C. Stroma

Calvin Cycle takes place in the stroma while the light reactions take place in the thylakoid membrane.

AP BIO INSTA-REVIEW

TOPIC
3.5

What are the three steps of the Calvin Cycle?

AP BIO INSTA-REVIEW

TOPIC 3.5

What are the three steps of the Calvin Cycle?

Carbon fixation

Reduction

Rearrangement

AP BIO INSTA-REVIEW

TOPIC 3.5

What enzyme used is for carbon fixation?

A. ATP Synthase

B. Decarboxylase

C. PEP Carboxylase

D. Rubisco

AP BIO INSTA-REVIEW

TOPIC 3.5

What enzyme used is for carbon fixation?

D. Rubisco

Carbon fixation is the first step of the Calvin Cycle. The rubisco is responsible for fixing the CO_2 to the RuBP to make the first intermediate of the cycle.

AP BIO INSTA-REVIEW

TOPIC
3.5

How many carbon dioxides are used in the Calvin Cycle?

A. 1
B. 2
C. 3
D. 6

AP BIO INSTA-REVIEW

TOPIC 3.5

How many carbon dioxides are used in the Calvin Cycle?

c. 3

Since the product of the Calvin Cycle is the G3P, which has 3 carbons, it would be logical that 3 CO_2 need to be added to the cycle to be used for the process.

AP BIO INSTA-REVIEW

TOPIC

3.5

What is the product of the Calvin Cycle?

A. 3PG

B. G3P

C. PGAL

D. RuBP

AP BIO INSTA-REVIEW

TOPIC 3.5

What is the product of the Calvin Cycle?

B. G3P

The Calvin Cycle makes 6 molecules of G3P. One of the G3Ps are removed while the other 5 will continue in the cycle to synthesize RuBP.

AP BIO INSTA-REVIEW

TOPIC
3.5

How many ATPs and NADPHs are needed for the Calvin Cycle? Where do the extra come from?

AP BIO INSTA-REVIEW

TOPIC 3.5

How many ATPs and NADPHs are needed for the Calvin Cycle? Where do the extra come from?

9 ATP and 6 NADPH
(6 ATP and 6 NADPH in reduction & 3 ATP in rearrangement)

The extra ATP comes from cyclic electron flow.

AP BIO INSTA-REVIEW

TOPIC

3.5

What is cyclic electron flow?

AP BIO INSTA-REVIEW

TOPIC 3.5

What is cyclic electron flow?

Electrons flow from the Photosystem II to Photosystem I through the ETC to facilitate ATP synthesis, then when the electron gains energy in Photosystem I it goes down the ETC between Photosystem II and Photosystem I. It cycles using only the ETC and Photosystem I only.

AP BIO INSTA-REVIEW

TOPIC

3.5

How are the light reactions and the Calvin cycle related?

AP BIO INSTA-REVIEW

TOPIC 3.5

How are the light reactions and the Calvin cycle related?

The light reactions synthesizes the 9 ATP and 6 NADPH to use in the Calvin cycle

AP BIO INSTA-REVIEW

TOPIC
3.5

What is the function of photosynthesis?

A. Capture sunlight and produce sugars
B. Capture ATP and produce ion gradients
C. Capture sugars and produce sunlight
D. Capture ions and produce ATP

AP BIO INSTA-REVIEW

TOPIC 3.5

What is the function of photosynthesis?

A. Capture sunlight and produce sugars

Photosynthesis is completed by photoautotrophs. They will use light energy to synthesize organic molecules (like sugar) from inorganic molecules.

AP BIO INSTA-REVIEW

TOPIC 3.5

Which provided evidence of oxygen generation in the atmosphere?

A. Production of ATP without a mitochondria

B. Production of fire on earth's surface

C. Production of iron oxide bands in rock layers

D. Production of organic compounds

AP BIO INSTA-REVIEW

TOPIC 3.5

Which provided evidence of oxygen generation in the atmosphere?

C. Production of iron oxide bands in rock layers

The iron will oxidize in the presence of oxygen. The fossil evidence shows banding in the rock layers which represents the generation of oxygen by photosynthesis.

AP BIO INSTA-REVIEW

TOPIC

3.5

Which describes light independent reactions?

A. Calvin cycle to break bonds to release carbon dioxide

B. Calvin cycle to synthesize organic compounds

C. Krebs cycle to break bonds to release carbon dioxide

D. Krebs cycle to synthesize organic compounds

AP BIO INSTA-REVIEW

TOPIC 3.5

Which describes light independent reactions?

B. Calvin cycle to synthesize organic compounds

Light independent reactions involves a process that does NOT require light. The Calvin Cycle itself does not require the light, but the products of the light reactions.

AP BIO INSTA-REVIEW

TOPIC 3.5

Where do the light independent reactions take place?

A. Cytosol

B. Matrix

C. Stroma

D. Thylakoid

AP BIO INSTA-REVIEW

TOPIC 3.5

Where do the light independent reactions take place?

C. Stroma

The light independent reactions are the Calvin Cycle which takes place in the stroma, while the light dependent reactions take place in the thylakoid membrane.

AP BIO INSTA-REVIEW

TOPIC
3.5

Which describes light dependent reactions?

A. Light is absorbed to synthesize ATP & NADPH

B. Light is absorbed to create a sodium gradient

C. Light is used to synthesize organic compounds

D. Light is used to heat the cell increasing reaction rate

AP BIO INSTA-REVIEW

TOPIC 3.5

Which describes light dependent reactions?

A. Light is absorbed to synthesize ATP & NADPH

The light dependent reactions is the light reactions. This process uses the photosystems to synthesize ATP and NADPH in the presence of light and water.

AP BIO INSTA-REVIEW

TOPIC

3.5

Describe how ATP is synthesized in the light dependent reactions.

AP BIO INSTA-REVIEW

TOPIC 3.5

Describe how ATP is synthesized in the light dependent reactions.

The light energy is absorbed by pigments in the reaction center complex causing the electrons to move to a higher energy level. As these electrons pump protons across the membrane, the electron falls in energy level. The proton gradient will flow through ATP synthase which phosphorylates ADP to synthesize ATP.

AP BIO INSTA-REVIEW

TOPIC 3.5

Where would you find chlorophyll?

A. Cytosol

B. Mitochondria

C. Ribosome

D. Thylakoid

AP BIO INSTA-REVIEW

TOPIC 3.5

Where would you find chlorophyll?

D. Thylakoid

Chlorophyll is the pigment used in the photosystems to absorb the light energy. The photosystems are part of the light reactions which take place in the thylakoid membrane.

AP BIO INSTA-REVIEW

TOPIC 3.6

Cellular Respiration

ENE-1.K.1

Fermentation and cellular respiration use energy from biological macromolecules to produce ATP. Respiration and fermentation are characteristic of all forms of life.

ENE-1.K.2

Cellular respiration in eukaryotes involves a series of coordinated enzyme-catalyzed reactions that capture energy from biological macromolecules.

AP BIO INSTA-REVIEW

TOPIC 3.6

Cellular Respiration

ENE-1.K.3

The electron transport chain transfers energy from electrons in a series of coupled reactions that establish an electrochemical gradient across membranes–

a. Electron transport chain reactions occur in chloroplasts, mitochondria, and prokaryotic plasma membranes.

AP BIO INSTA-REVIEW

TOPIC 3.6

Cellular Respiration

ENE-1.K.3

b. In cellular respiration, electrons delivered by NADH and $FADH_2$ are passed to a series of electron acceptors as they move toward the terminal electron acceptor, oxygen. In photosynthesis, the terminal electron acceptor is $NADP^+$. Aerobic prokaryotes use oxygen as a terminal electron acceptor, while anaerobic prokaryotes use other molecules.

AP BIO INSTA-REVIEW

TOPIC 3.6

Cellular Respiration

ENE-1.K.3

c. The transfer of electrons is accompanied by the formation of a proton gradient across the inner mitochondrial membrane or the internal membrane of chloroplasts, with the membrane(s) separating a region of high proton concentration from a region of low proton concentration. In prokaryotes, the passage of electrons is accompanied by the movement of protons across the plasma membrane.

AP BIO INSTA-REVIEW

TOPIC 3.6

Cellular Respiration

ENE-1.K.3

d. The flow of protons back through membrane-bound ATP synthase by chemiosmosis drives the formation of ATP from ADP and inorganic phosphate. This is known as oxidative phosphorylation in cellular respiration, and photophosphorylation in photosynthesis.

e. In cellular respiration, decoupling oxidative phosphorylation from electron transport generates heat. This heat can be used by endothermic organisms to regulate body temperature.

AP BIO INSTA-REVIEW

TOPIC 3.6

Cellular Respiration

ENE-1.L.1

Glycolysis is a biochemical pathway that releases energy in glucose to form ATP from ADP and inorganic phosphate, NADH from NAD^+, and pyruvate.

ENE-1.L.2

Pyruvate is transported from the cytosol to the mitochondrion, where further oxidation occurs.

AP BIO INSTA-REVIEW

TOPIC 3.6

Cellular Respiration

ENE-1.L.3

In the Krebs cycle, carbon dioxide is released from organic intermediates, ATP is synthesized from ADP and inorganic phosphate, and electrons are transferred to the coenzymes NADH and $FADH_2$.

ENE-1.L.4

Electrons extracted in glycolysis and Krebs cycle reactions are transferred by NADH and $FADH_2$ to the electron transport chain in the inner mitochondrial membrane.

AP BIO INSTA-REVIEW

TOPIC 3.6

Cellular Respiration

ENE-1.L.5

When electrons are transferred between molecules in a sequence of reactions as they pass through the ETC, an electrochemical gradient of protons (hydrogen ions) across the inner mitochondrial membrane is established.

AP BIO INSTA-REVIEW

TOPIC 3.6

Cellular Respiration

ENE-1.L.6

Fermentation allows glycolysis to proceed in the absence of oxygen and produces organic molecules, including alcohol and lactic acid, as waste products.

ENE-1.L.7

The conversion of ATP to ADP releases energy, which is used to power many metabolic processes.

AP BIO INSTA-REVIEW

TOPIC

3.6

Which step is anaerobic?

A. Glycolysis

B. Krebs Cycle

C. Oxidative Phosphorylation

AP BIO INSTA-REVIEW

TOPIC 3.6

Which step is anaerobic?

A. Glycolysis

Anaerobic means that it occurs without oxygen. Glycolysis takes place in the cytosol and does not require oxygen. Fermentation is able to regenerate the NAD^+ for glycolysis. Krebs Cycle and Oxidative Phosphorylation take place in the mitochondria and require oxygen.

AP BIO INSTA-REVIEW

TOPIC

3.6

Where does glycolysis take place?

A. Chloroplast

B. Cytosol

C. Mitochondria

D. Nucleus

AP BIO INSTA-REVIEW

TOPIC 3.6

Where does glycolysis take place?

B. Cytosol

Glycolysis takes place in the cytosol. This process can take place in all cells due to all cells having cytosol.

AP BIO INSTA-REVIEW

TOPIC

3.6

How does glycolysis taking place in the cytosol prove that glycolysis was the first evolved metabolic step?

AP BIO INSTA-REVIEW

TOPIC 3.6

How does glycolysis taking place in the cytosol prove that glycolysis was the first evolved metabolic step?

All organisms undergo glycolysis.

Glycolysis takes place in the cytosol and does not require membrane bound organelles. Evolved before the membrane bound organisms since the process does not need it.

Glycolysis does not require oxygen. Pre-historic earth did not have oxygen and so it evolved before oxygen was found in the atmosphere.

AP BIO INSTA-REVIEW

TOPIC

3.6

Fermentation synthesizes ATP...

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 3.6

Fermentation synthesizes ATP...

B. False

Fermentation is required to regenerate the NAD^+ in the absence of O_2. This process takes place after glycolysis which synthesizes 2 ATP molecules.

AP BIO INSTA-REVIEW

TOPIC

3.6

What is the function of fermentation?

AP BIO INSTA-REVIEW

TOPIC 3.6

What is the function of fermentation?

To regenerate the NAD^+ that is needed for cellular respiration steps.

NAD^+ takes an electron (and a hydrogen) to become reduced. This NADH is the electron shuttle around the steps of Cellular Respiration. If all the NADH is reduced there is no available NAD^+ and the processes will halt. Fermentation allows the NADH to offload the electrons (and become oxidized)

AP BIO INSTA-REVIEW

TOPIC

3.6

Where does Krebs Cycle take place?

A. Cristae

B. Cytosol

C. Intermembrane space

D. Matrix

AP BIO INSTA-REVIEW

TOPIC 3.6

Where does Krebs Cycle take place?

D. Matrix

The Krebs cycle takes place in the mitochondrial matrix. The pyruvate is transported into the mitochondria through a transport protein.

AP BIO INSTA-REVIEW

TOPIC

3.6

Where does the electron transport chain of cellular respiration occur?

A. Cristae

B. Cytosol

C. Intermembrane space

D. Matrix

AP BIO INSTA-REVIEW

TOPIC 3.6

Where does the electron transport chain of cellular respiration occur?

A. Cristae

The electron transport chain takes place in the inner mitochondrial membrane called the cristae. This is where the cytochromes will pass the electron which creates the proton gradient between the IM space and matrix.

AP BIO INSTA-REVIEW

TOPIC

3.6

ATP is synthesized in the electron transport chain...

A. True

B. False

AP BIO INSTA-REVIEW

TOPIC 3.6

ATP is synthesized in the electron transport chain...

B. False

There is NO ATP synthesized in the electron transport chain. The ATP is synthesized during chemiosmosis due to the proton gradient formed from the electron transport chain.

AP BIO INSTA-REVIEW

TOPIC 3.6

If the ETC doesn't make ATP, what is the function of the electron transport chain?

AP BIO INSTA-REVIEW

TOPIC 3.6

If the ETC doesn't make ATP, what is the function of the electron transport chain?

ETC generates the proton gradient that is used in chemiosmosis to synthesize ATP from ADP.

Proton gradient is the concentration gradient of the protons on one side of the membrane resulting in a potential energy that is used to add the terminal phosphate to the ADP molecule.

AP BIO INSTA-REVIEW

TOPIC

3.6

Which side has the high proton concentration?

A. Cristae

B. Cytosol

C. Intermembrane space

D. Matrix

AP BIO INSTA-REVIEW

TOPIC 3.6

Which side has the high proton concentration?

C. Intermembrane space

The protons are pumped out of the mitochondrial matrix and into the intermembrane (IM) space during the electron transport chain. As the electron releases energy, it pumps the protons against their concentration gradient.

AP BIO INSTA-REVIEW

TOPIC

3.6

What is the first step of cellular respiration?

A. Glycolysis

B. Krebs Cycle

C. Oxidative Phosphorylation

AP BIO INSTA-REVIEW

TOPIC 3.6

What is the first step of cellular respiration?

A. Glycolysis

Glycolysis is the first step of cellular respiration. In this step, the glucose molecule is split into two pyruvates and synthesizes 2 NADH & 2 ATP

AP BIO INSTA-REVIEW

TOPIC

3.6

What is the starting material for glycolysis?

AP BIO INSTA-REVIEW

TOPIC 3.6

What is the starting material for glycolysis?

Glucose

(NAD^+ & ADP)

AP BIO INSTA-REVIEW

TOPIC

3.6

What are the products of glycolysis?

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TOPIC 3.6

What are the products of glycolysis?

2 pyruvate
2 ATP
2 NADH

AP BIO INSTA-REVIEW

TOPIC

3.6

Why is the step of glycolysis important?

AP BIO INSTA-REVIEW

TOPIC 3.6

Why is the step of glycolysis important?

Provide NADH with high energy electrons to shuttle to the ETC in the mitochondria

Break down glucose into pyruvate for the next step

Substrate level phosphorylation of ATP

AP BIO INSTA-REVIEW

TOPIC

3.6

What is the second step of cellular respiration?

A. Glycolysis

B. Krebs Cycle

C. Oxidative Phosphorylation

AP BIO INSTA-REVIEW

TOPIC 3.6

What is the second step of cellular respiration?

B. Krebs Cycle

The acetyl CoA product from pyruvate oxidation enters the Krebs cycle which synthesizes 3 NADH, 1 $FADH_2$, 1 ATP, and releases 2 CO_2 from 1 molecule of pyruvate.

AP BIO INSTA-REVIEW

TOPIC

3.6

What step occurs between glycolysis and the Krebs cycle?

AP BIO INSTA-REVIEW

TOPIC 3.6

What step occurs between glycolysis and the Krebs cycle?

Pyruvate oxidation

Where the pyruvate is oxidized (loses electron to NADH) and loses a CO_2 then adds a coenzyme to make Acetyl CoA

AP BIO INSTA-REVIEW

TOPIC

3.6

How many of the 2 carbons from acetyl CoA remain after Krebs Cycle?

A. 0
B. 1
C. 2
D. 3

AP BIO INSTA-REVIEW

TOPIC 3.6

How many of the 2 carbons from acetyl CoA remain after Krebs Cycle?

A. 0

There are 2 carbons that enter the Krebs cycle as acetyl CoA and 2 carbon that leave the Krebs cycle as CO_2. There are NO carbons remaining from acetyl CoA.

AP BIO INSTA-REVIEW

TOPIC

3.6

What is the function of the Krebs Cycle?

AP BIO INSTA-REVIEW

TOPIC 3.6

What is the function of the Krebs Cycle?

To complete the breakdown of "glucose" by releasing the remaining carbons as CO_2

Provide more high energy electrons to ETC with NADH and $FADH_2$

Substrate level phosphorylation for ATP

AP BIO INSTA-REVIEW

TOPIC

3.6

What two parts make up oxidative phosphorylation?

AP BIO INSTA-REVIEW

TOPIC 3.6

What two parts make up oxidative phosphorylation?

Electron Transport Chain
Chemiosmosis

AP BIO INSTA-REVIEW

TOPIC

3.6

During ETC, protons are pumped across the cristae. How does the pH in the mitochondria compare?

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TOPIC 3.6

During ETC, protons are pumped across the cristae. How does the pH in the mitochondria compare?

The pH of the matrix is higher than the pH of the intermembrane space.

The protons are pumped OUT of the matrix INTO the intermembrane space. As the concentration increases in the IM space, pH the decreases.

AP BIO INSTA-REVIEW

TOPIC 3.6

Which enzyme in the cristae adds the P to ADP?

A. ADP Phosphorylase

B. ATP Synthase

C. Kinase

D. Phosphatase

AP BIO INSTA-REVIEW

TOPIC 3.6

Which enzyme in the cristae adds the P to ADP?

B. ATP Synthase

Recall, enzymes tells you what they do. ATP Synthase is the enzyme that will synthesize ATP.

AP BIO INSTA-REVIEW

TOPIC

3.6

Which process precedes fermentation?

A. Calvin Cycle

B. Glycolysis

C. Krebs Cycle

D. Oxidative Phosphorylation

AP BIO INSTA-REVIEW

TOPIC 3.6

Which process precedes fermentation?

B. Glycolysis

Fermentation is an anaerobic process to regenerate the NAD^+ molecules. This step takes place after glycolysis.

AP BIO INSTA-REVIEW

TOPIC

3.6

What is the function of fermentation?

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TOPIC 3.6

What is the function of fermentation?

To regenerate the NAD^+

The process of glycolysis will allow for NADH to be reduced as glucose is oxidized. If the cell is not going through the electron transport chain, it will be unable to oxidize the NADH back to NAD^+.

AP BIO INSTA-REVIEW

TOPIC

3.6

Identify the three steps of cellular respiration

AP BIO INSTA-REVIEW

TOPIC 3.6

Identify the three steps of cellular respiration

Glycolysis

Krebs Cycle

Oxidative Phosphorylation

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TOPIC 3.6

Prokaryotes perform an electron transport chain on their plasma membrane

A. True

B. False

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TOPIC 3.6

Prokaryotes perform an electron transport chain on their plasma membrane

A. True

The outer membrane of a prokaryote is the inner membrane of a mitochondria (recall the endosymbiotic theory). This means that the electron transport chain will take place on the plasma membrane of prokaryotes.

AP BIO INSTA-REVIEW

TOPIC

3.6

Which is the pathway of the electron through cellular respiration?

A. CO_2 > NADH > NADPH

B. Glucose > NADH > O_2

C. NADH > O_2 > Glucose

D. Water > ATP > NADPH

AP BIO INSTA-REVIEW

TOPIC 3.6

Which is the pathway of the electron through cellular respiration?

B. Glucose > NADH > O_2

Glucose enters and is oxidized to form pyruvate. When the electrons are removed, they reduce NAD^+ to NADH which carries the electron to the electron transport chain. At the end of the electron transport chain is an oxygen molecule to be the final electron acceptor.

AP BIO INSTA-REVIEW

TOPIC

3.6

What is the final electron acceptor in cellular respiration?

A. ATP

B. NADH

C. Oxygen

D. Water

AP BIO INSTA-REVIEW

TOPIC 3.6

What is the final electron acceptor in cellular respiration?

C. Oxygen

In aerobic respiration, the final electron acceptor is oxygen. The oxygen will be reduced and bond with hydrogen ions to form water.

AP BIO INSTA-REVIEW

TOPIC 3.6

What donates the electron in photosynthesis?

A. ATP

B. NADH

C. Oxygen

D. Water

AP BIO INSTA-REVIEW

TOPIC 3.6

What donates the electron in photosynthesis?

D. Water

In photosynthesis, the electrons are donated by the water molecule when it is split during photolysis in Photosystem II.

AP BIO INSTA-REVIEW

TOPIC 3.6

Where are the electrons pumped during the electron transport chain in the mitochondria?

A. Cytosol

B. Stroma

C. Matrix

D. Intermembrane space

AP BIO INSTA-REVIEW

TOPIC 3.6

Where are the electrons pumped during the electron transport chain in the mitochondria?

D. Intermembrane space

The electrons are pumped into the intermembrane (IM) space. This is a small space which allows the concentration to increase quickly to allow the generation of ATP through ATP synthase.

AP BIO INSTA-REVIEW

TOPIC

3.6

Describe how endotherms and ectotherms differ in their work to maintain body temperatures.

AP BIO INSTA-REVIEW

TOPIC 3.6

Describe how endotherms and ectotherms differ in their work to maintain body temperatures.

Endotherms use metabolism to maintain a higher body temperature than their environment

Ectotherms use behaviors to regulate internal body temperature

AP BIO INSTA-REVIEW

TOPIC

3.6

Krebs cycle: products?

A. ATP, NADH, $FADH_2$, CO_2

B. ATP, 2 NADH, 2 $FADH_2$, CO_2

C. ATP, 3 NADH, $FADH_2$, 2 CO_2

D. 2 ATP, NADH, $FADH_2$, 2 CO_2

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TOPIC 3.6

Krebs cycle: products?

C. ATP, 3 NADH, $FADH_2$, 2 CO_2

After 1 turn of the Krebs cycle, there are 3 NADH, 2 CO_2, 1 ATP, 1 $FADH_2$

AP BIO INSTA-REVIEW

TOPIC 3.7

Fitness

SYI-3.A.1

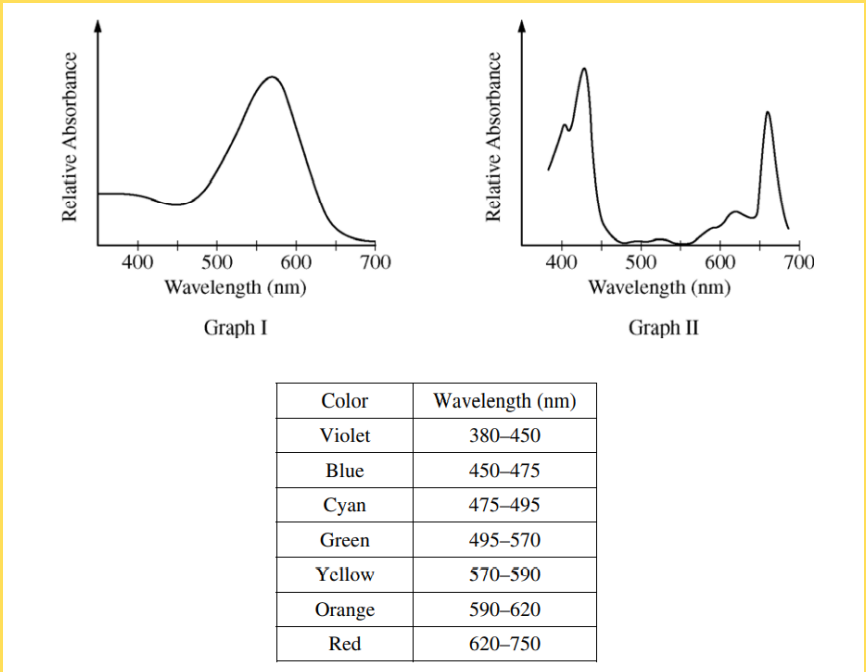
Variation at the molecular level provides organisms with the ability to respond to a variety of environmental stimuli.

SYI-3.A.2

Variation in the number and types of molecules within cells provides organisms a greater ability to survive and/or reproduce in different environments.

AP BIO INSTA-REVIEW

TOPIC 3.7



Color	Wavelength (nm)
Violet	380–450
Blue	450–475
Cyan	475–495
Green	495–570
Yellow	570–590
Orange	590–620
Red	620–750

Which pigment would be more favorable in green light?

A. Pigment A (Graph I)

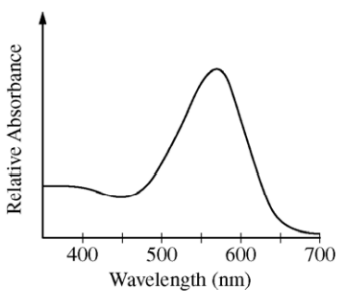
B. Pigment B (Graph II)

AP BIO INSTA-REVIEW

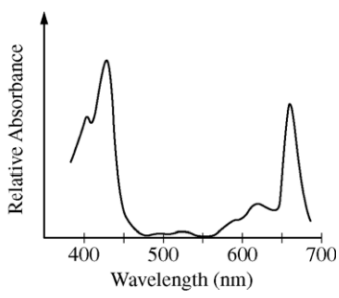
TOPIC 3.7

Which pigment would be more favorable in green light?

A. Pigment A (Graph I)



Graph I



Graph II

Color	Wavelength (nm)
Violet	380–450
Blue	450–475
Cyan	475–495
Green	495–570
Yellow	570–590
Orange	590–620
Red	620–750

This is showing the absorption spectrum of two different pigments. The graph with the highest absorption in the green range (490 – 570) is the favorable in green.

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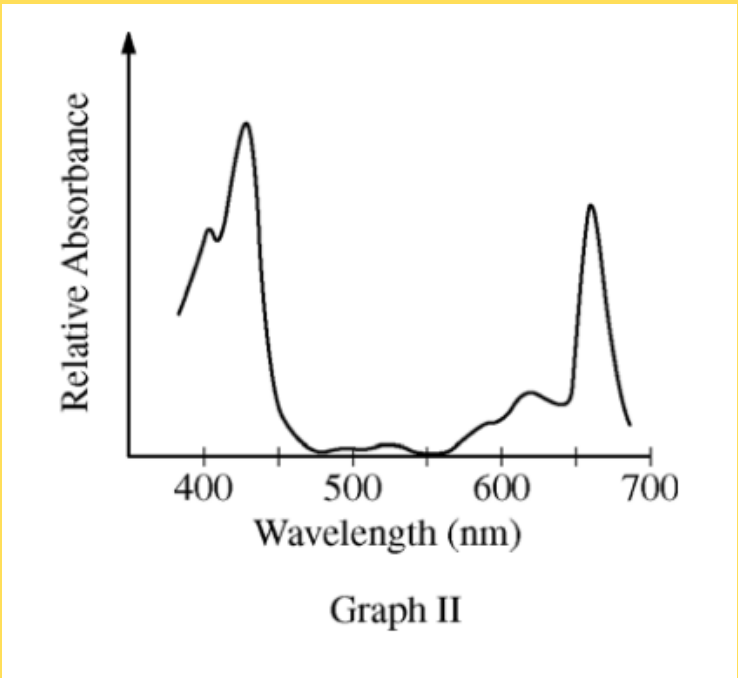
TOPIC 3.7



Graph II

Color	Wavelength (nm)
Violet	380–450
Blue	450–475
Cyan	475–495
Green	495–570
Yellow	570–590
Orange	590–620
Red	620–750

What color is the pigment from graph II?

A. Blue

B. Green

C. Red

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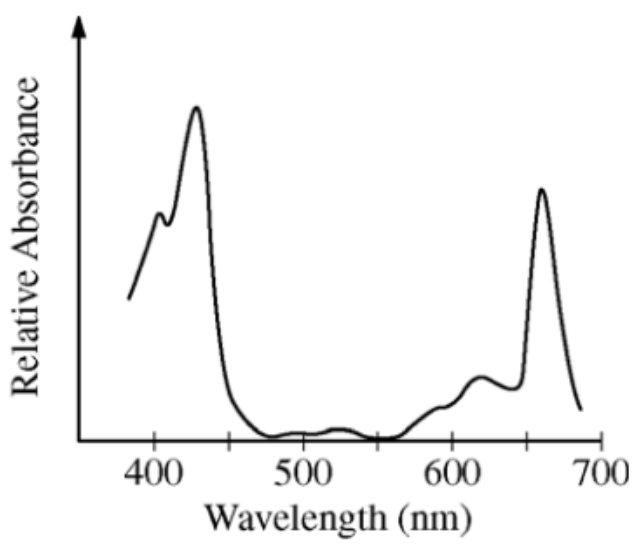
TOPIC 3.7

What color is the pigment from graph II?

B. Green



Graph II

As you see there is a low absorption in the green range (490 - 570), which means that it is the color of the pigment. Colors that are observed are reflected or transmitted while absorbing all other colors.

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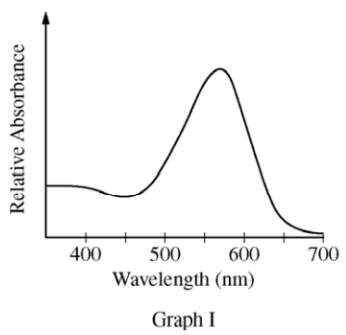
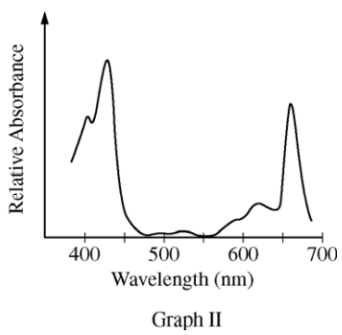
TOPIC 3.7



Graph I



Graph II

Color	Wavelength (nm)
Violet	380–450
Blue	450–475
Cyan	475–495
Green	495–570
Yellow	570–590
Orange	590–620
Red	620–750

Justify your claim that Pigment A (Graph I) is more favorable in green light.

AP BIO INSTA-REVIEW

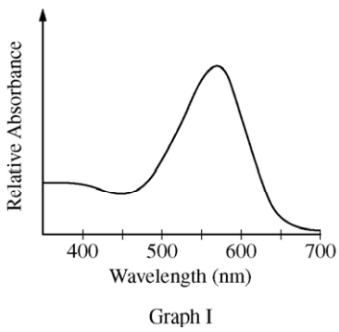
TOPIC 3.7

Justify your claim that Pigment A (Graph 1) is more favorable in green light.

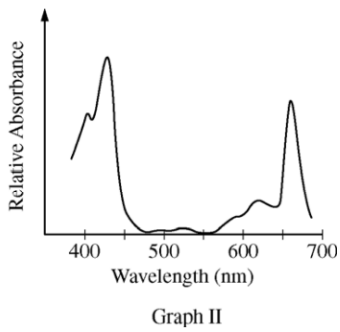
Pigment A absorbs more light for photosynthesis than Pigment B at green wavelengths.

AP BIO INSTA-REVIEW

TOPIC 3.7



Graph I



Graph II

Color	Wavelength (nm)
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Red	620–750

Why would the pigment in Graph II be less favorable in green light?

AP BIO INSTA-REVIEW

TOPIC 3.7

Why would the pigment in Graph II be less favorable in green light?

Notice in the green range (495 – 570), there is very LOW absorbance of light with the pigment in Graph II. The less light absorbed, the less energy is converted to chemical energy for the plant.

AP BIO INSTA-REVIEW

TOPIC

3.7

Many species of bacteria grow in the mouths of animals and can form biofilms on teeth (plaque). Within plaque, the outer layers contain high levels of oxygen and the layers closest to the tooth contain low levels of oxygen. The surface of the tooth is covered in a hard layer of enamel, which can be dissolved under acidic conditions. When the enamel breaks down, the bacteria in plaque can extract nutrients from the tooth and cause cavities.

Certain types of bacteria (e.g., *Streptococcus mutans*) thrive in the innermost anaerobic layers of the plaque and are associated with cavities. Other types of bacteria (*Streptococcus sanguinis*) compete with *S. mutans* but are unable to thrive in acidic environments.

If you forget to brush your teeth, which bacteria is favorable in your mouth (for them not you)?

A. S. mutans

B. S. sanguinis

AP BIO INSTA-REVIEW

TOPIC 3.7

If you forget to brush your teeth, which bacteria is favorable in your mouth (for them not you)?

A. S. mutans

If you don't brush your teeth, you are unable to break up the plaque layer on your teeth. The layers closest to the teeth contain low levels of oxygen. The S. mutans is favorable in the innermost anaerobic layers of the plaque.

AP BIO INSTA-REVIEW

TOPIC

3.7

Many species of bacteria grow in the mouths of animals and can form biofilms on teeth (plaque). Within plaque, the outer layers contain high levels of oxygen and the layers closest to the tooth contain low levels of oxygen. The surface of the tooth is covered in a hard layer of enamel, which can be dissolved under acidic conditions. When the enamel breaks down, the bacteria in plaque can extract nutrients from the tooth and cause cavities.

Certain types of bacteria (e.g., *Streptococcus mutans*) thrive in the innermost anaerobic layers of the plaque and are associated with cavities. Other types of bacteria (*Streptococcus sanguinis*) compete with *S. mutans* but are unable to thrive in acidic environments.

Justify the S. mutans is more favorable in a non-brushed mouth.

AP BIO INSTA-REVIEW

TOPIC 3.7

Justify the S. mutans is more favorable in a non-brushed mouth.

If you don't brush your teeth, there is less oxygen (you don't aerate your teeth). The S. mutans is favorable in an anaerobic environment.

AP BIO INSTA-REVIEW

TOPIC 3.7

Many species of bacteria grow in the mouths of animals and can form biofilms on teeth (plaque). Within plaque, the outer layers contain high levels of oxygen and the layers closest to the tooth contain low levels of oxygen. The surface of the tooth is covered in a hard layer of enamel, which can be dissolved under acidic conditions. When the enamel breaks down, the bacteria in plaque can extract nutrients from the tooth and cause cavities.

Certain types of bacteria (e.g., *Streptococcus mutans*) thrive in the innermost anaerobic layers of the plaque and are associated with cavities. Other types of bacteria (*Streptococcus sanguinis*) compete with *S. mutans* but are unable to thrive in acidic environments.

What process performed by the bacteria caused the low pH?

A. Fermentation/Glycolysis

B. Krebs Cycle

C. Oxidative Phosphorylation

D. All of the above

AP BIO INSTA-REVIEW

TOPIC 3.7

What process performed by the bacteria caused the low pH?

A. Fermentation/Glycolysis

Fermentation is a form of anaerobic respiration that takes place after glycolysis. There are two different types: ethanol fermentation and lactic acid fermentation. The increase in lactic acid will result in a low pH. Glycolysis ends with pyruvate (or pyruvic acid).

AP BIO INSTA-REVIEW

TOPIC 3.7

Many species of bacteria grow in the mouths of animals and can form biofilms on teeth (plaque). Within plaque, the outer layers contain high levels of oxygen and the layers closest to the tooth contain low levels of oxygen. The surface of the tooth is covered in a hard layer of enamel, which can be dissolved under acidic conditions. When the enamel breaks down, the bacteria in plaque can extract nutrients from the tooth and cause cavities.

Certain types of bacteria (e.g., *Streptococcus mutans*) thrive in the innermost anaerobic layers of the plaque and are associated with cavities. Other types of bacteria (*Streptococcus sanguinis*) compete with *S. mutans* but are unable to thrive in acidic environments.

Toothpaste is alkaline, which bacteria is more favorable?

A. S. mutans

B. S. sanguinis

AP BIO INSTA-REVIEW

TOPIC 3.7

Toothpaste is alkaline, which bacteria is more favorable?

B. S. sanguinis

Since toothpaste is alkaline (which means basic), this will increase the pH in the mouth. The S. sanguinis is unable to compete with S. mutans in acidic environments, but now that its alkaline they are more favorable