

## Cells and Energy

**Study Guide B****Answer Key****SECTION 1. CHEMICAL ENERGY AND ATP**

- adenosine triphosphate (ATP)
- a molecule that transfers energy from the breakdown of food molecules to cell processes
- ATP is a high-energy molecule that is converted into lower-energy ADP when a phosphate group is removed and energy is released. ADP is converted back into ATP by the addition of a phosphate group.  
**Cycle Diagram:** High-energy adenosine triphosphate (ATP); phosphate removed, energy released; lower-energy adenosine diphosphate (ADP); energy added from breakdown of carbon-based molecules, phosphate added.
- molecules most commonly broken down; glucose yields about 36 ATP; 4 calories per mg (4-Calories per gram)
- same amount of energy in a person's body; triglyceride yields about 145 ATP; 9 calories per mg (9-Calories per gram)
- least likely to be broken down; same about the same amount of energy as a mitochondrion; 4 calories per mg (4-Calories per g)
- a process by which some organisms use chemical energy instead of light energy to make energy-storing carbon-based molecules
- ATP has three phosphate groups; ADP has two phosphate groups
- Together, they mean "to put together with chemical energy." In chemosynthesis, chemical energy is used to produce carbon-based molecules that store energy.

**SECTION 2. OVERVIEW OF PHOTOSYNTHESIS**

- they produce the source of chemical energy for themselves and for other organisms
- to capture light energy to make sugars that store chemical energy

- a molecule in chloroplasts that absorbs some of the energy in visible light
- membrane-bound organelles where photosynthesis takes place in plants
- stroma and grana
- coin-shaped, membrane-enclosed compartments inside the grana
- $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$   
Carbon dioxide and water (the reactants) enter photosynthesis. Through many chemical reactions, with the help of many enzymes, a six-carbon sugar and oxygen (the products) are formed.
- The light-dependent reactions require light, and they absorb and transfer energy. The light-independent reactions do not directly need light, and they build sugars.  
**Labels for Chloroplast Steps:** (1) Energy from sunlight is absorbed and transferred along the thylakoid membrane. Water molecules are broken down and oxygen is released. (2) Energy stored along the thylakoid membrane is transferred to molecules that carry energy to the light-independent reactions. (3) Carbon dioxide is added to a cycle of chemical reactions to build larger molecules. (4) A six-carbon simple sugar (usually glucose)  $\text{C}_6\text{H}_{12}\text{O}_6$  is formed.
- Energy from light is used to put sugars together.
- Chlorophyll *a* is the light-absorbing molecule that makes leaves look green.
- The light-dependent reactions require sunlight; the light-independent reactions can occur without sunlight.

**SECTION 3. PHOTOSYNTHESIS IN DETAIL**

- to capture and transfer energy
- groups of molecules that capture and transfer energy

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