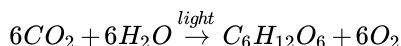


### 3.1: Prelude to Organic Chemistry

All life on Earth is ultimately based on photosynthesis. Photosynthesis is the process by which plants absorb  $\text{CO}_2$  and  $\text{H}_2\text{O}$  from their environment and, in the presence of sunlight, convert those substances into a simple sugar (glucose) and ultimately starches and other building blocks of life. The net photosynthesis chemical reaction is as follows:



Oxygen is also a product of photosynthesis. Most forms of animal life (including people) depend on oxygen to breathe, which makes plants indispensable. Virtually all food sources come from plants, eaten either directly (as fruits, vegetables, or grains) or indirectly (as feedstock for meat animals such as cattle, poultry, pigs, sheep, goats, and the like). Plants are absolutely necessary for life to exist.



Figure 3.1.1: Photosynthesis. In the presence of the sun, plants perform photosynthesis, the chemical reactions that convert  $\text{CO}_2$  and  $\text{H}_2\text{O}$  to glucose. The reaction also produces  $\text{O}_2$ , which is necessary for animal life. Virtually all life on Earth depends on photosynthesis.

The net reaction for photosynthesis is misleadingly simple. A series of reactions, called light-dependent reactions, start by the absorption of light by pigments (not just chlorophyll, as commonly misunderstood) in plant cells. This is followed by a series of light-independent reactions, so named not because they happen in the dark, but because they do not directly involve light. However, light-independent reactions involve the products of reactions stimulated by light, so they ultimately depend on light. The whole series of reactions involves many chemicals, enzymes, breaking and making chemical bonds, the transfer of electrons and  $\text{H}^+$  ions, and other chemical processes. The elucidation of the actual steps of photosynthesis—a process still unduplicated artificially—is a major achievement of modern chemistry.

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