Answers to Questions for Comprehension

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Q1. Photosynthesis traps energy from the Sun and converts it to chemical energy, in the form of high-energy molecules such as carbohydrates.

Q2. Cellular respiration involves the process of breaking down high-energy compounds, such as glucose, in order to generate ATP, which is required as an energy source for numerous cellular activities.

Q3. Adenosine triphosphate (ATP) acts as an energy source for almost all cellular activities, which includes ion transport, synthesis of complex molecules, muscle contraction, and cilia and flagella movement. It supplies energy through the breaking of the bond to the third phosphate group.

Q4. When ATP is used as an energy source (i.e., to release energy), the third phosphate group is cleaved off to produce ADP (adenosine diphosphate). ATP can be regenerated by the addition of a free phosphate group to ADP and an input of energy (i.e., energy is consumed).

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Q5. Chlorophyll is a photosynthetic pigment that causes the green colour in plants and most species of algae and acts to trap the Sun's energy for photosynthesis.

Q6. Chlorophyll, which causes the green colour in plants, is present in the thylakoid membranes of chloroplasts.

Q7. In mitochondria, reactions involving the breakdown of carbohydrates and other high-energy molecules are carried out, in order for required energy to be produced (ATP).

Q8. Eukaryotic organisms (plants, animals, fungi, and protists) contain mitochondria.

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Q9. Metabolic pathways that break down larger molecules into smaller ones release energy.

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Q10. The electrons are transferred to another compound, which as a result, becomes reduced.

Q11. A compound in its reduced form contains more energy.

suck on the straw.

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Q12. The two sets of reactions in photosynthesis are the light-dependent reactions and the light-independent reactions.

Q13. A pigment is a molecule capable of absorbing certain wavelengths of light and has a particular colour.

Q14. Chlorophyll is green because it absorbs other colours of light (red and blue) better than green. Therefore, green light is reflected back, providing the appearance of its green colour.

Q15. Since different pigments absorb different wavelengths of light, a plant can use a greater percentage of the Sun's light for photosynthesis by having more than one pigment.

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Q16. A photosystem is a group of proteins that are embedded in the membrane of the thylakoid. The photosystems absorb light energy and transfer it to the electrons.

Q17. Each photosystem is made up of various pigments molecules, including chlorophyll and careotenoids, and a specialized electron-accepting chlorophyll *a* molecule called the reaction centre.

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Q18. In the electron transport system, electrons are passed along a series of electron-carrying molecules. With each transfer or "step" through the electron-carrying molecules, electrons give off a small amount of energy. Therefore, high-energy electrons will enter the electron transport system, lose energy with each transfer through the electron transport system, and enter photosystem I as low-energy electrons.

Q19. NADPH is formed from the reduction of $NADP^+$, using electrons from photosystem I.

Q20. In photosystem I, an electron is replaced by one that has reached the end of the electron transport system from photosystem II.

Q21. The effect is the establishment of a hydrogen ion concentration gradient across the membrane. There is potential energy associated with the establishment of this gradient.

Q22. Hydrogen ions cannot diffuse out of the thylakoid space because the membrane is impermeable to these charged particles.

Q23. ATP synthase is an enzyme complex embedded in the thylakoid membrane that provides a pathway for hydrogen ions to move down their concentration gradient, from the thylakoid space to the stroma. This enzyme catalyzes the formation of ATP from inorganic phosphate and ADP.

Q24. The movement of hydrogen ions down the concentration gradient and the bonding of a free phosphate group to ADP to form ATP are linked in the process known as chemiosmosis.

carbon dioxide can become incorporated into a compound and can contribute to carbohydrate synthesis.

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Q25. Reasons that hydrogen is not easily used as a fuel include its lack of availability as a gas in nature, the high input of energy required to obtain it from water, and the generation of carbon dioxide when obtaining it from sources other than water.

Q26. Scientists are investigating using an artificial system similar to photosystem II because the system is designed to use solar energy to split water and convert the released ions and electrons into hydrogen gas. This would avoid the problems currently associated with hydrogen production.

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Q27. The Calvin-Benson cycle is a pathway in plants that uses the ATP and NADPH produced from the light-dependent reactions and carbon dioxide to synthesize glucose and other high-energy molecules that are needed by plants. This cycle involves the incorporation of carbon from carbon dioxide into ribulose bisphosphate for the synthesis of glyceraldehyde-3-phosphate (PGAL), which is used to synthesize glucose.

Q28. In the case of the Calvin-Benson cycle, carbon fixation refers to the carbon from carbon dioxide becoming chemically bonded to a pre-existing organic molecule (ribulose bisphosphate). It is a way that the carbon from

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Q29. Oxic conditions are those containing oxygen, while anoxic conditions lack oxygen.

Q30. Aerobic cellular respiration requires oxygen to produce ATP, while anaerobic respiration does not require oxygen to produce ATP.

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Q31. Glycolysis occurs in the cytoplasm of the cell and does not require oxygen.

Q32. Products of glycolysis include intermediate 3-carbon molecules, pyruvate, ATP, and NADH.

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Q33. The reactions of the Krebs cycle take place in the mitochondrial matrix.

Q34. The glucose-derived acetyl CoA is the compound that enters the Krebs cycle.

Q35. During the Krebs cycle, NAD^+ is reduced to NADH and FAD is reduced to $FADH_2$.

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Q36. Electron carriers of the electron transport system are attached to the inner membrane of the mitochondrion.

Q37. The source of high-energy electrons is the NADH and $FADH_2$ from the Krebs cycle.

Q38. Oxygen functions as the final electron acceptor at the end of the electron transport chain. The oxygen accepts the electrons and some hydrogen ions, with water ultimately being produced.

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Q39. Glycolysis is considered an anaerobic process because it can proceed without oxygen.

Q40. Fermentation occurs under anaerobic conditions (i.e., oxygen-lacking conditions).

Q41. Similarities between lactate and ethanol fermentation include: both occur under anaerobic conditions, both involve the production of pyruvate from glucose via glycolysis, and both result in the oxidation of NADH to NAD^+. The major difference between these two pathways is the final product that is formed. In lactate fermentation, pyruvate is converted to lactate, while in ethanol fermentation the pyruvate is converted to carbon dioxide and a 2-carbon molecule that is converted to ethanol.