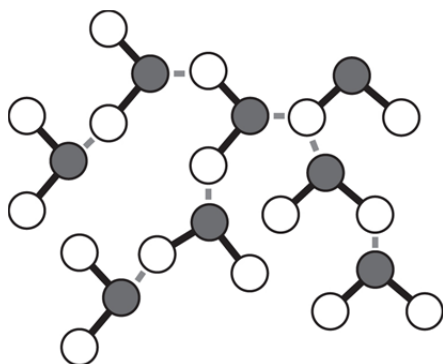


Unit Test: Chemistry in Living Systems

Read each question. Circle the letter of the correct answer.

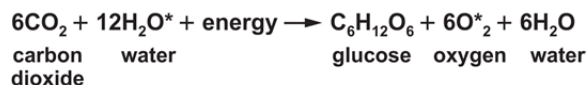
1. The model shows water molecules interacting. The gray circles represent oxygen, the white circles represent hydrogen.



Which conclusion is supported by this model?

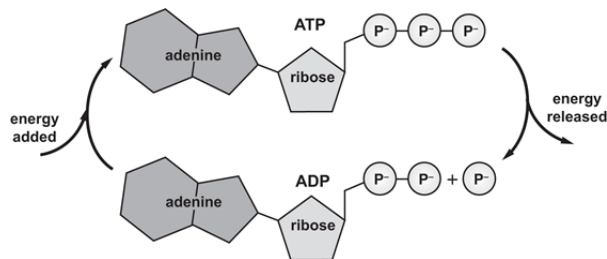
- A. Hydrogen atoms in water molecules are only attracted to other hydrogen atoms.
- B. Oxygen atoms in water molecules are attracted to both oxygen atoms and hydrogen atoms.
- C. Oxygen atoms in water molecules are also attracted to hydrogen atoms in other water molecules.
- D. Hydrogen atoms in water molecules are only attracted to an oxygen atom in the same water molecule.
2. Which statement best explains the role of energy in cellular respiration?
- A. The cell creates energy by forming large molecules.
- B. The cell destroys energy by breaking down large molecules.
- C. The cell creates stored chemical energy by capturing solar energy.
- D. The cell transfers stored chemical energy to different chemical bonds.

3. Scientists can radioactively label elements to track them as they move through a chemical reaction. The reaction shows the formation of glucose during photosynthesis. The asterisk shows radioactive oxygen.



In an experiment, a scientist adds radioactive oxygen to different parts of the environment in which he grows his plants. Based on the chemical equation, adding radioactive oxygen in which component would produce radioactive glucose?

- A. air
- B. water
- C. energy
- D. fertilizer
4. The diagram shows a model of the conversion between ATP and ADP.



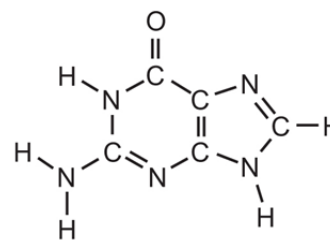
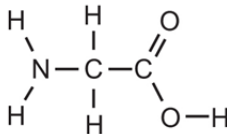
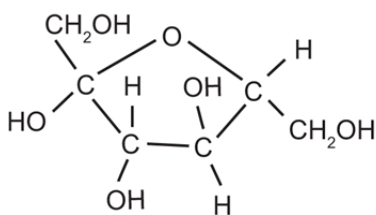
Which statement is supported by the model?

- A. ATP and ADP do not contain energy.
- B. ATP contains more energy than ADP.
- C. ADP contains more energy than ATP.
- D. ATP and ADP contain the same amount of energy.

5. Which pair of molecules are both compounds?
- A. H_2 , CO_2
 - B. H_2O , N_2
 - C. CO_2 , H_2O
 - D. O_2 , $C_6H_{12}O_6$
6. Which property of water is most responsible for water moving from the roots to the leaves of a plant?
- A. osmosis
 - B. adhesion
 - C. low boiling point
 - D. high specific heat

7. The images show carbon-based molecules found in living organisms.

Organic Molecules



Based on evidence from the images, which statement about the bonding of carbon atoms is true?

- A. Carbon has the ability to form up to four bonds.
- B. Carbon atoms form ring structures each time they bond.
- C. Carbon containing compounds must contain double bonds.
- D. Carbon has the ability to bond with no more than one other carbon atom.

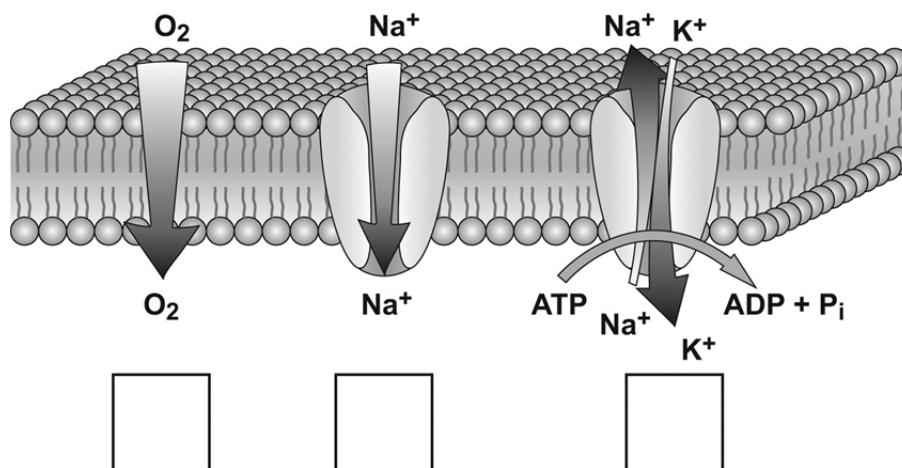
Read each question. Follow the instructions to answer the questions.

8. Write one letter in each blank to correctly complete the sentences.

Catalysts **1.** _____ the activation energy of a reaction and **2.** _____ the difference of energy in a reaction. Because of these properties, catalysts are used by cells to **3.** _____ the rate of reactions that help the cells maintain homeostasis. The catalysts themselves **4.** _____ consumed in the reaction.

1. and 2. A. increase B. decrease C. do not affect	3. A. increase B. decrease	4. D. are E. are not
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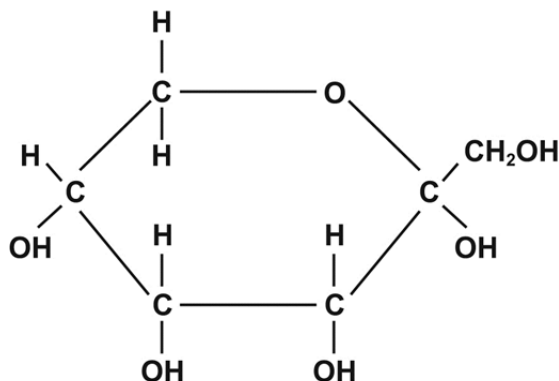
9. The diagram shows three types of transport the cell uses to move molecules across the cell membrane.



Write one letter in each box to correctly complete the diagram.

- A. diffusion
B. passive transport
C. active transport

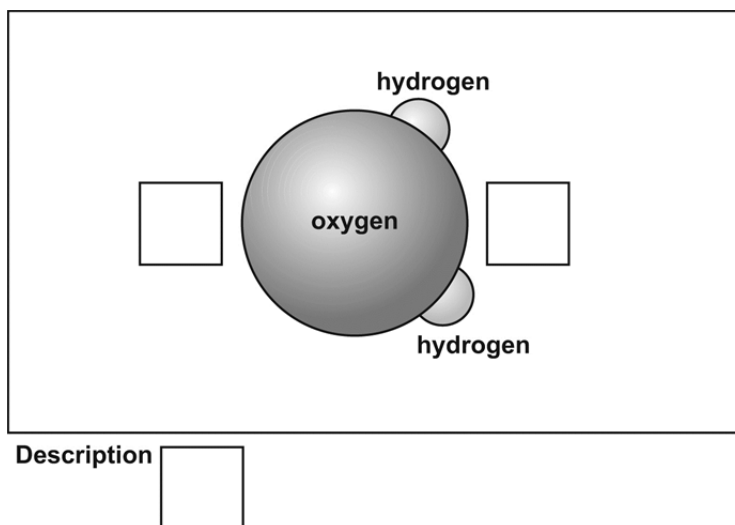
10. This model shows fructose, a common sugar.



Write an X in the correct box to show whether each of the listed elements would be expected to be found in fructose.

Element	In Fructose	Not in Fructose
A. carbon		
B. hydrogen		
C. oxygen		
D. nitrogen		
E. phosphorous		

11. The model shows a water molecule.



Write one letter in each box to correctly diagram and accurately describe the water molecule. Some labels may be used more than once or not at all.

- A. positive
- B. negative
- C. polar molecule that dissolves nonpolar molecules
- D. nonpolar molecule that dissolves polar molecules
- E. polar molecule that dissolves other polar molecules
- F. nonpolar molecule that dissolves other nonpolar molecules

12. A researcher is comparing sugar molecules that a cell takes in with amino acid molecules that the cell produces. Draw a circle around the statements that are true about amino acids but not about sugars.

- A. always contain carbon
- B. is an input in glycolysis
- C. structure is coded for in DNA
- D. can be used as an energy source
- E. can bond together to form proteins
- F. can bond together to form carbohydrates

13. Write one letter in each blank to match the function of the molecules with their structure that supports that function.

Waxes are useful for 1. _____ because they are composed of 2. _____.

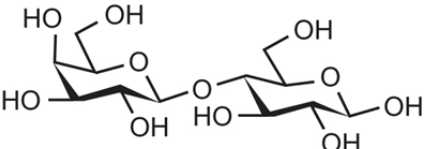
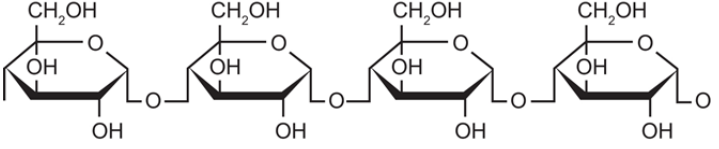
Phospholipids are useful for 3. _____ because they are composed of 4. _____.

Simple carbohydrates are useful for 5. _____ because they are composed of 6. _____.

Function	Structure
A. a source of energy for the cell	D. a polar head and non-polar tails
B. protective waterproof coatings	E. structures that can be quickly broken down and absorbed
C. providing a selectively permeable membrane	F. long chain lipids which are non-polar and very hydrophobic

14. Classify the molecules based on their chemical structure.

Write the letter of each classification to the box next to the molecule.

$ \begin{array}{c} \text{O} \quad \text{H} \quad \text{H} \quad \text{H} \\ \parallel \quad \quad \quad \\ \text{H}-\text{O}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \quad \\ \quad \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $		<p>A. carbohydrate containing ring structures</p> <p>B. lipid containing hydrocarbon chain</p>
		
		
$ \begin{array}{c} \text{O} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \parallel \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \\ \text{H}-\text{O}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \\ \quad \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $		

15. Write the letters of the figures to the correct cell to show whether they represent inputs or outputs of cellular respiration.

Inputs	Outputs

A. ATP

B. glucose

C. water

D. carbon dioxide

16. Zoe is comparing the molecules that are the inputs and outputs of photosynthesis. Write one letter in each blank to correctly complete the sentences.

Compared with the inputs of photosynthesis, the molecules that are outputs of photosynthesis will have

1. _____ total number of atoms, 2. _____ combined mass, and 3. _____ chemical properties. The energy stored in the chemical bonds of the output molecules, as compared to the energy in the bonds of the input molecules, will be 4. _____.

1., 2., 3., and 4.

A. different

B. the same

Read each statement. Write your answer on the lines.

17. A chemist is studying a reaction between a lipid and oxygen. The chemist compared the reactants to the products.

The chemist finds that the mass of the products is equal to the mass of the reactants. Explain why this is.

Identify evidence that a chemist would look for to indicate that energy was released.

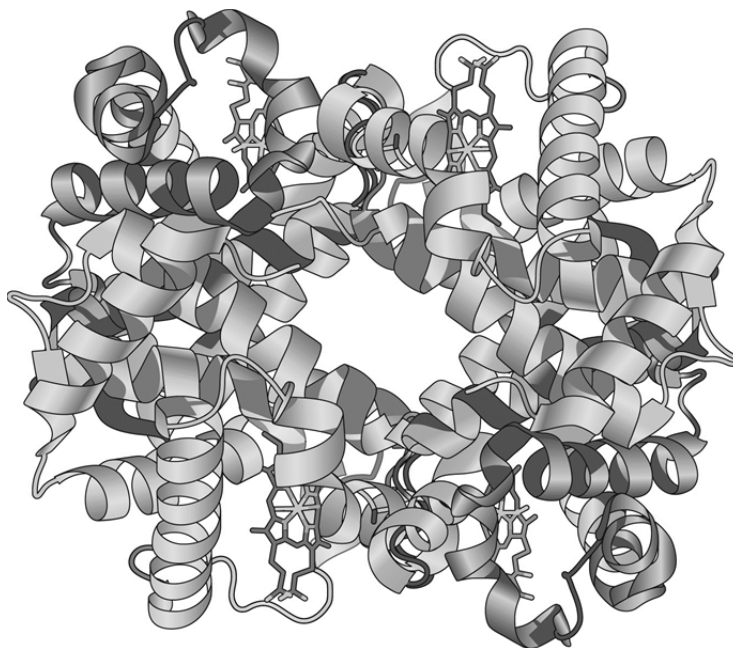
Explain what should happen to the atoms and bonds present in the reactants.

18. Life on Earth is ultimately powered by the sun. Solar energy is converted through a series of steps to power cellular functions in living organisms.

Describe the path that energy takes, from solar energy reaching Earth's surface to energy used to power cell processes in animals.

Name the molecule that stores energy in cells, and identify a cellular process that the molecule would provide energy for.

19. This model is a representation of the structure of a protein.



Describe what a scientist would examine to determine the primary structure of the protein.

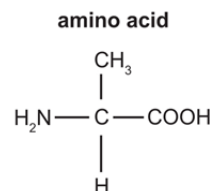
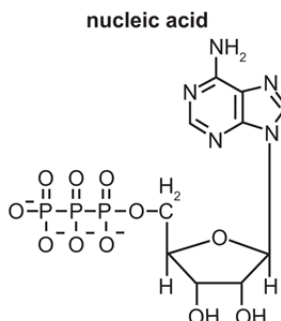
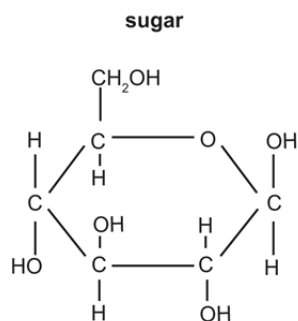
Explain how changes to the primary structure of the protein can affect its function.

20. Three strands of muscle tissue, all the same initial length, are placed in solutions of glucose, ATP, and pure water, respectively. After one minute, the tissues are removed and their lengths are remeasured. The tissue from the ATP solution is found to be shorter than the others.

Explain what the results of this experiment indicate about energy stored in ATP.

Describe how the molecules in the ATP solution would have changed after completion of the experiment.

21. The chemical structure of a nucleic acid, a sugar, and an amino acid are shown.



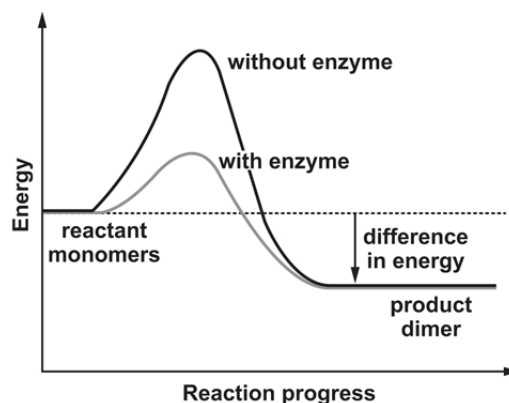
Explain why nucleic acids cannot be formed from sugars alone.

Explain why other nutrients are needed in the synthesis of nucleic acids.

Directions: Read the passage, then answer the questions that follow.

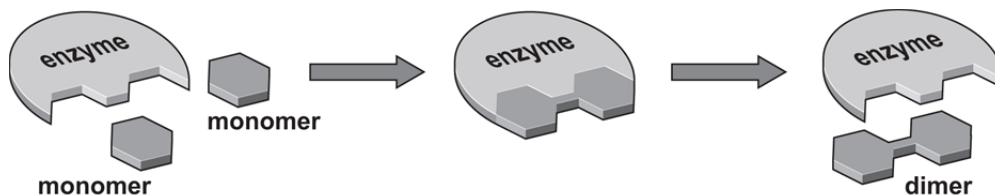
Energy of a Reaction

The graph shows the progress of a reaction in which two monomers combine to form a dimer (a polymer composed of two monomers). The two lines in the graph show the energy required with and without an enzyme present.



22. Which statement is accurate when comparing the reactants with the products? Circle the letter of the correct answer.
- A. The reactants have more mass than the products.
 - B. The reactants form more quickly than the products.
 - C. The bonds of the reactants contain more energy than the bonds of the products.
 - D. The bonds of the reactants contain the same amount of energy as the bonds of the products.
23. Suppose that a graph were created to show the energy involved in breaking the polymer into two monomers. How would that graph differ from the one shown? Circle the letter of the correct answer.
- A. In the new graph the products would have more energy than the reactants.
 - B. In the new graph the products would have less energy than the reactants.
 - C. In the new graph the enzyme would increase the activation energy required.
 - D. In the new graph the reaction would be considered exergonic because energy would be released.
24. Using the information in the graph, circle the letter of all the correct statements.
- A. Energy is absorbed in this reaction.
 - B. More energy would be released than absorbed in the reaction.
 - C. The enzyme raised the activation energy required for the reaction.
 - D. The reactants in this reaction have more energy than the products.
 - E. The products in this reaction contain more energy than the reactants.

25. The diagram shows a model of how the enzyme is able to catalyze the reaction that forms the dimer.



Which of these explains how a large increase in temperature would most likely affect the function of the enzyme.

- A. The enzyme's effectiveness would increase, because it would have more energy to catalyze the reaction.
- B. The enzyme's effectiveness would increase, because it would interact with more of the reactants.
- C. The enzyme's effectiveness would decrease, because it would change shape and be less able to catalyze the reaction.
- D. The enzyme's effectiveness would decrease, because it would no longer be able to provide the energy needed to bond the monomers.