

LECTURE 16 – Photosynthesis (Answers) [T00736985, T00737446, T00729435]

1) The process of photosynthesis probably originated

A) in plants.

B) in prokaryotes.

C) in fungi.

D) three separate times.

2) Which of the following statements concerning chloroplasts is FALSE?

A) They are unrelated to plastids.

B) They have outer and inner membranes.

C) They have their own DNA.

D) They have an internal membrane system known as the thylakoids.

3) Early investigators thought the oxygen produced by photosynthetic plants came from carbon dioxide. In fact, it comes from

A) water.

B) glucose.

C) H₂S.

D) electrons from NADPH.

4) Which of the following statements best describes the relationship between photosynthesis and respiration?

A) Respiration runs the biochemical pathways of photosynthesis in reverse.

B) Photosynthesis stores energy in complex organic molecules; respiration releases energy from complex organic molecules.

C) Photosynthesis occurs only in plants; respiration occurs only in animals.

D) ATP molecules are produced in photosynthesis but not in aerobic respiration.

E) Photosynthesis is catabolic; respiration is anabolic.

5) Which of the following is FALSE regarding photosynthesis? A)

It first appeared in ancient prokaryotes.

B) The earliest form of photosynthetic reactions oxidized (used) H₂O and yielded O₂.

C) Development of oxygenic photosynthesis led to atmospheric changes that allowed evolution of cells/organisms able to use aerobic respiration.

D) Some forms of photosynthesis involve oxidizing compounds such as ferrous iron or H₂S.

6) Chlorophylls absorb light in which colours of the visible range?

- A) green and blue
- B) blue and red**
- C) green and red
- D) orange and blue

7) The proteins of the electron transport chain active in the light-dependent reactions

- A) are membrane proteins present in the thylakoid.**
- B) are free proteins present in the thylakoid lumen.
- C) are part of the reaction center of photosystem I.
- D) have hydrophilic exterior surfaces.

8) Besides proteins, thylakoid membranes must contain a large number of _____ molecules in the reaction centers in order to harvest light energy.

- A) phospholipid
- B) oligosaccharide
- C) pigment**
- D) electron carrier

9) What is a difference between chlorophyll *a* and chlorophyll *b*?

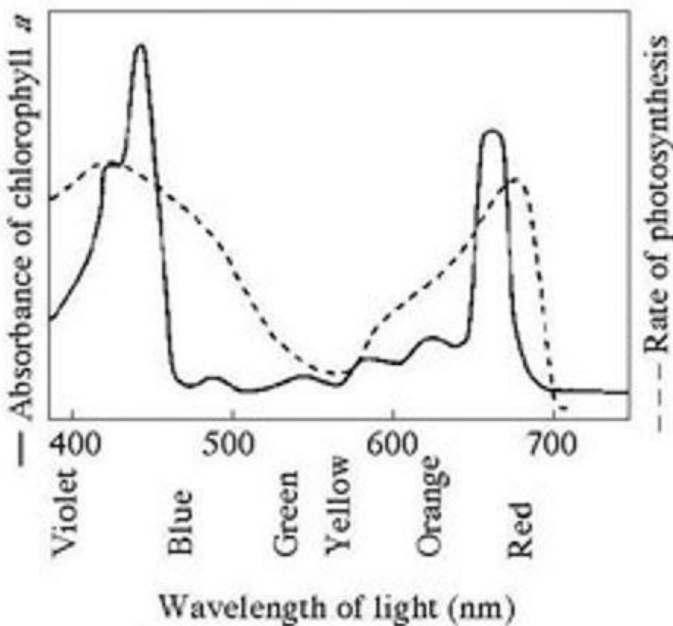
- A) Chlorophyll *a* is a pigment, and chlorophyll *b* is the enzyme that transfers excited electrons from chlorophyll *a* to electron carriers of the thylakoid membrane.
- B) Chlorophyll *a* absorbs yellow light, and chlorophyll *b* absorbs green.
- C) Chlorophyll *a* contains Mg^{++} in a ring structure, whereas chlorophyll *b* contains iron.
- D) Chlorophyll *a* and *b* absorb light energy at slightly different wavelengths.**

10) Why are there several structurally different pigments in the reaction centers of photosystems?

- A) Excited electrons must pass through several pigments before they can be transferred to electron acceptors of the electron transport chain.
- B) This setup enables the plant to absorb energy from sunlight from a variety of wavelengths.**
- C) They enable the plant to absorb more photons from light energy, all of which are at the same wavelength.
- D) They enable the reaction centre to excite electrons to a higher energy level.

11) If pigments from a particular species of plant are extracted and subjected to paper chromatography, which of the following is the most believable result?

- A) Paper chromatography for the plant would isolate a single band of pigment that is characteristic of the particular plant.
- B) Paper chromatography would separate the pigments from a particular plant into several bands.
- C) The single band of pigment that is isolated is always some shade of green.
- D) Paper chromatography isolates only the pigments that reflect green light.
- 12) The absorption spectrum of a plant shows what wavelengths of light the plant absorbs. The absorption spectrum depends on
- A) the wavelengths of light that hit the plant.
- B) wavelengths of light that are transmitted by the plant.
- C) wavelengths of light to which the plant's pigments respond.
- D) the thickness of the plant's leaves.
- 13) In autumn, the leaves of deciduous trees change colours. This is because the chlorophyll is degraded, and
- A) the carotenoids and other pigments are still present in the leaves.
- B) degraded chlorophyll becomes a pigment with different colours.
- C) water supply to the leaves has been reduced.
- D) the cells of the leaves begin to die.
- 14) The figure provided shows the absorption spectrum for chlorophyll *a* and the action spectrum for photosynthesis. Why are they different?



- A) Green and yellow wavelengths inhibit the absorption of red and blue wavelengths.
- B) Bright sunlight destroys photosynthetic pigments.
- C) Oxygen given off during photosynthesis interferes with the absorption of light.
- D) Other pigments absorb light in addition to chlorophyll *a*.
- E) Aerobic bacteria take up oxygen, which changes the measurement of the rate of photosynthesis.

15) What is the difference between NAD⁺ and NADP⁺?

- A) NAD⁺ functions as an electron transporter, whereas NADP⁺ does not.
- B) NAD⁺ functions as a free energy source for cells, whereas NADP⁺ does not.
- C) Both function as electron carriers, but NADP⁺ has a phosphate group and NAD⁺ does not.
- D) Both transport electrons to the electron transport chain (ETC) found on the inner mitochondrial membrane, but NADP⁺ transfers its electrons to the ETC at a higher energy level.

16) As electrons are passed through the system of electron carriers associated with photosystem II, they lose energy. What happens to this energy?

- A) It excites electrons of the reaction center of photosystem I.
- B) It is lost as heat.
- C) It is used to establish and maintain a proton gradient.
- D) It is used to phosphorylate NAD⁺ to NADPH, the molecule that accepts electrons from photosystem I.

17) The final electron acceptor(s) associated with photosystem I is A) oxygen.

B) hydrogen ions.

C) NADP⁺.

D) pheophytin.

18) During a discussion of photosynthesis, you are given the following series of facts:

1. Photosystem P700 alone is involved.
2. Water-splitting is not occurring.
3. A proton gradient is created in the Thylakoid lumen.

To which of the following processes do these statements collectively refer?

A) linear electron transport

B) cyclic electron transport

C) the Calvin cycle

D) the Krebs cycle (Citric Acid Cycle)

19) In photosynthesis, what is the role of water (H₂O)?

A) It accepts electrons liberated from the reaction centre of photosystem I.

B) It donates electrons to replace lost electrons in the reaction centre of photosystem II.C) It provides the necessary H⁺ ions needed to reduce glyceraldehyde-3-phosphate (G3P).D) It provides O₂, the terminal electron acceptor for the electron transport chain.

E) It allows cyclic photophosphorylation to occur when ATP levels are low in the stroma.

20) Assume a thylakoid is somehow punctured so that the interior of the thylakoid is no longer separated from the stroma. This damage will most directly affect the A) splitting of water.

B) absorption of light energy by chlorophyll.

C) flow of electrons from photosystem II to photosystem I.

D) synthesis of ATP.E) reduction of NADP⁺.

21) The light-independent reactions of plants function to make organic molecules using carbon dioxide as a carbon source. What is the electron source that helps reduce carbon dioxide to sugars and other organic molecules?

A) NADH

B) NADPH

C) ATP

D) electrons from oxygen

22) How are the light-dependent and light-independent reactions of photosynthesis related? A) They cannot occur in the absence of light.

B) The products of light-dependent reactions are used in light-independent reactions.

C) The products of light-independent reactions must be present for light-dependent reactions to take place.

D) They are not related.

23) In the carbon fixation step of the Calvin cycle, ribulose-1,5-bisphosphate (a five-carbon compound) is carboxylated to produce A) citric acid.

B) 2 three-carbon compounds.

- C) acetyl CoA (two carbons) and oxaloacetate (four carbons).
- D) glucose.

24) Stomata, openings in the leaf, are important to photosynthesis for

- A) entry of carbon dioxide that is used in the Calvin cycle.
- B) entry of oxygen that is used in the Calvin cycle.
- C) removal of water and carbon dioxide, the end-products of photo-oxidation.
- D) removal of nitrogen-containing waste products.