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Chloroplasts

Study Guide — Cell Organelles

Pre-Med practice questions about chloroplast structure, photosynthesis, and endosymbiosis

7 items — Study Guide with Answers

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1 In chloroplasts, the light-dependent reactions of photosynthesis primarily occur in the:

- A Stroma.
- B Inner chloroplast membrane.
- C Thylakoid membranes. ✓**
- D Outer chloroplast membrane.
- E Cytosol surrounding the chloroplast.

► **Explanation:** Photosystems and the photosynthetic electron transport chain are embedded in the thylakoid membranes, where light-dependent reactions occur.



2 Which statement correctly compares chloroplasts and mitochondria?

- A Both are part of the endomembrane system and arise from the Golgi apparatus.
- B Both contain their own DNA and 70S ribosomes. ✓**
- C Only chloroplasts, not mitochondria, have an inner membrane with a large surface area.
- D Only mitochondria use a proton gradient to synthesize ATP.
- E Neither organelle participates in redox reactions.

► **Explanation:** Both chloroplasts and mitochondria have their own genomes and bacterial-type ribosomes, supporting an endosymbiotic origin.



3 During the light-dependent reactions, where is the proton (H^+) concentration highest within a chloroplast?

- A In the stroma.
- B In the intermembrane space between the inner and outer membranes.**





- C In the thylakoid lumen. ✓**
- D In the cytosol.
- E In the nucleus.

► **Explanation:** The photosynthetic electron transport chain pumps protons into the thylakoid lumen, creating a gradient used by ATP synthase in the thylakoid membrane.

4 Which process occurs in the stroma of the chloroplast?



- A Calvin cycle (light-independent reactions) fixing CO₂ into carbohydrates. ✓**
- B Splitting of water by photosystem II.
- C Electron transport through photosynthetic electron carriers.
- D Glycolysis.
- E Formation of the mitotic spindle.

► **Explanation:** The Calvin cycle enzymes reside in the stroma, where CO₂ is fixed into sugars using ATP and NADPH from the light reactions.

5 Which of the following best explains why chloroplasts are considered to have arisen by endosymbiosis?



- A They lack any genetic material and depend entirely on the nucleus.
- B They are single-membrane organelles continuous with the ER.
- C They contain circular DNA and divide by a process similar to bacterial fission. ✓**
- D They are present in both prokaryotic and eukaryotic cells.
- E They organize the mitotic spindle during cell division.





► **Explanation:** Chloroplasts retain circular DNA, 70S ribosomes, and reproduce by fission, all of which support an origin from engulfed photosynthetic bacteria.

6 In a plant cell exposed to light, which statement best describes the relationship between mitochondrial and chloroplast ATP production?



- A** Chloroplasts export large amounts of ATP directly to the cytosol, making mitochondrial ATP production unnecessary in the light.
- B** Mitochondria generate ATP, but chloroplasts consume ATP rather than produce it in the light.
- C** Both organelles generate ATP in their own compartments, but most ATP used for general cellular processes comes from mitochondria. ✓
- D** Only chloroplasts generate ATP in plant cells, regardless of light conditions.
- E** Neither organelle is active in the light; ATP is generated only by substrate-level phosphorylation.

► **Explanation:** Chloroplast ATP is mainly used for carbon fixation reactions in the stroma and is not freely exported; mitochondria remain critical suppliers of ATP for most cytosolic and nuclear processes even in the light.

7 A herbicide specifically prevents photosystem II from oxidizing water and passing electrons into the photosynthetic electron transport chain. In an illuminated plant cell treated with this herbicide, which immediate effect is most likely?



- A** Oxygen evolution stops and NADPH production falls sharply. ✓
- B** Oxygen evolution increases and NADPH production increases.
- C** Oxygen evolution stops but NADPH production continues unchanged.
- D** NADPH production increases while ATP synthesis stops completely.
- E** CO₂ fixation in the Calvin cycle immediately accelerates.





► **Explanation:** Photosystem II is the source of electrons from water and of O₂; blocking it halts O₂ release and disrupts linear electron flow to NADP⁺, sharply reducing NADPH formation and the associated proton gradient.

