

AP Biology Summer Work



Alvord Unified School District
Hillcrest High School

"All students will realize their unlimited potential"



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Future AP Biology Students:

Ms. Smith and Mr. Waggoner would like to welcome you to AP Biology! Congratulations, you have made the best decision of your life by choosing to enroll in AP Biology next year! Though the year will be tough, you will grow tremendously as a student. We will be working through labs/experiments often as well as practice AP multiple choice and free response questions to prepare you to rock the AP exam.

Although AP Biology can be a lot of fun, it is also a lot of work. Since colleges teach different topics in their first biology course, the AP Biology test has to cover more information than most AP tests. To make sure we finish everything in time for the test and have enough time to review, you are required to complete the following work over summer. There will also be a quiz on this information when we return for class.

Please use the following checklist to make sure you complete all required work:

- ☒ Sign up for AP Biology
- ☐ Fill in 1.1 Energy and Thermodynamics Notes + Questions (hand written)
- ☐ Fill in 1.2 Properties of Water Notes + Questions (hand written)
- ☐ Fill in 1.3 Macromolecules Notes + Questions (hand written)
- ☐ Fill in 1.4 Enzymes Notes + Questions (hand written)
- ☐ Make a 3D model of a macromolecule of your choosing (protein, lipid, carbohydrate, nucleic acid)

Have the above completed by the first day of school, August 10th, 2017. We both look forward to meeting you all and WE LOVE SCIENCE!

-Ms. Smith and Mr. Waggoner

AP Biology Summer Work Questions

Use the powerpoint on google classroom to fill in the notes and answer the following questions on a separate piece of paper. You may also use other sources (books, internet, etc...)

1.1 Questions

1. **Distinguish between** the following:
 - a) endergonic/exergonic reactions
 - b) anabolic/catabolic pathways
 - c) kinetic/potential energy
2. **Describe** the first and second laws of thermodynamics.
3. **Define** free energy and **explain** how cells use energy coupling.
4. **Explain** how cells use ATP to perform work.

1.2 Questions

1. **Explain** different properties of water, such as cohesion and adhesion.
2. **Describe** how the chemical structure of water allows it to have these properties.
3. **Describe** how the unique chemical and physical properties of water (including cohesion and adhesion) influence life on earth (give specific examples).
4. **Distinguish** between acidic and basic solutions and **describe** how pH affects homeostasis citing specific examples.

1.3 Questions

1. **Define** monomer, polymer, hydrolysis, and dehydration synthesis and give specific examples from EACH of the 4 macromolecule groups (lipids, carbohydrates, proteins, nucleic acids).
2. **Describe** the biological importance (why do we need them) of each of the 4 macromolecule groups, citing examples.
3. **Describe** protein structure (including primary, secondary, tertiary and quaternary structure).
4. **Define** amphipathic. What is an example of an amphipathic molecule?
5. **Explain** how differences in bonding between carbohydrate monomers can affect the structural orientation and function of polymers (such as the difference between starch and cellulose).

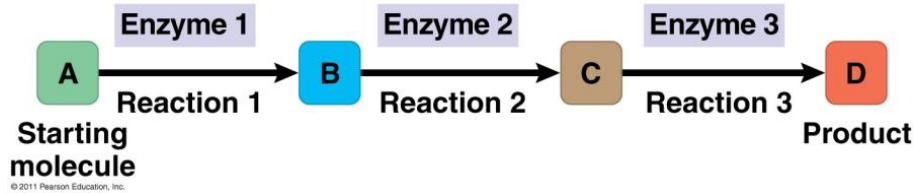
1.4 Questions

1. **Describe** different functions of enzymes in terms of chemical reactions.
2. **Define** each of the following terms and relate them to enzyme function: catalysts, active site, substrate, product, induced fit, activation energy.
3. **Describe** how each of the following affects enzyme function: cofactors, coenzymes, competitive inhibition, noncompetitive inhibition and allosteric regulation.
4. **Describe** the effects of each of the following on the rate of enzymatic activity: changes in temperature, pH, enzyme concentration and substrate concentration.
5. **Describe** the effect of denaturation on enzymatic activity.

All living systems require constant input of free energy.

1.1 Energy and Thermodynamics

L.O. The student is able to explain how biological systems use free energy based on empirical data that all organisms require constant energy input to maintain organization, to grow and to reproduce.

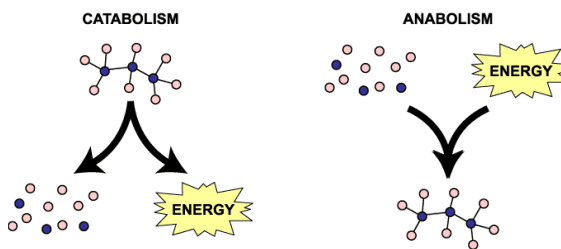


1. Metabolism

- Metabolism is the _____ of an organism's _____
 - Manage the _____ and _____ resources of a _____
- _____ pathways _____ energy by _____ complex molecules into simpler compounds
 - Eg. _____ break down food → _____ energy
- _____ pathways _____ energy to _____ complex molecules from simpler ones
 - Eg. _____ link to form _____ protein

2. Energy = capacity to do work

- _____ energy (KE): energy associated with _____
 - _____ (thermal energy) is KE associated with random _____ of atoms or molecules
- _____ energy (PE): _____ energy as a result of its position or structure
 - Chemical energy is PE available for _____ in a _____
- Energy can be converted from one form to another
 - Eg. _____ → _____ → _____



3. Thermodynamics is the study of energy _____ that occur in _____

- A _____ system, such as liquid in a _____, is isolated from its _____
- In an _____ system, _____ and _____ can be _____ between the system and its surroundings
- Organisms are _____

4. The First Law of Thermodynamics

- The energy of the universe is _____
 - Energy can be _____ and _____
 - Energy cannot be _____ or _____
- Also called the principle of _____



(a) First law of thermodynamics

All living systems require constant input of free energy.

1.1 Energy and Thermodynamics (continued)

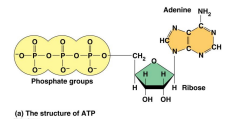
5. The Second Law of Thermodynamics

- Every _____ or transformation _____ the _____ (disorder) of the universe
- During every energy _____ or transformation, some energy is unusable, often lost as _____
- _____: part of a system's energy available to perform work
 - $\Delta G =$ _____
- **Exergonic** reaction: energy is _____
 - _____ reaction, ΔG _____
- **Endergonic** reaction: energy is _____
 - _____ free energy, ΔG _____

Exergonic Reaction	Endergonic Reaction

6. Energy Uses

- A cell does three main kinds of work: _____, _____, _____
- Cells manage energy resources to do work by _____: using an _____ process to drive an _____ one

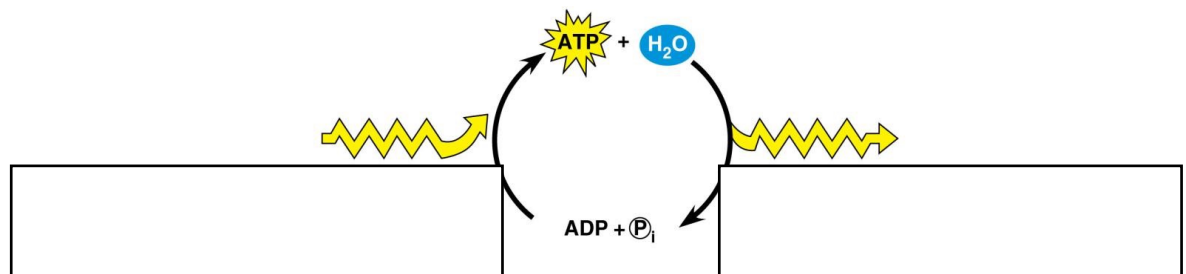


7. ATP

- ATP (_____) is the cell's main _____ source in energy _____
- ATP = _____ + _____ + _____
- When the bonds between the _____ groups are _____ by _____ \rightarrow energy is _____
- This _____ of energy comes from the _____ change to a state of _____ free energy, not in the phosphate bonds themselves

8. How ATP Performs Work

- _____ release of P_i (inorganic phosphate) is used to do the _____ work of cell
- When ATP is _____, it becomes ADP (adenosine _____)



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Organisms must exchange matter with the environment to grow, reproduce and maintain organization.

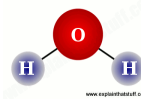
1.2 Properties of Water

L.O. The student is able to justify the selection of data regarding the types of molecules that an animal, plant or bacterium will take up as necessary building blocks and excrete as waste products.

1. Polarity of H₂O

- _____ will bond with _____ on a different molecule of _____ = _____ bond
- _____ can form up to _____ hydrogen bonds

Draw Hydrogen Bonds to the following H₂O molecule:



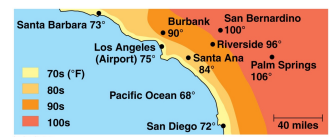
2. Properties of H₂O

- A: _____ = H-bonding between _____ molecules
 - (ex: _____)
- Surface Tension = measure of how difficult it is to _____ or stretch _____ of liquid
- B: _____ = bonding between _____ molecules
 - (ex: _____ to _____ counters the downward pull of _____)
- C: _____ = movement of H₂O up plants
 - H₂O clings to each other by _____, cling to _____ by adhesion



3. Moderation of Temperature

- _____ = Total amount of _____ in system
 - Temperature = measure intensity of _____ due to _____ KE of molecules
- A: Water's _____
 - _____ temp _____ when absorbs/loses heat
 - Large bodies of water _____ and _____ more _____ → warmer coastal areas
 - Create _____ marine/land _____
 - Humans ~ _____ → stable _____, resist temp _____
- B: _____ Cooling
 - Water has high heat of _____
 - Molecules with _____ KE leave as _____
 - Stable temp in _____ & ponds
 - _____ Plants
 - Humans _____
- C: Insulation by _____ - Less _____, floating ice _____ liquid H₂O below
 - _____ exists under _____ surface (ponds, lakes, oceans)
 - Ice = solid _____ (polar bears)



Organisms must exchange matter with the environment to grow, reproduce and maintain organization.

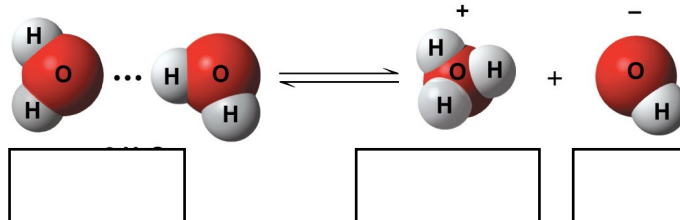
1.2 Properties of Water (continued)

4. Solvent of Life

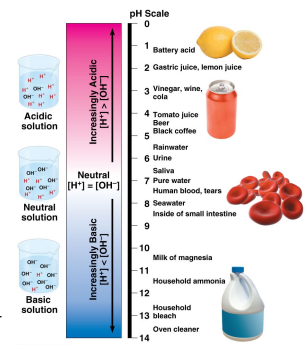
- _____ = liquid, _____ mixture of _____ substances
- _____ = _____ agent (liquid)
- _____ = _____ substance
- Water = _____ solvent
 - “_____ dissolves _____”

Hydrophilic	Hydrophobic
<ul style="list-style-type: none"> • • • • 	<ul style="list-style-type: none"> • • • •

5. Acids and Bases



- _____ = increases _____ concentration (_____)
- _____ = reduces _____ concentration (_____)
- Most _____ fluids are pH _____
- _____: minimize _____ in concentration of _____ and _____ in a solution (_____ acids and bases)
 - Buffers keep _____ at pH ~ _____
 - If blood drops to 7 or up to 7.8, then _____
- _____: important buffers in blood plasma
 - H_2CO_3 (_____) \rightarrow HCO_3^- (_____) + H^+
- Ocean _____ threatens _____ ecosystems



(a)

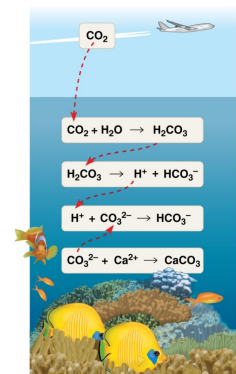
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(b)



(c)



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The subcomponents of biological molecules and their sequence determine the properties of that molecule.

1.3 Macromolecules

L.O. The student is able to explain the connection between the sequence and the subcomponents of a biological polymer and its properties.

L.O. The student is able to refine representations and models to explain how the subcomponents of a biological polymer and their sequence determine the properties of that polymer.

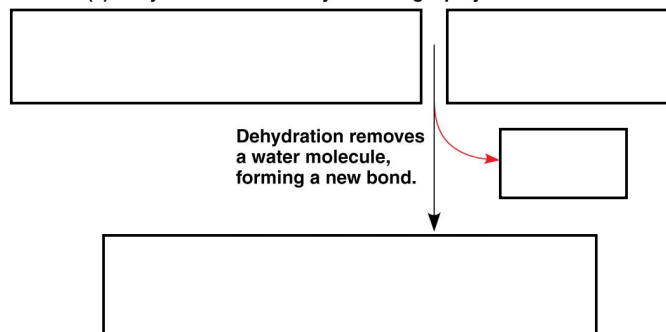
L.O. The student is able to use models to predict and justify that changes in the subcomponents of a biological polymer affect the functionality of the molecule.

1.	<table><tr><th>Monomers</th><th>Polymers</th><th>Macromolecules</th></tr><tr><td>_____ organic Used for building blocks of _____ Connects with condensation reaction (_____ synthesis)</td><td>_____ molecules of monomers With many _____ or similar blocks _____ by _____ bonds</td><td>_____ molecules _____ or more _____ bonded together</td></tr></table>	Monomers	Polymers	Macromolecules	_____ organic Used for building blocks of _____ Connects with condensation reaction (_____ synthesis)	_____ molecules of monomers With many _____ or similar blocks _____ by _____ bonds	_____ molecules _____ or more _____ bonded together
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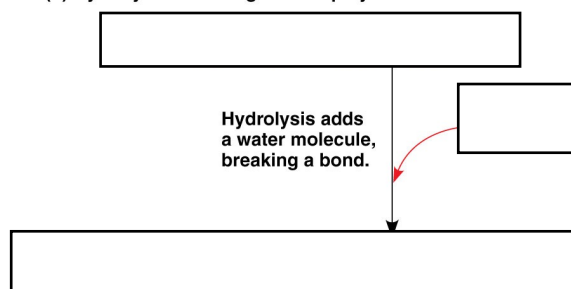
ie. _____ → _____ → _____ → _____

2.	<table border="1"> <tr> <th>Dehydration Synthesis (Condensation Reaction)</th><th>Hydrolysis</th></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </table>	Dehydration Synthesis (Condensation Reaction)	Hydrolysis										
Dehydration Synthesis (Condensation Reaction)	Hydrolysis												

(a) Dehydration reaction: synthesizing a polymer



(b) Hydrolysis: breaking down a polymer



The subcomponents of biological molecules and their sequence determine the properties of that molecule.

1.3 Macromolecules (continued)		
<div>Use the notes to add info. for each macromolecule, include structure and function</div>	<div>Proteins:</div>	<div>Nucleic Acids:</div>
	<div>Lipids:</div>	<div>Carbohydrates:</div>

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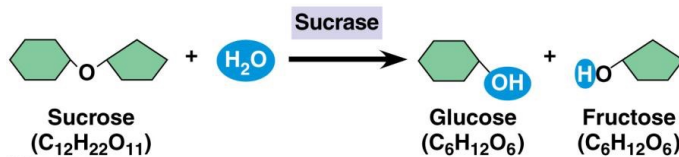
Interactions between molecules affect their structure and function.

1.4 Enzymes

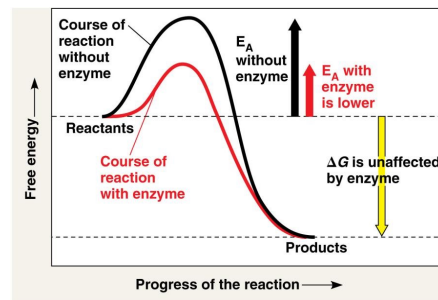
L.O. The student is able to analyze data to identify how molecular interactions affect structure and function.

1. Enzymes

- _____: substance that can change the _____ of a reaction _____ being _____ in the process
- _____ = biological _____

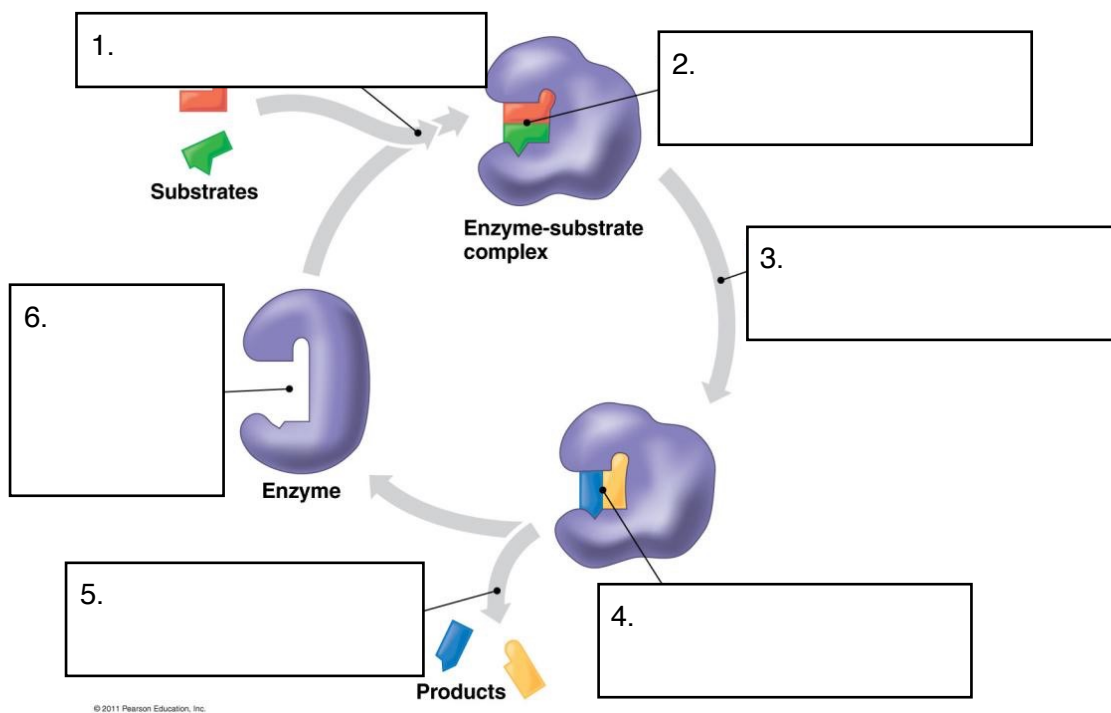


- Speeds up _____ reactions by _____ the _____ energy (energy needed to _____ reaction)



2. Substrate Specificity of Enzymes

- The _____ that an enzyme acts on is called the enzyme's _____
- The enzyme _____ to its substrate, forming an _____ complex
- The _____ is the region on the enzyme where the _____ binds



_____ Fit: Enzyme fits snugly around substrate - “_____”

3. What can affect an enzyme?

- An enzyme's _____ can be _____ by:
 - _____
 - _____
 - _____

Interactions between molecules affect their structure and function.

1.4 Enzymes (continued)

4. Cofactors

- _____ are _____ enzyme helpers such as minerals (eg. _____)
- _____ are organic cofactors (eg. _____)
- Enzyme Inhibitors
 - _____ inhibitor: binds to the _____ of an enzyme, _____ with _____
 - _____ inhibitor: binds to _____ of an enzyme → enzyme changes _____ → active site is _____

5. Inhibition of Enzyme Activity

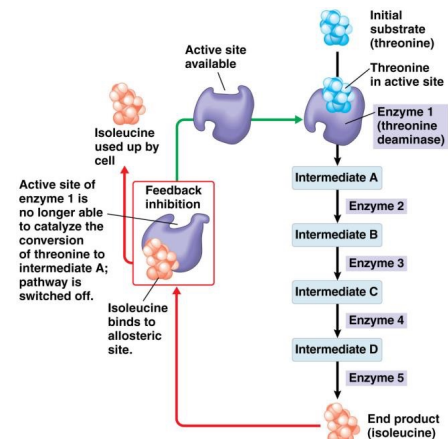
Normal Binding	Competitive Inhibition	Noncompetitive Inhibition

6. Regulation of Enzyme Activity

- To _____ metabolic pathways, the cell switches _____ the _____ that encode specific enzymes
- _____ regulation: protein's _____ at one site is affected by _____ of a regulatory molecule to a _____ site (allosteric site)
 - _____ – stabilizes active site
 - _____ – stabilizes inactive form
 - _____ – one substrate triggers shape change in other active sites → increase catalytic activity

7. Feedback Inhibition

- _____ of a metabolic pathway _____ pathway by _____ to the _____ site of an _____
- Prevent _____ chemical resources, increase _____ of cell



Summary:

[illegible]

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