

What Are Photosystem (Light-Dependent) Reactions?

Worksheet

Photosystem reactions use light energy absorbed by Photosystem II and I to split water, release oxygen, and generate ATP and NADPH through the thylakoid electron transport chain.



Questions

1. Where do photosystem (light-dependent) reactions occur?
 - A) Stroma
 - B) Thylakoid membrane
 - C) Mitochondrial matrix
 - D) Cytoplasm
2. Which photosystem is responsible for splitting water?
 - A) Photosystem I
 - B) Photosystem II
 - C) Both equally
 - D) Neither
3. What gas is released when water is split?
 - A) Carbon dioxide
 - B) Nitrogen
 - C) Oxygen
 - D) Hydrogen gas
4. What are the two main energy carriers produced by light reactions?
 - A) Glucose and O
 - B) ATP and NADPH
 - C) CO and HO
 - D) Pyruvate and NADH
5. Splitting one H₂O molecule releases how many electrons?
6. Using the minimum quantum requirement of 2 photons per electron, how many photons are needed to release 4 electrons (enough for one O molecule)?
7. A leaf absorbs 800 photons per second at the minimum quantum requirement (8 photons per O₂). How many O₂ molecules can it release per second?
8. Define: Where do the light-dependent reactions occur?
9. Define: Which photosystem splits water?
10. Define: What are the two main products of the light reactions?

Answer Key

1. B) Thylakoid membrane - The photosystems and their electron transport chain are embedded in the thylakoid membrane.
2. B) Photosystem II - Photosystem II splits water to replace the electrons it loses.
3. C) Oxygen - Splitting water releases O as a byproduct.
4. B) ATP and NADPH - ATP and NADPH are produced and used to power the Calvin cycle.
5. $2 \text{ H}_2\text{O} \rightarrow \text{O}_2 + 4\text{H}^+ + 4\text{e}^-$ So 1 H_2O releases $4/2 = 2$ electrons
6. 4 electrons $2 \text{ photons/electron} = 8 \text{ photons}$
7. 800 photons $8 \text{ photons per O} = 100 \text{ O molecules/second}$
8. In the thylakoid membrane of the chloroplast.
9. Photosystem II (PSII) - it also releases O and H.
10. ATP and NADPH, both used in the Calvin cycle.

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