

## Chapter 3 Matter, Energy, and Life

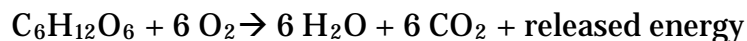
Grasping the basic chemistry of molecules and atoms helps in understanding the more in-depth concepts of this course. While it is not necessary to know detailed structures for fats, carbohydrates, etc., it is imperative to know basic chemistry in order to understand a basic chemical equation for photosynthesis. Knowledge of pH and its applications to both terrestrial and aquatic ecosystems is essential.

The concepts of energy flow and ecosystem dynamics are key. Trophic level diagrams, food chains, and food webs illustrate these concepts. It is essential to understand the connections between trophic levels, biomass, and energy, with reference to the second law of thermodynamics. Organisms are categorized as producers or consumers, and each consumer is further categorized as an herbivore, a carnivore, or an omnivore.

The five geochemical cycles are the hydrologic, carbon, sulfur, nitrogen, and phosphorus cycles. It is important to know the nitrogen cycle in detail, understanding each step and the processes that are occurring in each step. The carbon cycle is two basic chemical equations—photosynthesis and cellular respiration. The basic equation for photosynthesis:



and the equation for cellular respiration:



are reverse processes.

Energy flows according to the laws of thermodynamics; nutrients cycle according to the law of conservation of matter. As nutrients cycle through the environment, human activities affect the cycling of these nutrients. It is necessary to understand both the cause and the effect of such activities.