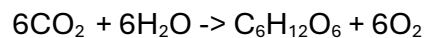


This is an energy process and this is an energy process and this is an energy process and this is an energy process and this is Bioenergetics.

Bioenergetics are the processes by which organisms get their energy. Plants get their energy by photosynthesis. Photosynthesis is a chemical reaction that converts Carbon Dioxide, and Water into Glucose and Oxygen. Light is essential for powering this process. Light is obtained by a green pigment in the chloroplasts of the leaves called chlorophyll. The whole process of photosynthesis occurs in the chloroplasts of the leaf.

Plants acquire the Carbon Dioxide that they need for photosynthesis via diffusion through the stomata of their leaves.

The water is obtained by osmosis from the soil to the roots. Water is transported from the roots to the chloroplasts in the leaves through the xylem. This process is called transpiration.



The glucose made in photosynthesis is used for respiration.

The rate of photosynthesis can be affected by limiting factors. Limiting factors are a thing that stops the photosynthesis reaction from happening at a faster rate. Temperature, light intensity, and carbon dioxide levels are all limiting factors in photosynthesis. Increasing the temperature will speed up the rate of photosynthesis but only up until around 45°C, temperatures higher than this will cause the plant's enzymes that catalyse the photosynthesis reaction to denature. Increasing the light intensity will increase the rate of reaction, because there is more energy to carry out more reactions. Increasing the Carbon Dioxide concentration will increase the rate of photosynthesis because there are more reactants available.

To increase the rate of photosynthesis and enhance plant growth, we use greenhouse economics. A greenhouse traps the sun's radiation as heat inside the greenhouse, ensuring that temperature is not a limiting factor in photosynthesis. Artificial lighting can also be installed into a greenhouse to ensure that light intensity is not a limiting factor of

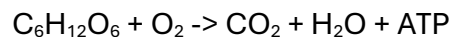
photosynthesis. A paraffin heater may also be used to provide heat energy and Carbon Dioxide, as the heater produces Carbon Dioxide as a byproduct of its combustion. Growing crops in a greenhouse can be expensive, however the benefits often outweigh the cost, as it allows for healthier, faster-growing crops.

The inverse square law is used to describe the light intensity at different distances from the light source. The inverse square law states that the intensity of light is inversely proportional to the square distance from the source.

Light intensity $\propto 1/\text{distance}^2$

Respiration is the chemical reaction that releases energy for all living functions and processes. Respiration occurs in the mitochondria of cells. Aerobic respiration is the respiration which requires oxygen.

Aerobic respiration is effectively the opposite of the photosynthesis equation: Glucose + Oxygen \rightarrow Carbon Dioxide + Water + Energy.



When the body requires more energy, it respire anaerobically. Anaerobic respiration does not require oxygen. Anaerobic respiration releases less energy than aerobic respiration and also releases lactic acid.

The equation for anaerobic respiration is: Glucose \rightarrow Lactic Acid + Energy $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{C}_3\text{H}_6\text{O}_3 + \text{ATP}$

Plants can also respire anaerobically. Aerobic respiration in plants creates different products, however. Anaerobic respiration in plants is often also called fermentation.

The fermentation equation is: Glucose \rightarrow Ethanol + Carbon Dioxide + Energy $C_6H_{12}O_6 \rightarrow 2C_3H_6O_3 + CO_2 + ATP$

Respiration is a process included in metabolism. Metabolism is the combination of all the reactions in the body. Energy released from respiration is used to fuel metabolic processes such as:

Converting Glucose into Starch, Glycogen, and Cellulose

Joining glycerol and fatty acids to create lipid molecules

Glucose and nitrate ions joining to form amino acids

Amino acids joining to form proteins

Production of Urea

Exercise has an affect on respiration. When a person exercises, their muscles require more energy. To release more energy, more respiration must take place. The heart will pump fater, and breathing rate will increase to supply more oxygen to the muscles for more respiration. If muscles are not receiving enough oxygen to keep up with the demand, anaerobic respiration will begin to occur. Anaerobic respiration produces lactic acid, which can build up in the muscles and result in oxygen debt. Oxygen debt is the amount of oxygen needed to convert lactic acid into glucose. This process occurs in the liver.