

## Cellular Respiration: Harvesting Chemical Energy

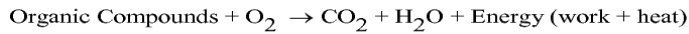
### **I. Introduction**

Chemical elements essential to life are recycled but energy is not. It flows into the ecosystem as sunlight and back out as heat (Figure 9.2)

- Organic compounds store energy in their arrangements of atoms.
- Catabolic pathways systematically degrade complex organic molecules (rich in energy) to simpler waste products, which store less energy. In the process, energy is transferred from the energy rich nutrient molecules to energy rich molecules that can be used directly by the cell to perform work.

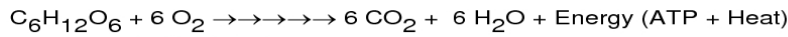
#### **Cellular Respiration**

- Organic compounds are degraded in the presence of oxygen to produce carbon dioxide, water and usable forms of energy (i.e., ATP)



#### **Organic compounds**

- carbohydrates (e.g., glucose)
- fats
- proteins



$\Delta G = - 686 \text{ kcal/mol}$  of glucose

**Where does cellular respiration occur?**

### **II. What is Cellular Respiration?**

Cellular respiration is how cells transfer the energy stored in complex organic molecules (“food”) to ATP

- Cellular respiration is a controlled stepwise **oxidation** of organic molecules in a cell
- Enzymes catalyze oxidation via a series of small steps. Free energy is transferred to carrier molecules (**most often but not always ATP and NADH**).

#### **What is Oxidation?**

- During catabolism of organic molecules, electrons are relocated. This releases stored energy that is used to synthesize ATP and generate heat.
- Transfer of one or more electrons ( $e^-$ ) from one reactant to another occurs in many chemical reactions.
- These  $e^-$  transfers are oxidation-reduction reactions or **redox** reactions.