

AP Biology – Cellular Energetics Study Guide

Life: The Science of Biology (Chapters 7-8)

For Questions 1-10, compare the light reactions with the Calvin cycle of photosynthesis in plants. Use the following key:

- | | |
|--|--------------------------------------|
| 1. Produces molecular oxygen (O ₂) | 6. Produces NADPH |
| 2. Forms a proton gradient | 7. Produces triose (3-carbon) sugars |
| 3. Requires ATP | 8. Is inactive in the dark |
| 4. Requires ADP | 9. Requires CO ₂ |
| 5. Produces NADH | 10. Requires glucose |

Questions 11-14 are based on the stages of glucose oxidation listed below.

11. Which one of the stages produces the most ATP when glucose is completely oxidized to carbon dioxide and water?
12. Which one of the stages normally occurs whether or not oxygen is present?
13. Which one of the stages occurs in the cytosol of the cell?
14. Carbon dioxide is released during which stages?

Questions 15 and 16 are based on the following information. A series of enzymes catalyze the reaction $X \rightarrow Y \rightarrow Z \rightarrow A$. Product "A" binds to the enzyme that converts X to Y at a position remote from its active site. This binding decreases the activity of the enzyme.

15. In this example, substance X is
16. In this example, substance A functions as

Refer to Figure 1 to answer the questions 17-19.

17. The electron transport chain energy is used to pump H⁺ ions into which location?
18. Glycolysis takes place in which location?
19. Where are the proteins of the electron transport chain located?
20. You are a research scientist studying photosynthesis. In an experiment performed during the day, you provide a new plant, just discovered in South America, with radioactive carbon (14C) dioxide as a metabolic tracer. The 14C is incorporated first into oxaloacetic acid. The plant is best characterized as
21. In a plant cell, where is ATP synthase located?
22. Which of the following are products of the Calvin cycle and are utilized in the light reactions of photosynthesis?
23. As a research scientist, you measure the amount of ATP and NADPH consumed by the Calvin cycle in 1 hour. You find 30,000 molecules of ATP consumed, but only 20,000 molecules of NADPH. Where did the extra ATP molecules come from?
24. Which of the following events in the functioning of photosystem II is FALSE?
25. Which of the following enzymes is probably the most abundant protein in the world?
26. In C₄ photosynthesis, carbon fixation takes place in the _____ cells, and then is transferred as malic or aspartic acid to _____ cells where carbon dioxide is released for entry into the Calvin cycle.
27. You have just discovered a new flower species that has a unique photosynthetic pigment. The leaves of this plant appear to be reddish yellow. What wavelengths of visible light are not being absorbed by this pigment?
28. The reactions of the Calvin cycle require all of the following molecules EXCEPT
29. The primary function of the light reactions of photosynthesis is
30. Of the following colors of light in Figure 2, the color of light LEAST effective in driving photosynthesis is
31. Cyclic electron flow in the chloroplast produces

32. CAM plants can keep stomata closed in daytime, thus reducing loss of water. They can do this because they can
33. When a chlorophyll molecule in photosystem I traps light, it loses an electron. In noncyclic electron flow, this electron is replaced
34. During cellular respiration, electrons travel downhill from
35. Cellular respiration harvests the most chemical energy by
36. The direct energy source that drives ATP synthesis during respiratory oxidative phosphorylation is
37. What kind of metabolic poison would most directly interfere with glycolysis?
38. Suppose a yeast cell uses 10 moles of glucose for energy production. No oxygen is available. What will be the maximum net yield of ATP in moles?
39. Which product in eukaryotic cells will normally proceed whether O_2 is present or absent?
40. During oxidative phosphorylation, H_2O is formed. Where do the oxygen atoms in the H_2O come from?
41. Which metabolic process is most closely associated with intracellular membranes?
42. Which of the following statements about lactate fermentation is FALSE?
43. The end product of glycolysis is
44. The drug 2, 4-dinitrophenol (DNP) destroys the proton gradient across the inner mitochondrial membrane. What would you expect to be the effect of incubating isolated mitochondria in a solution of DNP?
45. In human muscle cells, the fermentation process produces
46. The citric acid cycle begins with
47. When light strikes a blue pigment, blue light is
48. In cacti, CO_2 is stored for use in the Calvin-Benson cycle
49. When a photon is absorbed by a molecule, what happens to the photon?
50. How does rubisco "decide" whether to act as an oxygenase (fix O) or carboxylase (fix C)?