Photosynthesis and cellular respiration equation

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Capable organisms are called autotrophic/photoautotrophics and include certain bacteria (Cyanobacteria), algae and all plants. Since photosynthesis is the only process by which light energy is used to assemble inorganic molecules into organic molecules that can be used as an energy source by other organisms, it is undoubtedly one of the most important chemical processes on earth. Vegetable photosynthesis - image of Hajnalka Mahler from PixabayFor a majority of plants, the leaves act as photosynthetic plants. As such, they are well suited to all photosynthesis processes. Like solar panels, the leaves, for the most part, are thin and wide with the wide part of the leaf facing the sun. This allows maximum interception of light. Plants have been shown to reorient their leaves in a way that ensures maximum light interception during the day. This ensures that enough light energy is collected for photosynthesis. In addition to the general shape of the sheet and the ability to reorient itself, some of the other leaf structures involved in photosynthesis include: Chloroplast - Chloroplast is machinery/photosynthesis SiteChlorophylle - Pigment in the chloroplastvascular system in the mesophyll layer - xylème that provides waterPhotosynthesis Processes and reactionsDuring on ecology, there are three main types of photosynthesis: the cycle CycleC3 or photosynthesis C3 is the type of photosynthetic reaction observed in the majority of plants (80-90% of all plants). The plants in which this form of photosynthesis occurs are called C3 plants. Steps of photosynthesis C3 (Calvin cycle) Carbon dioxide fixation CarbonCarbon StageDuring during the day, carbon dioxide diffuses through pores and into mesophyll cells. Here, CO_2 is released into the stroma where sugar is synthesized. In stroma, the enzyme ribulose bisphosphate carboxylase catalyzes a reaction between gas (CO_2) and three molecules of a five-carbon acceptor known as ribulose bisphosphate (RuBP). These reactions result in the production of a 6-carbon compound that is then divided to produce 2 molecules of 3-phosphoglyceric acid. Carbon dioxide fixation is a light-independent reaction that can be represented as follows: C02 - RuBP ------- (Rubisco) -------- 2 (3- PGA)Carbon Reduction StageDuring the reduction stage, 6 molecules of APT and NADPH convert 3-PGA into 6 3-phosphate glyceraldehyde molecules. As a result, ATP is converted to ADP (having lost a terminal phosphate atom) while NADPH is converted to NADP. RegenerationDuring the regeneration phase, a single molecule of G3P is transported to the cytoplasm where it is involved in the formation of compounds required by the plant. The other G3P, however, undergo other reactions to produce ruBP, glucose and other sugars as well as various other organic compounds. C4 CycleIn C4 plants (pineapple, corn and sugar cane among others), photosynthesis takes place in mesophyll and beam sheath cells. As with the C3 cycle, the C4 cycle is also independent of light. In mesophyll cells, carbon dioxide hydration produces a bicarbonate ion in the presence of carbon dioxide dioxide. Using carbonate ions, a carbon-fixing enzyme known as carboxylase phosphoenolpyruvate, a carbon phosphoenolpyruvate (PEP) is converted to oxaloacetate (a 4-carbon compound). The PEP enzyme is absent from the C3 cycle but is present in the C4 cycle. This has a great advantage for C4 plants since the enzyme is able to fix carbon dioxide at low concentrations (carbonate). For this reason, C4 plants do not necessarily need to have their stomata open to absorb more carbon dioxide for photosynthesis. The photosynthetic reaction that occurs in mesophyll can be represented as follows: CO_2 - H20 -------- (carbon dioxide) ----- - HCO_3 - H-HCO_3^- - PEP -------- (ENZYME PEP) ---------- OAA (Oxaloacetate)In mesophyll cells, Oxaloacetate is converted to malate (a compound of 4 carbons) in the presence of NADPH before being transported to beam sheath cells. In beam sheath cells (in the chloroplast of these cells), malate is converted to carbon pyruvate 3 after CO_2 removal by decroxylation (this reaction produces CO_2, pyruvate, and NADPH). As the pyruvate moves the mesophyll layer for phosphorylation (to form PEP) carbon dioxide enters the C3 cycle where it goes through biochemical reactions to produce 3 carbon glyceraldehyde-3-phosphate. This process ensures a high concentration of carbon dioxide. In this case, therefore, rubisco serves as carboxylase carboxylase plays an important role in reducing photorespiration. Photorespiration - Is a breathing process where the plant retains high levels of oxygen during the light period (closed stomata). This turns out to be a problem during photosynthesis since oxygen, at high levels, competes with carbon dioxide for active rubisco sites. Here the gas exchange does not occur (oxygen output and carbon dioxide input). As a result, cellular respiration, rather than photosynthesis takes place during this photorespiration. Cam Cycle (Crassulacean Acid Metabolism)CAM is a common form of photosynthesis in members of the Crassulaceae family. Unlike C4 plants, plants described as CAM tend to fix carbon dioxide at night. thus, cam plants can also be described as C4 plants. At night, the pores open allowing the leaves to take carbon dioxide. In the presence of PEP carboxylase (also found in C4 plants), carbon dioxide is attached to form oxaloacetate which is then converted to malate. The next morning, the malat is transported to the cytosol where it undergoes a decaboxylation that releases the carbon dioxide needed for the Calvinist cycle. In addition, it ensures that the leaves have enough carbon dioxide needed for photosynthesis during sunlight. During the night, the pores open, allowing the plant to absorb carbon dioxide and release excess oxygen. It also helps prevent photorespiration. Overview of photosynthesisGenerally, photosynthesis is divided into two main stages that include: Light-dependent reactionsReactions are reactions that convert light energy into chemical energy (ATP and NADPH). They occur in the thylakoid membranes of chloroplasts and involve three main steps that include: Photosystem arousal - Once chlorophyll absorbs light energy, the electrons relocated into the pigments are energized and become excited. These electrons are then transferred to the carrier molecules located in the thylakoid membrane (electron acceptor). ATP Production - As electrons pass through the electron transport chain (in the thylakoid membrane), they lose energy as an electrochemical gradient is created in the thylakoid. Using hydrogen ions translocated in the thylakoid, ATP synthase catalyzes the synthesis of ATP in a process known as As this stage draws to a close, the now energized electron are taken up by photossystem 1 of photolysis photossystem II.Water photolysis and nadp -reduction - In this phase, The electrons of Photosystem I can be used to reduce NADP to NADPH-. With ATP, this molecule plays an important role in reactions independent of light. Reactions independent of lightAlso lightAlso like the Calvin cycle, the energized electrons of old reactions provide the energy needed to synthesize sugars. The Calvinist cycle, which occurs in the stroma, is divided into three basic stages that include: FixationReductionRegeneration, these steps are described in the C3 cycle. Photosynthesis and cellular respirationAlthese and cellular respiration are different processes, the products of one react to each other. The two processes are therefore opposed to each other. Although plants are well known for their ability to make food by photosynthesis, cellular respiration also takes place in the mitochondria of their cells. When oxygen is used, this process is known as aerobic respiration. Besides plants, cellular respiration also takes place in animals and is the process by which energy is released by organic compounds. The following are general representations (formulas) for both photosynthesis and cellular respiration: Cellular Respiration (aerobic)$C_6H_{12}O_6$ - $6O_2$ → $6CO_2$ - $6H_2O$ - 32 ATPPhotosynthesis$6CO_2$ - $6H_2O$ - $C_6H_{12}O_6$ - $6O_2$ Looking at both formulas, it becomes clear that the products of one reaction are reactions of the other. This shows the relationship between the two reactions in nature. When animals break down sugars in their cells, carbon dioxide and water are released. Plants can then use these products to make food and the cycle continues. Learn more about plant biology and photosynthesis:Structure of leaves under microscopePage on PlastidsIn read more about chloroplastsMesophyll CellsMeristem CellsGuard CellsReturn to AlgaeReturn to Plant Biology overviewReturn from learning about Photosynthesis to MicroscopeMaster homeReferencesHarvey J.M. et al., (2018). Photosynthesis: Structures, Mechanisms and Applications.Matthew P. Johnson. Photosynthesis. William G. Hopkins. (2008). Photosynthesis and Respiration.Links //ib.bioninja.com.au/higher-level/topic-8-metabolism-cell/untitled-2/light-dependent-reactions.html Respiration.Links //ib.bioninja.com.au/higher-level/topic-8-metabolism-cell/untitled-2/light-dependent-reactions.html

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