

Photochemistry: The branch of chemistry that deals with the chemical processes that are caused by the absorption of light energy.

Photochemical reactions are utilized in synthetic chemistry to produce various organic molecules.

In addition, many common processes are photochemical in nature and have important applications. For example:

- 1- Photosynthesis involves the absorption of light by the chlorophyll in plants to produce carbohydrates from carbon dioxide and water.
- 2- Photography uses the action of light on grains of silver chloride or silver bromide to produce an image.
- 3- Ozone formation in the upper atmosphere results from action of light on oxygen molecules.
- 4- Solar cells, which are used to power satellites and space vehicles, convert light energy from the sun to chemical energy and then release that energy in the form of electrical energy.

Historical Background

Important developments in the study of photochemistry occurred in the early 1800s. In 1817 the German physicist Theodor von Grotthus recognized that in order for light to be effective in producing a chemical change it had to be absorbed. In 1841 the American chemist John William Draper studied the reaction between moist hydrogen and chlorine gases. This reaction was observed first about 1801 and may have been the first recognized photochemical reaction. Draper noted that after a certain inhibition period the rate of the reaction was proportional to the intensity of the light absorbed. These observations led to the first law of photochemistry (the Grotthus-Draper law), which states that the amount of photochemical reaction is proportional to the quantity of light absorbed.

The development of the quantitative aspects of photochemistry began in earnest with the enunciation of the quantum theory by Max Planck in 1900 and its elucidation by Albert Einstein in 1905. Planck, who is regarded as the founder of the quantum theory, espoused that an atom or a molecule can absorb only fixed quantities (quanta) of light energy. This energy, E , he theorized, is proportional to the frequency, f , of the light. The energy of a single quantum of radiation is given by

$$E = h f,$$

where h is a proportionality constant that was named "Planck's constant." Five years later Einstein proposed that light can be thought of as consisting of unusual particles called photons. Each photon of light is said to possess a quantum of energy given by the above relationship. These conclusions led to the second law of photochemistry, which states that the number of primary processes resulting from the absorption of light is equal to the number of photons absorbed. Exceptions to this rule sometimes occur.