

Cellular Respiration Practice Test (Sample)

Study Guide



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SAMPLE

Questions

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- 1. What is the overall equation for cellular respiration?**
 - A. Glucose + Oxygen → ATP + Carbon Dioxide + Water**
 - B. Glucose + Carbon Dioxide → Oxygen + Water + Energy**
 - C. Oxygen + Water → Glucose + Energy**
 - D. Glucose + Water → ATP + Carbon Dioxide + Oxygen**
- 2. How many ATP molecules are produced from one molecule of glucose during glycolysis?**
 - A. 2 ATP**
 - B. 4 ATP**
 - C. 6 ATP**
 - D. 8 ATP**
- 3. What is the main purpose of the Krebs cycle?**
 - A. To break down glucose into pyruvate**
 - B. To produce electron carriers and ATP from acetyl-CoA**
 - C. To generate carbon dioxide for photosynthesis**
 - D. To synthesize glucose from non-carbohydrate sources**
- 4. What is the primary purpose of oxidative phosphorylation?**
 - A. To generate carbon dioxide**
 - B. To convert glucose to ATP through substrate-level phosphorylation**
 - C. To produce ATP using the energy from electron transport**
 - D. To regenerate NAD⁺**
- 5. What is the main function of the Krebs cycle?**
 - A. To convert glucose to pyruvate**
 - B. To generate ATP**
 - C. To oxidize acetyl-CoA and produce electron carriers**
 - D. To produce oxygen**

- 6. What is produced as a waste product during cellular respiration?**
- A. Glucose**
 - B. Oxygen**
 - C. Carbon dioxide and water**
 - D. ATP only**
- 7. Why are electron carriers such as NAD⁺ and FAD important?**
- A. They prevent ATP synthesis**
 - B. They transfer protons to the surface of mitochondria**
 - C. They transfer electrons to the electron transport chain, driving ATP synthesis**
 - D. They inhibit the Krebs cycle**
- 8. Where does the Krebs cycle take place in eukaryotes?**
- A. In the cytoplasm**
 - B. In the nucleus**
 - C. In the mitochondria**
 - D. On the cell membrane**
- 9. What is cellular respiration?**
- A. The process of photosynthesis in plants**
 - B. The process by which cells convert glucose and oxygen into energy, carbon dioxide, and water**
 - C. A method for cellular division and growth**
 - D. The mechanism of protein synthesis in cells**
- 10. What is chemiosmosis?**
- A. The process of ATP generation in mitochondria driven by the electrochemical gradient of protons**
 - B. The breakdown of glucose into pyruvate**
 - C. The conversion of acetyl-CoA into carbon dioxide**
 - D. The synthesis of glucose from carbon dioxide and water**

Answers

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1. A
2. A
3. B
4. C
5. C
6. C
7. C
8. C
9. B
10. A

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Explanations

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1. What is the overall equation for cellular respiration?

A. Glucose + Oxygen → ATP + Carbon Dioxide + Water

B. Glucose + Carbon Dioxide → Oxygen + Water + Energy

C. Oxygen + Water → Glucose + Energy

D. Glucose + Water → ATP + Carbon Dioxide + Oxygen

The overall equation for cellular respiration encapsulates the metabolic process by which cells convert glucose and oxygen into usable energy in the form of ATP, as well as production of carbon dioxide and water as byproducts. This equation can be expressed as: Glucose + Oxygen → ATP + Carbon Dioxide + Water. In this process, glucose serves as the primary energy source, which is broken down through various biochemical pathways to release energy. Oxygen is crucial in this process, especially during aerobic respiration, where it acts as the final electron acceptor in the electron transport chain, allowing for the efficient production of ATP. The byproducts, carbon dioxide and water, are generated as a result of the chemical reactions that occur during cellular respiration. Efficient energy production is vital for maintaining cellular functions, growth, and metabolism in living organisms. This overall equation accurately reflects the reactants used and the products formed in cellular respiration, making it a fundamental representation of the energy transformation that occurs in cells.

2. How many ATP molecules are produced from one molecule of glucose during glycolysis?

A. 2 ATP

B. 4 ATP

C. 6 ATP

D. 8 ATP

Glycolysis is the initial step of cellular respiration that occurs in the cytoplasm of the cell. During this process, one molecule of glucose, which is a six-carbon sugar, is broken down into two molecules of pyruvate. Throughout the glycolytic pathway, there are two main phases: the energy investment phase and the energy payoff phase. In the energy investment phase, two ATP molecules are consumed to help initiate the breakdown of glucose. However, during the energy payoff phase, a total of four ATP molecules are generated through substrate-level phosphorylation as the pyruvate molecules are formed. Therefore, when considering the net gain of ATP from glycolysis, two ATP molecules are produced after accounting for the two that were utilized in the investment phase. This leads to the conclusion that for each molecule of glucose that undergoes glycolysis, a net yield of two ATP molecules can be obtained, making this understanding crucial for grasping the overall energy yield from glucose during the first stage of cellular respiration.

3. What is the main purpose of the Krebs cycle?

- A. To break down glucose into pyruvate
- B. To produce electron carriers and ATP from acetyl-CoA**
- C. To generate carbon dioxide for photosynthesis
- D. To synthesize glucose from non-carbohydrate sources

The main purpose of the Krebs cycle, also known as the citric acid cycle or TCA cycle, is to produce electron carriers and ATP from acetyl-CoA. During this cycle, acetyl-CoA, derived from carbohydrates, fats, and proteins, is oxidized, leading to the generation of energy-rich molecules such as NADH and FADH₂. These electron carriers play a crucial role in the subsequent steps of cellular respiration, particularly in the electron transport chain, where they are used to produce a significant amount of ATP. Additionally, the Krebs cycle results in the release of carbon dioxide as a waste product, which animals exhale and plants may use for photosynthesis, but the primary goal of the cycle is energy production rather than gas generation. Although glucose breakdown is an early step in cellular respiration leading to the production of acetyl-CoA, it is not the key function of the Krebs cycle itself. The cycle also does not synthesize glucose; rather, it's part of catabolic pathways that help break down biomolecules for energy.

4. What is the primary purpose of oxidative phosphorylation?

- A. To generate carbon dioxide
- B. To convert glucose to ATP through substrate-level phosphorylation
- C. To produce ATP using the energy from electron transport**
- D. To regenerate NAD⁺

The primary purpose of oxidative phosphorylation is to produce ATP using the energy derived from the electron transport chain. During this process, electrons from NADH and FADH₂, which are produced in earlier stages of cellular respiration, are transferred through a series of electron carrier proteins located in the inner mitochondrial membrane. As these electrons move through the chain, energy is released and used to pump protons (H⁺) from the mitochondrial matrix into the intermembrane space, creating a proton gradient. This buildup of protons creates a potential energy difference across the membrane, often referred to as the proton motive force. ATP synthase, an enzyme located within the inner membrane, harnesses this gradient by allowing protons to flow back into the matrix. The flow of protons through ATP synthase drives the conversion of ADP and inorganic phosphate into ATP. This mechanism is essential for the efficient production of ATP during cellular respiration, making C the correct choice. In contrast, the other options highlight processes not central to oxidative phosphorylation: generating carbon dioxide is more closely associated with the citric acid cycle; substrate-level phosphorylation specifically refers to the direct production of ATP in glycolysis and the citric acid cycle without the involvement of the electron transport chain; and while NAD⁺ regeneration

5. What is the main function of the Krebs cycle?

- A. To convert glucose to pyruvate**
- B. To generate ATP**
- C. To oxidize acetyl-CoA and produce electron carriers**
- D. To produce oxygen**

The main function of the Krebs cycle, also known as the citric acid cycle or TCA cycle, is to oxidize acetyl-CoA and produce electron carriers. During this cycle, acetyl-CoA, derived from carbohydrates, fats, and proteins, undergoes a series of enzymatic reactions. Each turn of the cycle results in the release of carbon dioxide and the production of high-energy electron carriers, specifically NADH and FADH₂. These electron carriers are crucial because they transport electrons to the electron transport chain, where their energy is used to generate ATP through oxidative phosphorylation. While the Krebs cycle does participate indirectly in ATP generation, its primary role is in the oxidation of acetyl-CoA and the production of these electron carriers, making it a pivotal step in cellular respiration. The conversion of glucose to pyruvate is a separate process known as glycolysis, and oxygen production is related to photosynthesis rather than cellular respiration.

6. What is produced as a waste product during cellular respiration?

- A. Glucose**
- B. Oxygen**
- C. Carbon dioxide and water**
- D. ATP only**

During cellular respiration, glucose is metabolized to release energy stored in its chemical bonds. This process primarily occurs in three stages: glycolysis, the Krebs cycle, and the electron transport chain. As cells break down glucose, they convert it into energy that can be used in the form of ATP (adenosine triphosphate), which is essential for various cellular activities. As a result of this metabolic process, carbon dioxide and water are generated as waste products. Carbon dioxide is produced during the Krebs cycle when carbon atoms from glucose are removed and released into the atmosphere through respiration. Water is formed at the end of the electron transport chain when oxygen acts as the final electron acceptor, combining with electrons and protons. Other substances mentioned, such as glucose and oxygen, are not waste products; glucose is the primary fuel for cellular respiration, while oxygen is consumed during the process to help extract energy from glucose. ATP is the energy currency produced by the process rather than a waste product. Therefore, carbon dioxide and water are indeed the correct waste products produced during cellular respiration.

7. Why are electron carriers such as NAD⁺ and FAD important?

- A. They prevent ATP synthesis**
- B. They transfer protons to the surface of mitochondria**
- C. They transfer electrons to the electron transport chain, driving ATP synthesis**
- D. They inhibit the Krebs cycle**

Electron carriers like NAD⁺ and FAD play a crucial role in cellular respiration by facilitating the transfer of electrons during metabolic processes. When these carriers accept electrons (as NAD⁺ does to become NADH and FAD does to become FADH₂), they store energy that can be released later. These reduced forms, NADH and FADH₂, then donate the high-energy electrons to the electron transport chain, a series of protein complexes located in the inner mitochondrial membrane. This transfer of electrons through the chain creates a proton gradient across the membrane, which is essential for ATP synthesis. As protons flow back into the mitochondrial matrix through ATP synthase, ATP is generated. This process is a key part of oxidative phosphorylation and contributes to the majority of ATP produced in cellular respiration. Thus, the importance of electron carriers lies in their ability to link the products of earlier metabolic pathways, such as glycolysis and the Krebs cycle, to the final stage of ATP production, highlighting their essential role in energy metabolism.

8. Where does the Krebs cycle take place in eukaryotes?

- A. In the cytoplasm**
- B. In the nucleus**
- C. In the mitochondria**
- D. On the cell membrane**

The Krebs cycle, also known as the citric acid cycle, occurs in the mitochondria of eukaryotic cells. This is significant because mitochondria are often referred to as the "powerhouses" of the cell, as they are the primary site of ATP production through aerobic respiration. The Krebs cycle is a central component of cellular respiration where acetyl-CoA, derived from carbohydrates, fats, and proteins, is oxidized to produce electron carriers (NADH and FADH₂) and carbon dioxide, which are then utilized in the electron transport chain to generate ATP. The mitochondrial matrix provides the necessary environment and enzymes required for this cycle, making it the ideal location for these biochemical reactions to occur. This specialized localization in the mitochondria allows for efficient energy conversion within eukaryotic cells.

9. What is cellular respiration?

- A. The process of photosynthesis in plants
- B. The process by which cells convert glucose and oxygen into energy, carbon dioxide, and water**
- C. A method for cellular division and growth
- D. The mechanism of protein synthesis in cells

Cellular respiration is defined as the process by which cells convert glucose and oxygen into energy, carbon dioxide, and water. This biochemical process is essential for producing ATP (adenosine triphosphate), which is the primary energy carrier in cells. During cellular respiration, glucose is broken down in a series of metabolic pathways, including glycolysis, the citric acid cycle, and oxidative phosphorylation. Oxygen plays a critical role in this process, particularly in the electron transport chain, where it acts as the final electron acceptor, allowing for efficient ATP production. The byproducts of this process, carbon dioxide and water, are released into the environment, highlighting the interconnectedness of cellular respiration and environmental cycles. This process is crucial in sustaining cellular functions, enabling growth, repair, and maintenance of all living organisms.

10. What is chemiosmosis?

- A. The process of ATP generation in mitochondria driven by the electrochemical gradient of protons**
- B. The breakdown of glucose into pyruvate
- C. The conversion of acetyl-CoA into carbon dioxide
- D. The synthesis of glucose from carbon dioxide and water

Chemiosmosis refers specifically to the process by which ATP is generated in mitochondria and chloroplasts, taking advantage of a proton (H^+) electrochemical gradient. During cellular respiration, electrons are transported through a series of proteins in the electron transport chain, which creates an electrochemical gradient by moving protons from the mitochondrial matrix into the intermembrane space. This accumulation of protons creates potential energy, referred to as the proton motive force. As protons flow back into the mitochondrial matrix through ATP synthase, a protein that acts as a channel and enzyme, the energy released is harnessed to synthesize ATP from ADP and inorganic phosphate. This mechanism of ATP generation is crucial for cellular energy supply and is a key component of oxidative phosphorylation. In contrast, the other options describe different biological processes: the breakdown of glucose into pyruvate is glycolysis, converting acetyl-CoA into carbon dioxide occurs in the Krebs cycle, and the synthesis of glucose from carbon dioxide and water refers to photosynthesis. Therefore, A is the accurate representation of chemiosmosis within the context of cellular respiration.