

Study Guide BSCS Chapter 5

1. Define: cellular respiration.
2. How would you describe the flow of energy in cells?
 - food directly to cell work
 - food to ATP to cell work
 - ATP to food
 - ADP to ATP to cell work
3. Draw the overall reaction of aerobic cellular respiration.

Choose from the following that would best represent this process.

- CO_2 and $\text{H}_2\text{O} \longrightarrow \text{glucose} + \text{H}_2\text{O} + \text{O}$
- $\text{H}_2\text{O} \longrightarrow \text{H} + \text{O}$
- $\text{food} + \text{ADP} \longrightarrow \text{ATP} + \text{H}_2\text{O} + \text{CO}_2$

4. Name the type of reaction that breaks down glucose to carbon dioxide and water
5. Name the process that combines small, simple organic molecules to form more complex compounds (i.e. proteins).
6. Is energy released during decomposition or biosynthesis?
7. Simple compounds produced by _____ can also serve as carbon skeletons in _____.
8. $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \longrightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}$
 - a. Which compound in the above reaction could be compared to fuel?
 - b. Which compound would be the "final" electron acceptor in the above reaction?

c. Which compound would contain the carbon released from glucose in the above compound?

9. Use figure below:

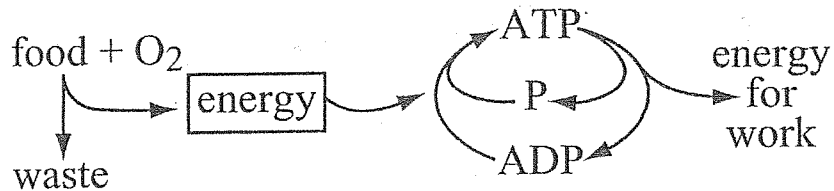


Figure 05.01

- Which has more useable energy ADP or ATP?
 - Does ATP or ADP lose a phosphate?
 - This diagram shows the importance of _____ in organisms.
 - If this is a diagram of cellular respiration the energy comes from chemical bonds in foods that link _____ to _____.
 - If this is a diagram of cellular respiration the waste is _____ and _____.
10. There are 3 mains stages of respiration. **Glycolysis** is the process of breaking down glucose and happens in the cytoplasm of the cell (anaerobic pathway) or in the mitochondria (aerobic pathway). The **Krebs cycle** is a major biological pathway because it occurs in both plants and animals and is part of aerobic respiration. The **electron transport chain** is a process where electrons transfer from one carrier molecule to another in cell respiration resulting in storing some of the energy in ATP molecules. Describe how these processes work. Use back of paper if more room is needed.

11. Based upon your explanation in #10, answer the following questions.
- a. Name the substance which is a hydrogen carrier during glycolysis.
 - b. Where does glycolysis occur?
 - c. Where does Krebs cycle occur?
 - d. What substance is formed in the Krebs cycle?
 - e. What substance carries hydrogen for use in the electron transport system for ATP synthesis?
 - f. Where is the electron transport system?
 - g. Where is most of an aerobic cell/s ATP formed?
 - h. Which stage of cellular respiration releases the most hydrogen from glucose?
 - i. Name the part of the mitochondria which contains the electron transport system enzymes for ATP formation and some of the enzymes of the Krebs system.
 - j. Name the raw materials for the electron transport system.
 - k. Name the hydrogen-carrier molecule that can drive the synthesis of up to 3 molecules of ATP.
 - l. The flow of protons through the inner mitochondrial membrane on cellular respiration provides energy to make _____.
 - m. Name the hydrogen-carrier molecule that can drive the synthesis of up to 2 molecule of ATP.
 - n. How does a lack of oxygen inhibit the Krebs cycle?

- o. How many times more ATP is produced in the presence of oxygen than in its absence (as in fermentation)?
- p. True/False: Cells make ATP during glycolysis by transferring a phosphate group from a sugar-phosphate to ADP.
- q. Name the stage in which energy is carried by NADH and harvested during cellular respiration.
- r. True/False: (If false, make true) In cellular respiration the oxidation-reduction reaction plays a key role in the flow of energy during decomposition of glucose.
- s. Name the product released during aerobic respiration after oxygen accepts hydrogen.
- t. Name the source of oxygen used in cellular respiration.
- u. Name the pathway involved in rearranging carbon compounds.
- v. Name the pathway which provides carbon skeletons used in biosynthetic pathways.
- w. Name the pathway in which NADH is made.
- x. Name the pathway in which NADH contributes to the formation of ATP.
- y. Name the pathway in which ATP is consumed.

12. Use the diagram below to answer the following questions.

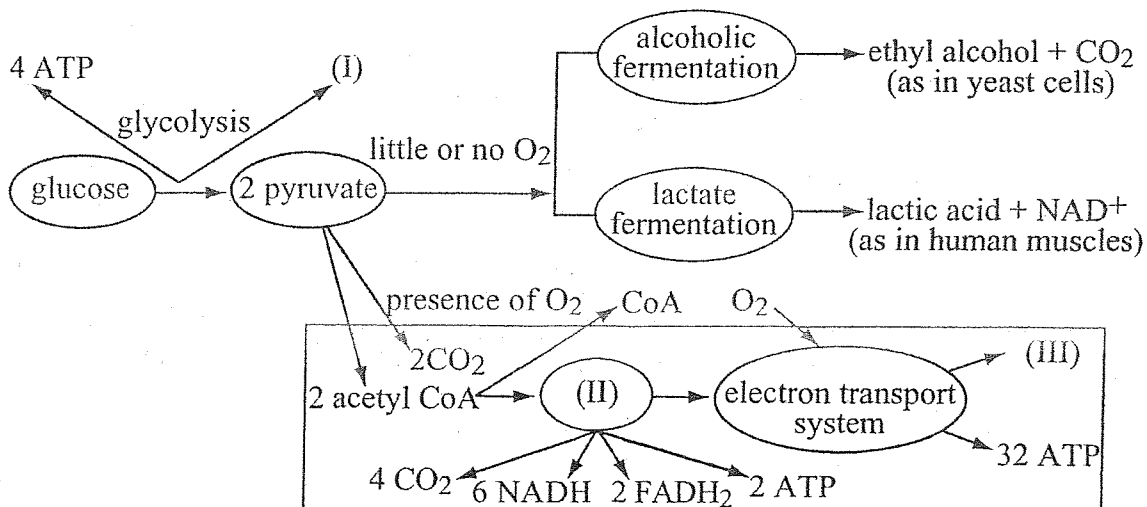


Figure 05.02

- a. Does glycolysis or the Krebs cycle complete the decomposition of glucose into carbon skeletons?
 - b. Which state would be the main source of energy for anaerobic yeast cells?
 - c. Name another product of glycolysis at I.
 - d. Name the important branch point in cellular respiration.
13. What evidence is there that some energy remains untapped in the products of fermentation?
14. Why do mitochondria provide an efficiency and organization to cellular respiration?
15. The proteins that are embedded in the cristae of mitochondria
- NADH
 - FADH₂
 - cytochromes
 - Krebs-cycle enzymes
16. True/False: Since yeast cells are facultative anaerobes, they ferment only after O₂ in solution has been used up.
17. Carbohydrates are stored in the _____ of our bodies.
18. The carrier for glucose in our _____.
19. What causes pain and cramps in our oxygen-starved muscles?
20. Which of the following occurred first in the sequence of evolution, if the heterotroph hypothesis is correct?
- a. aerobic respiration
 - b. photosynthesis
 - c. reproduction
 - d. fermentation

21. Chloroplasts and mitochondria both have inner membranes which contain _____ carrier molecules.
21. Which of the following is analogous to how energy is released during electron transfer in both photosynthesis and cellular respiration?
- setting off a firecracker
 - a ball bouncing down a flight of stairs
 - throwing a rock into a pond to create ripples
 - winding up an alarm clock
22. True/False:
- Photosynthesis, fermentation, and cellular respiration replace the supply of atmospheric O_2 .
 - Photosynthesis, fermentation, and cellular respiration produce ATP molecules.
 - Photosynthesis, fermentation, and cellular respiration involve electron transport system.
 - Photosynthesis, fermentation, and cellular respiration produce CO_2 and H_2O .
23. Name the compounds that release urea when cells break them down to be used in the Krebs cycle.
24. Why don't cells ferment fatty acids?
25. In order for fatty acids to enter the Krebs cycle they must be broken down into _____.
26. You observe an airtight aquarium each week and carefully weigh it each time. It is filled with several kinds of aquatic plants, algae, bacteria, one-celled eukaryotes, snails, and fish. Will the weight of the aquarium and its contents increase, decrease, or remain the same.
27. You take a beaker of water and place a fish in it. In addition you add the pH indicator bromothymol blue. Within in 1 hour the water will turn yellow. You decide to add an aquatic plant to the water in order to prevent the color change because the photosynthetic activity of the plant would balance the fish's _____.

28. When energy demand for energy is low, do animals convert glucose to fat and then to glycogen or glucose to glycogen and then to fat?
29. There are mechanisms that control the respiration rates in organisms. These mechanisms respond to _____ and _____ of energy and the _____ or _____ of oxygen.
30. Why do yeast cells consume more sugar when their supply of oxygen is reduced?
31. Some water, a small amount of soil, a few aquatic plants, and a fish were placed in a large bottle. The bottle was sealed to prevent the exchange of gases and other materials between its contents and the outside. The bottle was then placed in a window to receive light during the day. After a week, both plants and the fish appeared healthy.

There will be 5 questions associated with the above scenario.

- Do the plants use oxygen?
- Do the fish use oxygen?
- Do the plants use carbon dioxide?
- Do the plants produce carbon dioxide?
- How is the oxygen replenished in the bottle?

32. Use the figure below to answer the following questions.

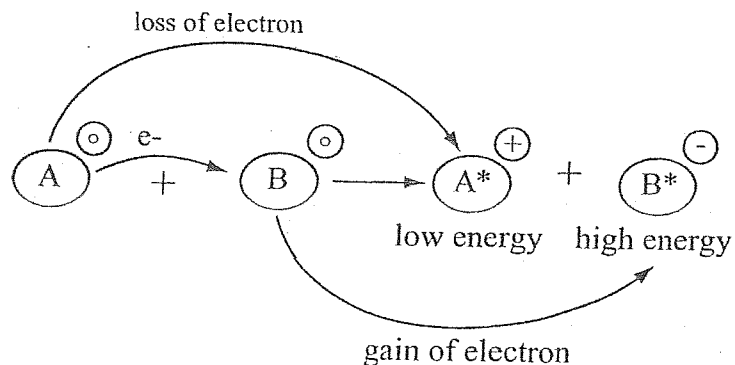


Figure 05.03

- a. The diagram demonstrates what part of cellular respiration?
- b. If A is glucose and B is NAD^+ , what does B^* represent?

33. The following two samples of wheat seeds were soaked in water at room temperature. One sample was then boiled in water for 10 minutes. After the boiled sample cooled to room temperature, each sample was placed in a thermos container with a thermometer to record temperature changes.

You will have 8 questions associated with the above scenario. We will go over these in class.

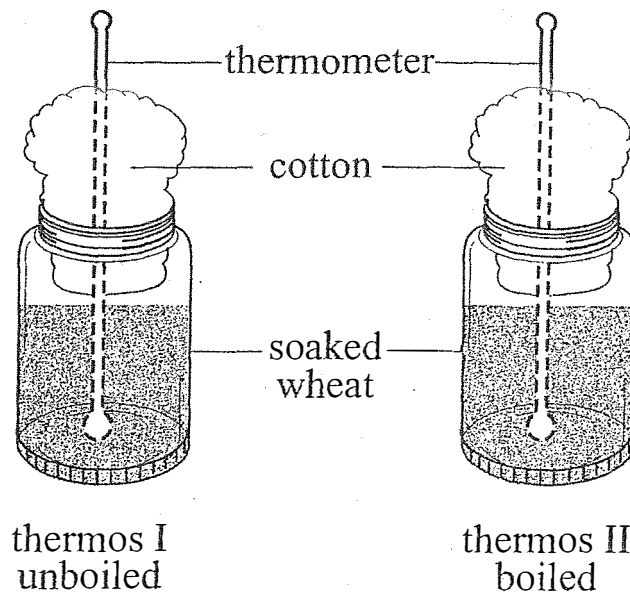


Figure 05.04

11. What substance carries hydrogen for use in the biosynthesis of macromolecules (e.g. complex molecule)?

12. What is the product of III which results from oxygen?

After transporting acetate to the Krebs cycle, what happens to the coenzyme A that returns the cytoplasm?

What does converting pyruvic acid to lactic acid enable the cell to do?