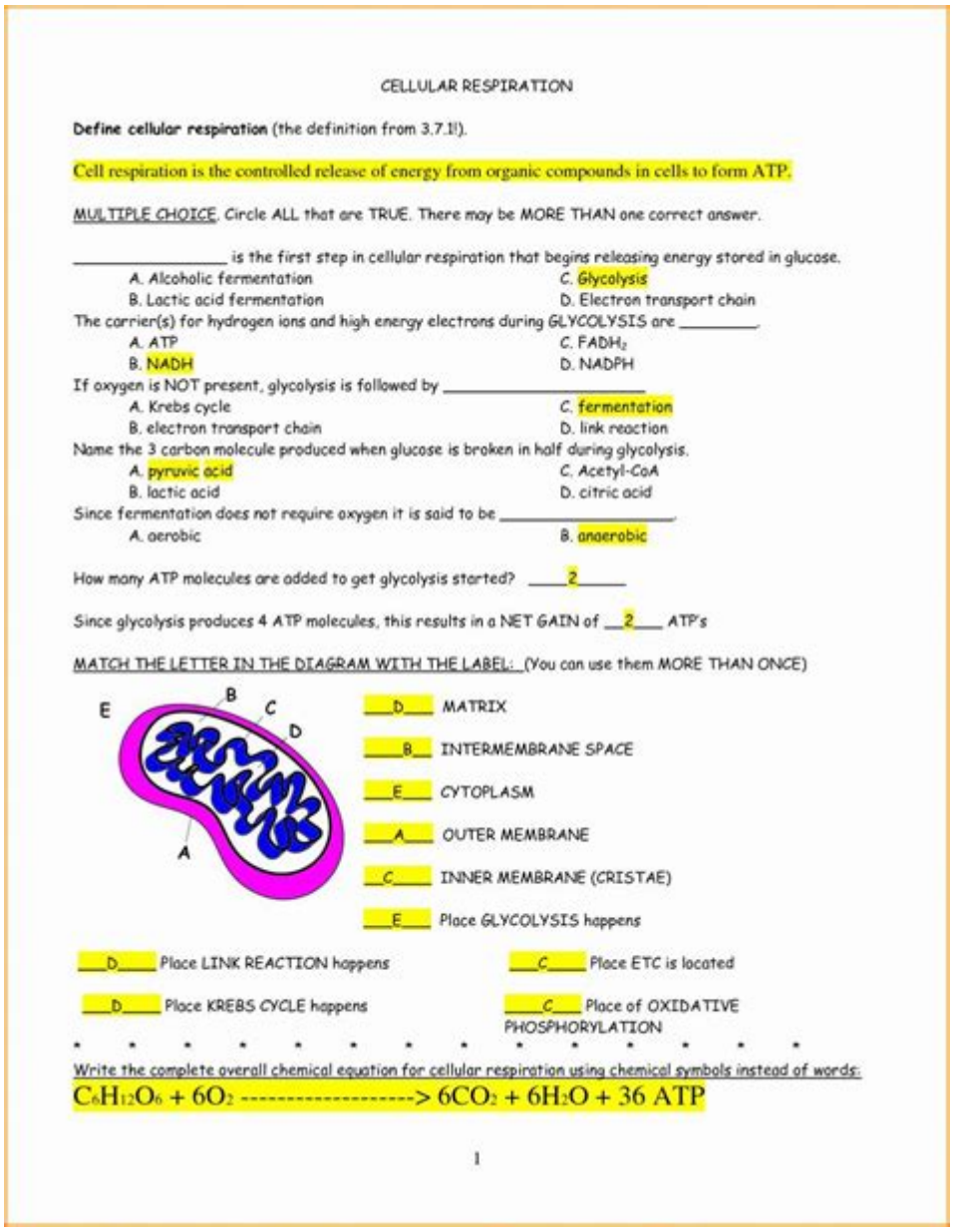
Energy Photosynthesis And Cellular Respiration Worksheet Answer Key



CELLULAR RESPIRATION

Define cellular respiration (the definition from 3.7.II).

Cell respiration is the controlled release of energy from organic compounds in cells to form ATP.

MULTIPLE CHOICE. Circle ALL that are TRUE. There may be MORE THAN one correct answer.

_____ is the first step in cellular respiration that begins releasing energy stored in glucose.
A. Alcoholic fermentation
B. Lactic acid fermentation
C. Glycolysis
D. Electron transport chain

The carrier(s) for hydrogen ions and high energy electrons during GLYCOLYSIS are _____.
A. ATP
B. NADH
C. $FADH_2$
D. NADPH

If oxygen is NOT present, glycolysis is followed by _____
A. Krebs cycle
B. electron transport chain
C. fermentation
D. link reaction

Name the 3 carbon molecule produced when glucose is broken in half during glycolysis.
A. pyruvic acid
B. lactic acid
C. Acetyl-CoA
D. citric acid

Since fermentation does not require oxygen it is said to be _____.
A. aerobic
B. anaerobic

How many ATP molecules are added to get glycolysis started? ___2___

Since glycolysis produces 4 ATP molecules, this results in a NET GAIN of __2__ ATP's

MATCH THE LETTER IN THE DIAGRAM WITH THE LABEL: (You can use them MORE THAN ONCE)

___D___ MATRIX
___B___ INTERMEMBRANE SPACE
___E___ CYTOPLASM
___A___ OUTER MEMBRANE
___C___ INNER MEMBRANE (CRISTAE)
___E___ Place GLYCOLYSIS happens

___D___ Place LINK REACTION happens
___C___ Place ETC is located
___D___ Place KREBS CYCLE happens
___C___ Place of OXIDATIVE PHOSPHORYLATION

Write the complete overall chemical equation for cellular respiration using chemical symbols instead of words:

$C_6H_{12}O_6 + 6O_2$ ----------> $6CO_2 + 6H_2O + 36$ ATP

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Energy photosynthesis and cellular respiration worksheet answer key is an essential resource for students studying the fundamental biological processes that sustain life on Earth. Photosynthesis and cellular respiration are interconnected processes that facilitate the transformation of energy, enabling plants to produce glucose and oxygen while organisms utilize these products to generate energy. This article examines the key concepts of these processes, common questions found in worksheets, and provides a detailed answer key that can aid in understanding these critical biological functions.

Understanding Photosynthesis

Photosynthesis is the process by which green plants, algae, and certain bacteria convert light energy into chemical energy stored in glucose. This process primarily occurs in the chloroplasts of plant cells and involves two main stages: the light-dependent reactions and the light-independent reactions (Calvin cycle).

1. The Light-Dependent Reactions

- Location: Thylakoid membranes of the chloroplasts.
- Key Inputs:
- Light energy (from the sun)
- Water (H_2O)
- $NADP^+$
- ADP (adenosine diphosphate)

- Key Outputs:
- Oxygen (O_2, released as a byproduct)
- ATP (adenosine triphosphate)
- NADPH (reduced nicotinamide adenine dinucleotide phosphate)

The light-dependent reactions harness sunlight to split water molecules, releasing oxygen and generating ATP and NADPH, which are essential for the next stage of photosynthesis.

2. The Calvin Cycle (Light-Independent Reactions)

- Location: Stroma of the chloroplasts.
- Key Inputs:
- Carbon dioxide (CO_2)
- ATP (from light-dependent reactions)
- NADPH (from light-dependent reactions)

- Key Outputs:
- Glucose ($C_6H_{12}O_6$)
- ADP (which is recycled back to the light-dependent reactions)
- $NADP^+$ (which is recycled back to the light-dependent reactions)

The Calvin cycle uses the ATP and NADPH produced in the light-dependent reactions to convert carbon dioxide into glucose, a vital energy source for the plant and other organisms.

Understanding Cellular Respiration

Cellular respiration is a metabolic process in which organisms convert biochemical energy from nutrients into ATP, releasing waste products. This process occurs in three main stages: glycolysis, the Krebs cycle, and oxidative phosphorylation (electron transport chain).

1. Glycolysis

- Location: Cytoplasm of the cell.
- Key Inputs:
- Glucose ($C_6H_{12}O_6$)
- 2 NAD^+
- 2 ATP (investment phase)

- Key Outputs:
- 2 Pyruvate ($C_3H_4O_3$)
- 4 ATP (net gain of 2 ATP)
- 2 NADH (reduced form of NAD^+)

Glycolysis breaks down glucose into two molecules of pyruvate, releasing energy stored in ATP and NADH.

2. Krebs Cycle (Citric Acid Cycle)

- Location: Mitochondrial matrix.
- Key Inputs:
- Acetyl-CoA (derived from pyruvate)
- NAD^+
- FAD (flavin adenine dinucleotide)
- ADP

- Key Outputs:
- 2 CO_2 (as byproducts)
- 3 NADH
- 1 $FADH_2$
- 1 ATP (or GTP)

The Krebs cycle processes acetyl-CoA, producing electron carriers (NADH and $FADH_2$) and small amounts of ATP while releasing carbon dioxide.

3. Oxidative Phosphorylation (Electron Transport

Chain)

- Location: Inner mitochondrial membrane.
- Key Inputs:
- NADH and $FADH_2$ (from glycolysis and the Krebs cycle)
- Oxygen (O_2)

- Key Outputs:
- Approximately 28-34 ATP (depending on the cell type)
- Water (H_2O, formed when electrons combine with oxygen)

In oxidative phosphorylation, electrons from NADH and $FADH_2$ travel through a series of proteins, driving the production of ATP while oxygen serves as the final electron acceptor, forming water.

Relationship Between Photosynthesis and Cellular Respiration

Photosynthesis and cellular respiration are crucial to the energy cycle in ecosystems. The products of one process are the reactants of the other, creating a continuous flow of energy and matter.

- Photosynthesis Equation:
$$
6CO_2 + 6H_2O + light \, energy \rightarrow C_6H_{12}O_6 + 6O_2
$$

- Cellular Respiration Equation:
$$
C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP \, energy
$$

The glucose and oxygen produced through photosynthesis are used in cellular respiration to generate ATP, while the carbon dioxide and water produced in cellular respiration are utilized in photosynthesis.

Common Worksheet Questions and Answer Key

Below are examples of questions that might appear in a worksheet on energy photosynthesis and cellular respiration, along with their corresponding answers.

Question 1: What are the main products of photosynthesis?

Answer: The main products of photosynthesis are glucose ($C_6H_{12}O_6$) and oxygen (O_2).

Question 2: Where does glycolysis occur, and what is its primary function?

Answer: Glycolysis occurs in the cytoplasm of the cell, and its primary function is to break down glucose into pyruvate while generating a net gain of ATP and NADH.

Question 3: Describe the role of oxygen in cellular respiration.

Answer: Oxygen serves as the final electron acceptor in the electron transport chain during oxidative phosphorylation. It combines with electrons and protons to form water, which is crucial for maintaining the flow of electrons and the production of ATP.

Question 4: Explain the significance of ATP in cellular processes.

Answer: ATP (adenosine triphosphate) is the primary energy carrier in cells. It provides the energy required for various cellular processes, including muscle contraction, active transport, and biosynthesis.

Question 5: How do photosynthesis and cellular respiration contribute to the carbon cycle?

Answer: Photosynthesis absorbs carbon dioxide from the atmosphere to produce glucose, while cellular respiration releases carbon dioxide back into the atmosphere. This interplay helps regulate atmospheric CO_2 levels and supports life by cycling carbon through ecosystems.

Conclusion

The processes of photosynthesis and cellular respiration are integral to the survival of living organisms and the energy flow within ecosystems. The energy photosynthesis and cellular respiration worksheet answer key serves as a valuable tool for students to grasp these complex biological processes. Understanding the mechanisms and products of these processes not only

enhances comprehension of biology but also underscores the importance of plants and organisms in sustaining life on Earth. As such, mastering these concepts is crucial for students pursuing studies in the biological sciences, environmental studies, and related fields.

Frequently Asked Questions

What is the primary purpose of photosynthesis?

The primary purpose of photosynthesis is to convert light energy from the sun into chemical energy in the form of glucose, which plants use for growth and energy.

What are the main stages of photosynthesis?

The main stages of photosynthesis are the light-dependent reactions and the light-independent reactions (Calvin cycle).

What is the equation for cellular respiration?

The equation for cellular respiration is C6H12O6 + 6O2 -> 6CO2 + 6H2O + ATP, which represents the conversion of glucose and oxygen into carbon dioxide, water, and energy (ATP).

How are photosynthesis and cellular respiration interconnected?

Photosynthesis and cellular respiration are interconnected because the products of photosynthesis (glucose and oxygen) are the reactants for cellular respiration, and vice versa, creating a cycle of energy transfer.

What role does chlorophyll play in photosynthesis?

Chlorophyll is the pigment in plants that absorbs light energy, primarily from the sun, which is essential for the photosynthesis process to occur.

What are the byproducts of photosynthesis?

The byproducts of photosynthesis are glucose and oxygen, which are released into the environment.

What is ATP and why is it important?

ATP (adenosine triphosphate) is the energy currency of the cell, providing energy for various cellular processes, including those involved in both photosynthesis and cellular respiration.

What factors can affect the rate of photosynthesis?

Factors that can affect the rate of photosynthesis include light intensity, carbon dioxide concentration, temperature, and the availability of water.

What is anaerobic respiration and how does it differ from aerobic respiration?

Anaerobic respiration occurs without oxygen and produces less energy (ATP) compared to aerobic respiration, which uses oxygen to generate more ATP from glucose.

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