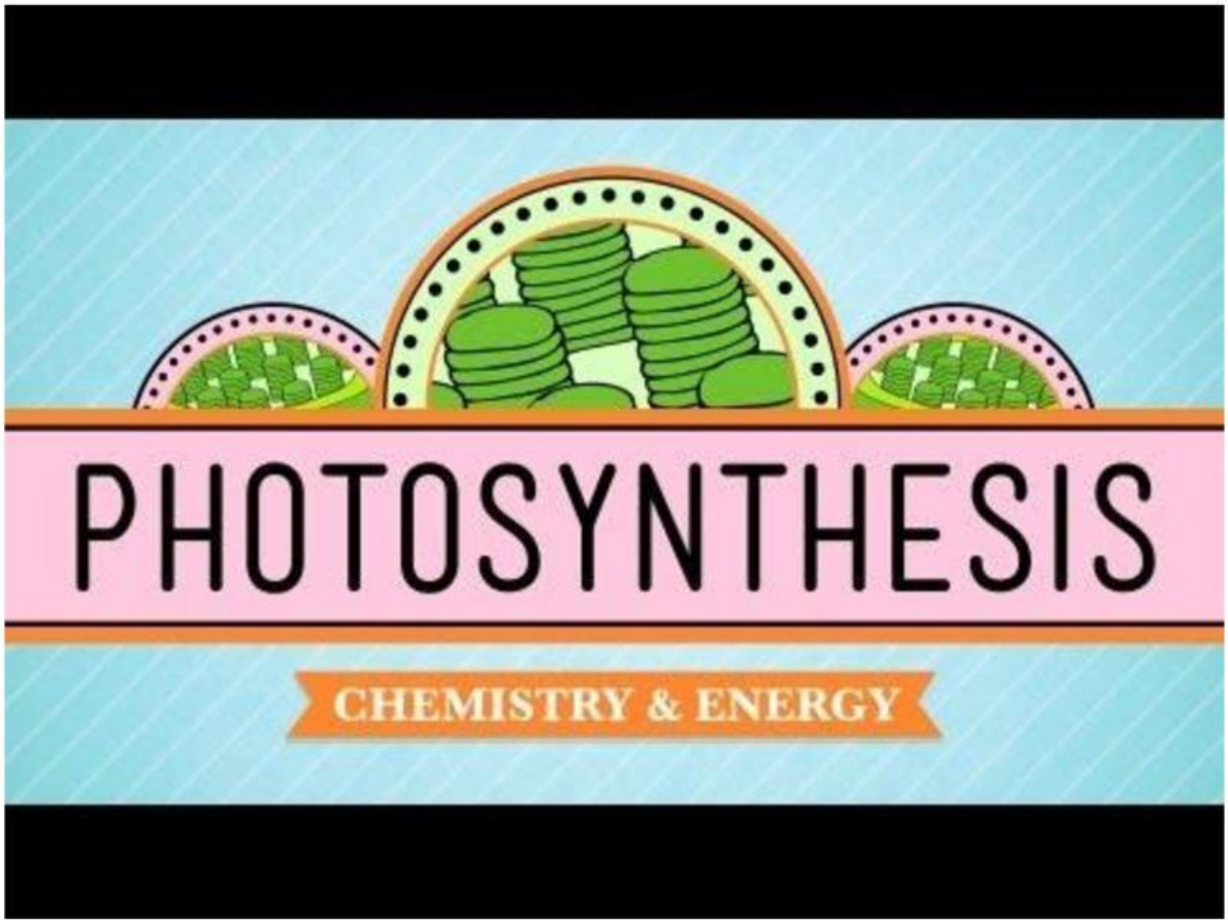
**Photosynthesis: Crash Course Biology #8**

**Watch the video and then choose the correct option. Some of the questions may have more than one answers**




1. If a vascular plant's xylem were blocked, which immediate impact would most directly hinder the light-dependent reactions?

   a. The stomata would close to prevent carbon dioxide entry.

   b. The chlorophyll would be unable to absorb photons.

   c. Photosystem II would lack the electrons necessary to replace those lost to photoexcitation.

   d. RuBisCo would begin fixing oxygen instead of carbon dioxide.

   e. The Calvin cycle would immediately stop due to a lack of G3P.

2. Which of the following are necessary to maintain the thylakoid's function as a biological battery?

   a. The pumping of protons into the thylakoid by the cytochrome complex.

   b. The maintenance of a concentration gradient by the phospholipid bilayer.

   c. The release of hydrogen ions from the splitting of water molecules.

   d. The immediate conversion of ATP back into ADP within the lumen.

LIVEWORKSHEETS

3. Why is the Calvin cycle often referred to as light-independent rather than the dark reactions?

   a. Because the reactions occur exclusively at night to save energy.

   b. Because they use photons directly but at a lower frequency.

   c. Because they generally occur during the day but do not require direct photon energy.

   d. Because the stroma is physically shielded from all light by the grana.

4. During the light-dependent reactions, what specific roles do photons play?

   a. They provide the energy to excite electrons in chlorophyll.

   b. They are used by ATP synthase to pack phosphate onto ADP.

   c. They provide the energy for the second excitation of electrons in Photosystem I.

   d. They directly split water molecules into hydrogen and oxygen.

5. What evolutionary context explains why RuBisCo is considered inefficient in the modern atmosphere?

   a. It was designed to function in a world where oxygen levels were high and CO2 was low.

   b. It evolved when there was very little oxygen in the atmosphere, making it prone to confusing O2 with CO2.

   c. It was originally a protein used for cellular respiration that plants repurposed.

   d. It requires more ATP than the plant can produce in a single day.

   e. It can only function within the vascular tissue of the xylem.

6. What are the consequences when RuBisCo fixes oxygen instead of carbon dioxide?

   a. The plant produces a toxic byproduct called phosphoglycolate.

   b. The Calvin cycle is hindered because enzyme functions may be tinkered with.

   c. The plant must expend energy to break down useless byproducts into glycine.

   d. The plant immediately converts all stored starch into glucose to compensate.

7. How does the structure of the thylakoid membrane facilitate the production of ATP?

   a. It allows protons to diffuse freely so they can reach the stroma.

   b. It acts as a barrier that allows for the creation of a proton concentration gradient.

   c. It contains RuBisCo, which powers the ATP synthase enzyme.

   d. It absorbs photons and converts them directly into chemical bonds.

8. Which characteristics are shared by both Photosystem II and Photosystem I?

   a. Both are complexes composed of proteins and chlorophyll.

   b. Both use electron carriers to transport energized electrons.

   c. Both are responsible for splitting water to release oxygen.

   d. Both straddle the thylakoid membrane. e. Both produce NADPH as their primary end product.

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9. If a plant could no longer produce NADP+, which part of photosynthesis would be most directly stopped?

   a. The initial photoexcitation of electrons in Photosystem II.

   b. The pumping of protons by the cytochrome complex.

   c. The final step of the light-dependent reactions where electrons are stored for the Calvin cycle.

   d. The regeneration of RuBP from G3P.

10. Which substances are required to successfully convert 3-phosphoglycerate into G3P during the reduction phase?

   a. ATP to provide a phosphate group.

   b. NADPH to provide electrons.

   c. Oxygen to stabilize the carbon chain.

   d. RuBisCo to catalyze the stabilization.

11. Why is G3P, rather than glucose, considered the ultimate product of photosynthesis?

   a. G3P is the only substance that can be stored in the roots.

   b. G3P is a high-energy compound that can be converted into any carbohydrate the plant needs.

   c. Glucose is too unstable to be produced within the chloroplast.

   d. G3P is the byproduct of the light-dependent reactions.

   e. Only G3P can be used to regenerate RuBP to keep the cycle going.

12. What specific events occur within the stroma of the chloroplast?

   a. The fixation of $CO_2$ onto RuBP.

   b. The splitting of water into hydrogen and oxygen.

   c. The regeneration of RuBP.

   d. The formation of the proton gradient.

13. What is the functional purpose of the mobile electron carrier?

   a. To transport water from the xylem to the leaves.

   b. To carry excited electrons between protein complexes in the thylakoid.

   c. To move $CO_2$ through the stomata.

   d. To take ATP from the chloroplast to the rest of the plant cell.

14. Which inputs are necessary for a vascular plant to perform the entirety of photosynthesis?

   a. Water. b. Carbon dioxide. c. Sunlight. d. Oxygen. e. Glucose.

15. What would be the most likely result if the internal thylakoid (lumen) became less acidic?

   a. Oxygen production would increase to balance the pH.

   b. ATP Synthase would lack the energy source needed to create ATP.

   c. The Calvin cycle would speed up due to the lack of toxic byproducts.

   d. Chlorophyll would absorb more photons to compensate.

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16. Why must the Calvin cycle happen multiple times to produce one G3P for the plant's use? Select all that apply.

    a. Most G3P produced is needed to regenerate RuBP.

    b. The cycle is inefficient and loses carbon to the atmosphere.

    c. It takes three RuBPs to create enough G3Ps to have a surplus.

    d. RuBisCo destroys half of the G3P during carbon fixation.

17. Which of the following best describes the relationship between the light-dependent and light-independent reactions?

    a. The light reactions provide the carbon, while the Calvin cycle provides the energy.

    b. The light reactions produce ATP and NADPH, which power the Calvin cycle.

    c. The Calvin cycle produces oxygen, which is used by the light reactions.

    d. They are unrelated processes that happen in different parts of the plant.

    e. The light reactions happen in the stroma and the Calvin cycle happens in the thylakoid.

18. What are the known byproducts of the various stages of photosynthesis? Select all that apply.

    a. Oxygen. b. Phosphoglycolate. c. G3P. d. NADPH.

19. Why is it important for plants to keep oxygen levels low inside their leaves?

    a. High oxygen levels can cause the stomata to burst.

    b. High oxygen levels increase the likelihood of RuBisCo fixing oxygen instead of $CO_2$.

    c. Oxygen blocks the absorption of photons by chlorophyll.

    d. Oxygen is toxic to the xylem tissues.

20. Which molecules act as energy carriers within the photosynthetic process? Select all that apply.

    a. ATP. b. NADPH. c. RuBP. d. Chlorophyll. e. Mobile electron carriers.

LIVEWORKSHEETS