

## Reconstruction of the chemical processes within the PBB-experiment

Please have a look at the diagram in assignment 2. It demonstrates the chemical processes within the PBB-experiment. By means of the following assignments, you will be able to understand the relevant chemical reactions.

1. **Watch** the clip “Photosynthese, ein Fall für zwei” and **match** the following terms with the appropriate definition by connecting them with a line. (If matched correctly, there will form a word from ‘light’ to ‘sacrificial electron donor’ based on the letters in brackets. It has to be read backwards.)

light

The source that provides the energy for all the other reactions. (NO)

oxygen

This is the ‘light catcher’ that helps use sunlight in the reactions. It is the model substance for chlorophyll (/ˈklɒrəfɪl/). (RE)

yellow **photocatalyst**,  
PF<sup>+</sup> (proflavine<sup>+</sup>)

This is the oxidized form of the photocatalyst. (OC)

yellow photocatalyst in an  
**excited** state, PF<sup>++</sup>  
(proflavine<sup>++</sup>)

The substance that oxidizes the blue substance EV<sup>+</sup> to colourless EV<sup>2+</sup>. (IS)

yellow photocatalyst, PF<sup>2+</sup>

The molecule that has just caught light energy. As a consequence, it can reduce other molecules and give them an electron. (VN)

handshake position

The substance which recycles PF<sup>2+</sup> and reduces it to PF<sup>+</sup>. In this process, it is destroyed. (NE)

blue substance, EV<sup>+</sup>  
(ethyl viologen<sup>+</sup>)

The model substance for carbon dioxide. It is reduced by the excited form of the photocatalyst. (E)

colourless substance, EV<sup>2+</sup>  
(ethyl viologen<sup>2+</sup>)

The place in the cycle where PF<sup>+</sup> gives one electron to the colourless substance EV<sup>2+</sup>. (\_Y)

**sacrificial electron donor**  
(German: *Opferdonor*)

The model substance for sugar that is formed from the colourless substance. (GR)

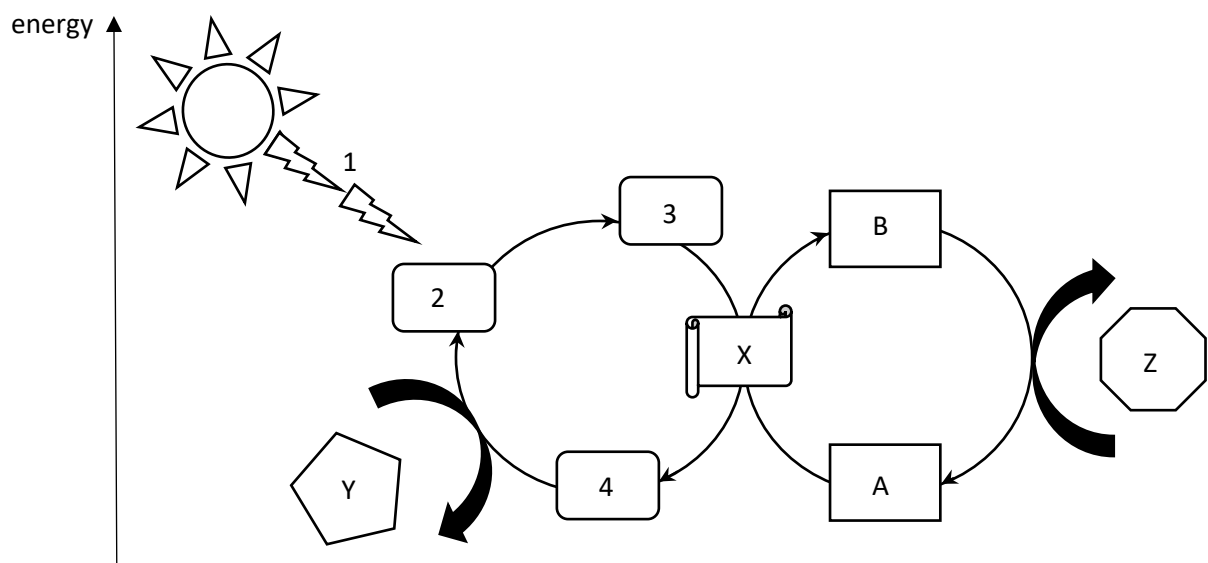
**Annotation of important terms:**

**photocatalyst** /'fəʊtəʊ'kætəlaɪst/ -- Generally speaking, photocatalysis is a reaction which uses light to activate a substance which modifies the rate of a chemical reaction without being involved itself. And the photocatalyst is the substance which can modify the rate of chemical reaction using light irradiation. (Source: <http://www.greenearthnanoscience.com/what-is-photocatalyst.php>)

**excited state** /ɪk'saɪtɪd steɪt/ -- The condition of an atom or molecule after absorbing energy from exposure to light, electricity, elevated temperature, or chemical reaction, and which may be a necessary prelude to a chemical reaction or to the emission of light. (Source: <http://www.dictionary.com/browse/excited-state>)

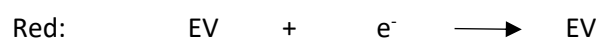
**sacrificial electron donor** /,sækrɪ'fɪʃl ɪ'lektrən'dəʊnə(r)/ -- A compound that gives electrons to another one. At the same time, it is destroyed. (to sacrifice sth /'sækrɪfaɪs/ – etw. opfern)

2. **Label** each term in task 1. with a **number** or **letter** in order to complete the reaction cycles.



3. **Mark** the photosynthesis part and the respiration part with a coloured pen.

4. This is the essential redox reaction of the PBB-experiment. Please **complete** it.



5. Based on your findings above, use the diagram below and **explain** the processes in nature. Use the words from the figure below, the following expressions, and further words (you can talk in either English or German):

light-driven part / the part that is driven by light (lichtgetriebener Teil)  
serves as photocatalyst (dient als)

low-energy Substanzen (Stoffe mit niedrigem Energiegehalt)  
high-energy substances are fuels (... sind Antriebsstoffe)

energy transformation / energy is transformed (Energieumwandlung/ ~ wird umgewandelt)  
matter transformation / matter is transformed (Stoffumwandlung/ ~ werden umgewandelt)

the energy-providing part / the part that provides energy  
(der Teil, der Energie zur Verfügung stellt)

this part is located in plants  
this part is located in animals or human beings

