

8.1 Energy and Life

Lesson Objectives

- Describe the role of ATP in cellular activities.
- Explain where plants get the energy they need to produce food.

Lesson Summary

Chemical Energy and ATP Energy is the ability to do work. Organisms need energy to stay alive.

- ▶ **Adenosine triphosphate (ATP)** is a chemical compound cells use to store and release energy.
 - An ATP molecule consists of adenine, the sugar ribose, and three phosphate groups.
 - Cells store energy by adding a phosphate group to adenosine diphosphate (ADP) molecules.
 - Cells release energy from ATP molecules by subtracting a phosphate group.
- ▶ Energy provided by ATP is used in active transport, to contract muscles, to make proteins, and in many other ways.
- ▶ Cells contain only a small amount of ATP at any one time. They regenerate it from ADP as they need it, using energy stored in food.

Heterotrophs and Autotrophs The energy to make ATP from ADP comes from food. Organisms get food in one of two ways.

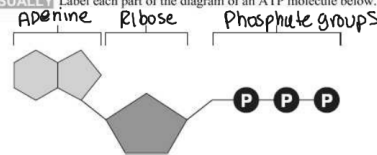
- ▶ **Heterotrophs** get food by consuming (eating) other organisms.
- ▶ **Autotrophs** use the energy in sunlight to make their own food.
- ▶ **Photosynthesis** is the process that uses light energy to produce food molecules.

Chemical Energy and ATP

For Questions 1–6, complete each statement by writing the correct word or words.

1. Energy is the ability to do work.
2. The main chemical compound cells use for energy is Adenosinetriphosphate (ATP).
3. Ribose is a 5-carbon sugar molecule that is part of an ATP molecule.
4. The phosphate groups of ATP are the key to its ability to store and supply energy.
5. ATP releases energy when it breaks bonds between its phosphate groups.
6. Most cells only store enough ATP for A few seconds of activity.

7. **THINK VISUALLY** Label each part of the diagram of an ATP molecule below.



For Questions 8–10, refer to the Visual Analogy comparing ATP to a charged battery.

8. **VISUAL ANALOGY** In the visual analogy, what chemical is represented by the low battery?

ADP

9. What are two ways in which the diagram shows an increase in energy?

Flashlight is brighter
zigzaggy-lightning bolt

10. Describe the concepts shown in the diagram.

ADP is low on energy
+ By Adding A phosphate
ADP becomes ATP.
ATP is fully charged +
capable of releasing
energy to power our
cells. ATP becomes ADP
when it releases that energy

11. What are two ways in which cells use the energy temporarily stored in ATP?

Contract muscles, Active transport, making stuff
and signals, reproduce/divide

12. Energy is needed to add a third phosphate group to ADP to make ATP. What is a cell's source of this energy?

GLUCOSE for most of our cells
Some can use fat.

Heterotrophs and Autotrophs

For Questions 13-17, write True if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

- T 13. All heterotrophs must eat food to get energy.
T 14. Autotrophs do not need to eat food because they make food.
F SUN 15. The energy in food originally came from ATP.
F putting together 16. The term photosynthesis means "pulling apart with light" in Greek.
T 17. The energy of sunlight is stored in the chemical bonds of carbohydrates.

18. Complete the table comparing two types of organisms.

Autotrophs and Heterotrophs		
Type	Description	Examples
Autotrophs	MAKE OWN FOOD BY USING EITHER photosynthesis or Chemosynthesis	Plants, certain Bacteria, Algal phytoplankton
Heterotrophs	EAT FOOD FOR Energy	Animals, Fungi, some protists

Apply the Big idea

19. Suppose that you ate a hamburger on a wheat roll with lettuce, tomatoes, and onions for lunch. As you ate, you took in food molecules from plants and animals. Explain why all the energy in the food molecules of this hamburger could be traced back to the sun.

Burger → cow → grass → sun
 Tomatoes → sun
 Onion → sun
 lettuce → sun
 Cheese → milk → cow → grass → sun