

Photosynthesis

1. _____ is the process by which certain organisms capture energy from sunlight and use it to build energy-rich food molecules.
2. In the _____ reactions of photosynthesis, electron carrier molecules are reduced and ATP is synthesized.
3. Each pigment molecule has a characteristic _____ spectrum, a range of photons that it is capable of absorbing.
4. Molecules that absorb light are called _____.
5. The wavelengths absorbed by a particular pigment depend on the available _____ levels to which the light-excited electrons can be absorbed.
6. Plants and algae use a two-stage _____ in the light dependent reactions.
7. The Calvin cycle is driven by ATP and _____ produced in the light reactions.
8. Even though the Calvin cycle reactions require the products of the light reactions, its reactions can occur in the _____.
9. In eukaryotes, photosynthesis takes place inside the _____.
10. Clusters of chlorophyll and accessory pigments are called _____.
11. The _____ plants utilize a specialized carbon fixation enzyme and a unique cell structure to reduce the problems of photorespiration.
12. _____ adapted plants such as cacti, pineapples, etc. show a pattern of stomatal opening and closing that is the reverse of C₃ plants.
13. The process whereby protons accumulate on one side of a membrane and can flow back across the membrane through ATP synthase resulting in ATP production is called _____.
14. Carbon fixation occurs during the dark reactions, or the _____, in photosynthesis.
15. Carbon atoms of CO₂ are incorporated into organic molecules in a series of dark reactions called
 - A. carbon reduction
 - B. carbon synthesis
 - C. carbon fixation
 - D. carbon activation
 - E. carbon oxidation

16. Most plants incorporate carbon dioxide into sugars by means of a cycle of reactions called the
- A. CAM cycle
 - B. carbon cycle
 - C. Calvin cycle
 - D. Krebs cycle
 - E. Electron transport cycle
17. Flattened sacs of internal membranes which have proteins embedded and are associated with photosynthesis are called
- A. chloroplasts
 - B. photosystems
 - C. the stroma
 - D. thylakoids
 - E. cristae
18. In green plant photosynthesis, the electron donor for the light dependent reaction is
- A. carbon dioxide
 - B. oxygen
 - C. RuBP
 - D. chlorophyll II
 - E. water
19. In the dark reactions of photosynthesis, CO_2 is added to a five-carbon sugar-phosphate known as
- A. cyclic AMP
 - B. NADH
 - C. NAD^+
 - D. RuBP
 - E. CAM
20. Which of the following scientists is not associated with studies on photosynthesis?
- A. Blackman
 - B. Jan Ingenhousz
 - C. Krebs
 - D. Calvin
 - E. Van Niel
21. Light consists of units of energy called
- A. electrons
 - B. photons
 - C. protons
 - D. neutrons
 - E. pigments

22. Visible light has a wavelength range of
- A. 400-700 nanometers
 - B. 200-800 nanometers
 - C. 200-400 nanometers
 - D. 200-700 nanometers
 - E. 0.001-100,000 nanometers
23. Sunburn is caused by which component of sunlight?
- A. infrared rays
 - B. X rays
 - C. gamma rays
 - D. ultra violet rays
 - E. long wavelength rays
24. Molecules that absorb light are called
- A. enzymes
 - B. electron carriers
 - C. pigments
 - D. photosynthesizers
 - E. absorbers
25. Which of the following two types of pigments are used in photosynthesis?
- A. chloroplasts
 - B. carotenoids
 - C. chlorophylls
 - D. a and b
 - E. b and c
26. The connection between carrots and vision is that the beta carotene of carrots can produce two molecules of vitamin A and oxidation of vitamin A produces a pigment used in vertebrate vision. This pigment's name is
- A. chlorophyll
 - B. ferredoxin
 - C. cytochrome
 - D. carotene
 - E. retinal
27. Chlorophyll *b* absorbs in green wavelengths of light that chlorophyll *a* cannot absorb. In this respect, chlorophyll *b* acts as
- A. an accessory pigment
 - B. an energizer for photosynthetic bacteria
 - C. a light absorber in the green light
 - D. a more efficient pigment
 - E. all of the above are true

28. The photosystem channels the excitation energy gathered by absorption of light by any one of the pigment molecules to a specific “reaction center chlorophyll,” which in turn passes the energy to
- A. photosystem I
 - B. photosystem II
 - C. the primary electron acceptor
 - D. the secondary electron center
 - E. cytochrome
29. Which of the following is common to both cellular respiration and the light reactions of photosynthesis?
- A. the transfer of electrons to glucose
 - B. the chemiosmotic formation of ATP
 - C. oxygen is one of the byproducts
 - D. mitochondria are essential organelles
 - E. must have light
30. In the photosystem I photocenter, light energy captured by pigment molecules is passed on to a special molecule called
- A. P₆₈₀
 - B. P₇₀₀
 - C. chlorophyll I
 - D. chlorophyll II
 - E. retinal
31. Photosystem ii absorbs photons that are slightly more energetic than photosystem I, but similarly pass this energy to a pigment called
- A. P₆₈₀
 - B. P₇₀₀
 - C. chlorophyll I
 - D. chlorophyll II
 - E. retinal
32. Photosystem II differs from photosystem I in that the following molecule is not made directly from the process
- A. ATP
 - B. NADH
 - C. NADPH
 - D. carbohydrates
 - E. water

33. The dark reactions of photosynthesis are those that
- A. convert chlorophylls into enzymes
 - B. convert enzymes into chlorophylls
 - C. convert water into hydrogen and oxygen
 - D. convert CO₂ into reduced molecules (sugars)
 - E. only occur in the dark
34. In dark reactions, when CO₂ is added to a molecule of RUBP the product is
- A. citric acid
 - B. glucose
 - C. glyceraldehyde-3-phosphate
 - D. phosphoglycerate
 - E. pyruvate
35. The cyclic carbon fixation reactions are also known as the
- A. Krebs cycle
 - B. Calvin cycle
 - C. citric acid cycle
 - D. tri carboxylic acid cycle
 - E. Blackman cycle
36. How many revolutions of the Calvin cycle are required to produce the sugar glucose?
- A. 2
 - B. 3
 - C. 4
 - D. 5
 - E. 6
37. Internal chloroplast membranes are organized into flattened sacs called
- A. microbodies
 - B. mitochondria
 - C. thylakoids
 - D. vesicles
 - E. Calvin bodies
38. Which part of the chloroplasts contain the Calvin-cycle enzymes?
- A. stroma
 - B. thylakoids
 - C. grana
 - D. envelope
 - E. cristae

39. The photosynthetic electron transport causes the accumulation of protons in which part of the chloroplast?
- A. matrix
 - B. stroma
 - C. envelope
 - D. outer membrane
 - E. internal thylakoid space
40. Embedded in the thylakoid membrane and protruding as knobs from the outer surface into the stroma, there are
- A. enzymes that fix carbon dioxide
 - B. proton channels that synthesize ATP
 - C. chlorophyll *a* and *b*
 - D. P₆₈₀ and P₇₀₀
 - E. specialized bundle sheath cells
41. What products of light reactions of photosynthesis are used in the Calvin cycle?
- A. oxygen and protons
 - B. carbon dioxide and water
 - C. ATP and NADPH
 - D. ADP and NADP
 - E. glucose and oxygen
42. CO₂ is released without the production of ATP or NADPH. This process is called
- A. carbon fixation
 - B. oxygen fixation
 - C. photophosphorylation
 - D. photorespiration
 - E. photooxidation
43. The loss of carbon fixing activity of the enzyme RuBP carboxylase is directly proportional to
- A. high temperatures and high light intensities
 - B. low temperature and low light intensities
 - C. completely dark conditions
 - D. lack of carbon dioxide
 - E. lack of oxygen

44. Many tropical plants circumvent the loss of carbon fixation due to oxygen by using a four carbon synthesis (C_4) metabolism. The special cells of these plants, which can carry out C_4 synthesis are
- A. mesophyll cells
 - B. bundle sheath cells
 - C. epidermal cells
 - D. guard cells
 - E. xylem cells
45. One of the disadvantages of the C_4 pathway is that it requires
- A. more O_2
 - B. more NADPH
 - C. more light
 - D. more ATP
 - E. a much higher temperature
46. A method devised by succulent desert plants to reduce the problem of photorespiration is
- A. the C_3 pathway
 - B. the CAM metabolism
 - C. the Calvin cycle
 - D. light reactions
 - E. nitrogen fixation
47. Most of the atmospheric oxygen occurs as a result of photosynthesis. From which of the following molecules is the oxygen derived?
- A. water
 - B. carbon dioxide
 - C. glucose
 - D. chlorophyll
48. A scientist is hoping to synthesize a new herbicide that will kill certain weeds. She has found that one weed species in particular has thylakoids that have rather large pores. The herbicide will open the pores of these thylakoids, causing them to leak
- A. stromal enzymes
 - B. chlorophyll
 - C. ATP
 - D. glucose
 - E. NADPH

49. C. B. van Niel used sulfur bacteria in his research on photosynthesis. His equation involved carbon dioxide and hydrogen sulfide. The bacteria produce sulfur. In green plants which molecule is split to form the oxygen?
- A. water
 - B. carbon dioxide
 - C. glucose
 - D. chlorophyll
50. If chlorophyll *a* is blocked from absorbing, what will happen to chlorophyll *b* since it is an accessory pigment?
- A. Chlorophyll *b* will become denatured and will not function as a light-absorbing pigment.
 - B. Chlorophyll *b* will still absorb near the green wavelengths of light, but photosynthesis will be greatly reduced.
 - C. Chlorophyll *b* will become saturated with light and will continue photosynthesis even in the absence of chlorophyll *a*.
 - D. Chlorophyll *b* will also be blocked and thus photosynthesis will be stopped.
51. Carotenoids are important to many plants because these pigments are able to
- A. remove carbon dioxide from the air
 - B. absorb wavelengths of light that neither chlorophyll *a* nor *b* can absorb
 - C. absorb water so that hydrolysis can be carried out in the chloroplasts
 - D. capture UV radiation that is harmful to the DNA in the nucleus of plant cells
 - E. store electrons for use during the “dark” reaction of photosynthesis
52. Engelmann (1883) determined the wavelengths of light that plants could use most effectively. He used a green algae and _____ to obtain his results.
- A. another green algae
 - B. anaerobic bacteria
 - C. aerobic bacteria
 - D. radioactive isotopes
 - E. a mass spectrometer
53. Engelmann (1883) discovered that the wavelengths of light that chlorophyll most strongly absorbed were
- A. in the red-violet wavelengths of the visible light spectrum
 - B. in the green wavelength of the visible light spectrum
 - C. in the yellow-orange wavelengths of the visible light spectrum
 - D. in the ultraviolet wavelengths of the light spectrum
 - E. in the infrared wavelengths of the light spectrum

54. Fall leaf color on deciduous trees is a result of
- the production of more accessory pigments because of the cooler temperatures
 - the reduction in the production of accessory pigments because of the cooler temperatures
 - cessation of chlorophyll production, which allows the accessory pigments to be revealed
 - the increased angle of the sun during the fall, which reflects more of the accessory pigments causing the human eye to see the red, yellow, and orange colors that were masked by the green chlorophyll
55. In the plants that utilize the CAM pathway, what happens to the stomata?
- The stomata open in the afternoon but close as soon as the sun sets.
 - The stomata open in the morning but close in the afternoon.
 - The stomata open in the evening but close in the morning.
 - The stomata open only when the sun is shining and close at night.
56. Which of the following is not part of the light-dependent reactions?
- primary photoevent
 - charge separation
 - calvin Cycle
 - electron transport
 - chemiosmosis
57. The Calvin Cycle requires all of the following except
- carbon dioxide
 - oxygen
 - ATP
 - NADPH
 - water
58. Match each of the following (some letters may be used more than once or not at all).
- | | |
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| _____ A. Shortest wavelength and highest-energy photons within the visible spectrum; one of the regions where chlorophylls absorb. | 1. green |
| _____ B. Visible light not strongly absorbed by light. | 2. violet-blue |
| _____ C. High energy component of the electromagnetic spectrum; associated with sunburn. | 3. red |
| _____ D. Apparent color of chlorophylls. | 4. ultraviolet |
| _____ E. Visible light with longest wave length and lowest-energy photons; one of the regions where chlorophylls absorb. | 5. yellow-orange |

Answer Key

No. on Test	Correct Answer
1	Photosynthesis
2	light
3	absorption
4	pigments
5	energy
6	photosystem
7	NADPH
8	dark
9	chloroplasts
10	photosystems
11	C ₄
12	CAM
13	chemiosmosis
14	Calvin Cycle
15	C
16	C
17	D
18	E
19	D
20	C
21	B
22	A
23	D
24	C
25	E
26	E
27	A
28	C
29	B
30	B
31	A
32	C
33	D
34	D

35	B
36	E
37	C
38	A
39	E
40	B
41	C
42	D
43	A
44	B
45	D
46	B
47	A
48	B
49	A
50	B
51	B
52	C
53	A
54	C
55	C
56	C
57	B
58	1-B, 2-A, 3-D, 4-A, 5-C