

Cellular Respiration And Photosynthesis Study Guide Answers

Name _____ Date _____ Class _____

CHAPTER 8

Study Guide

Section 3: Cellular Respiration

In your textbook, read about cellular respiration and glycolysis.

Use each of the terms below only once to complete the passage.

~~aerobic~~ ~~anaerobic~~ ~~ATP~~ ~~cellular respiration~~ ~~cytoplasm~~ ~~energy~~
~~glucose~~ ~~glycolysis~~ ~~mitochondria~~ ~~NADH~~ ~~oxygen~~

Organisms obtain energy in a process called (1) cellular respiration. This process harvests electrons from carbon compounds, such as (2) glucose, and uses that energy to make (3) ATP. ATP is used to provide (4) energy for cells to do work. In (5) glycolysis, glucose is broken down into pyruvate. Glycolysis is a(n) (6) anaerobic process because it does not require oxygen. Glycolysis takes place in the (7) cytoplasm. Two molecules of ATP and two molecules of (8) NADH are formed for every glucose molecule that is broken down. (9) Aerobic respiration takes place in the (10) mitochondria. It is aerobic because the process requires (11) oxygen.

Refer to the diagram of glycolysis. Label the steps in the description to match the diagram.

12. Step 4. Each three-carbon compound is converted into a three-carbon pyruvate.
13. Step 2. A six-carbon compound is broken down into two three-carbon compounds.
14. Step 1. Phosphate groups from two ATP molecules are transferred to a glucose molecule.
15. Step 3. Two NADH molecules and four ATP molecules are produced.

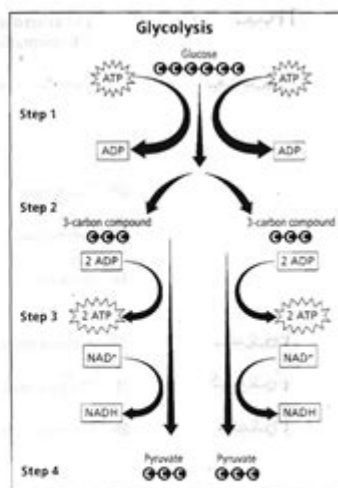
Respond to each question.

16. Interpret How many total ATP molecules are produced from the glycolysis of one six-carbon glucose?

2 net ATP, 4 are produced.

17. Explain Why is there a net gain of only two ATP molecules in the glycolysis of one six-carbon glucose?

4 are produced, but 2 are used to for ADP + P; so a net gain of 2 ATP



Unit 2

CHAPTER 8 Cellular Energy 91

CELLULAR RESPIRATION AND PHOTOSYNTHESIS STUDY GUIDE ANSWERS ARE CRUCIAL FOR UNDERSTANDING THE FUNDAMENTAL PROCESSES THAT SUSTAIN LIFE ON EARTH. THESE TWO BIOLOGICAL PROCESSES ARE INTERCONNECTED AND PLAY A VITAL ROLE IN ENERGY TRANSFORMATION WITHIN LIVING ORGANISMS. THIS ARTICLE WILL PROVIDE A COMPREHENSIVE STUDY GUIDE COVERING THE ESSENTIAL ELEMENTS OF CELLULAR RESPIRATION AND PHOTOSYNTHESIS, INCLUDING THEIR DEFINITIONS, PROCESSES, EQUATIONS, AND SIGNIFICANCE.

OVERVIEW OF CELLULAR RESPIRATION

CELLULAR RESPIRATION IS THE PROCESS BY WHICH CELLS CONVERT GLUCOSE AND OXYGEN INTO ENERGY. THIS ENERGY IS STORED IN THE FORM OF ADENOSINE TRIPHOSPHATE (ATP), WHICH IS USED BY CELLS TO PERFORM VARIOUS FUNCTIONS.

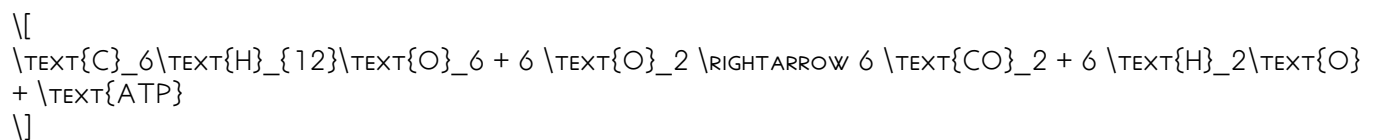
KEY STAGES OF CELLULAR RESPIRATION

CELLULAR RESPIRATION OCCURS IN THREE MAIN STAGES:

1. **GLYCOLYSIS:** THIS PROCESS TAKES PLACE IN THE CYTOPLASM AND BREAKS DOWN GLUCOSE INTO PYRUVATE, PRODUCING A SMALL AMOUNT OF ATP AND NADH.
2. **KREBS CYCLE (CITRIC ACID CYCLE):** OCCURRING IN THE MITOCHONDRIA, THIS CYCLE PROCESSES PYRUVATE INTO CARBON DIOXIDE WHILE GENERATING ATP, NADH, AND FADH_2 .
3. **ELECTRON TRANSPORT CHAIN (ETC):** THIS FINAL STAGE OCCURS IN THE INNER MITOCHONDRIAL MEMBRANE, WHERE ELECTRONS FROM NADH AND FADH_2 ARE TRANSFERRED THROUGH A SERIES OF PROTEINS, LEADING TO THE PRODUCTION OF A LARGE AMOUNT OF ATP AND WATER.

CELLULAR RESPIRATION EQUATION

THE OVERALL EQUATION FOR CELLULAR RESPIRATION CAN BE SUMMARIZED AS:



THIS EQUATION ILLUSTRATES THAT GLUCOSE AND OXYGEN ARE CONVERTED INTO CARBON DIOXIDE, WATER, AND ENERGY (ATP).

TYPES OF CELLULAR RESPIRATION

THERE ARE TWO MAIN TYPES OF CELLULAR RESPIRATION:

- **AEROBIC RESPIRATION:** THIS TYPE REQUIRES OXYGEN AND PRODUCES A SIGNIFICANT AMOUNT OF ATP.
- **ANAEROBIC RESPIRATION:** THIS OCCURS IN THE ABSENCE OF OXYGEN, RESULTING IN LESS ATP PRODUCTION AND BYPRODUCTS LIKE LACTIC ACID OR ETHANOL.

OVERVIEW OF PHOTOSYNTHESIS

PHOTOSYNTHESIS IS THE PROCESS BY WHICH GREEN PLANTS, ALGAE, AND SOME BACTERIA CONVERT LIGHT ENERGY INTO CHEMICAL ENERGY STORED IN GLUCOSE. THIS PROCESS PRIMARILY OCCURS IN THE CHLOROPLASTS OF PLANT CELLS.

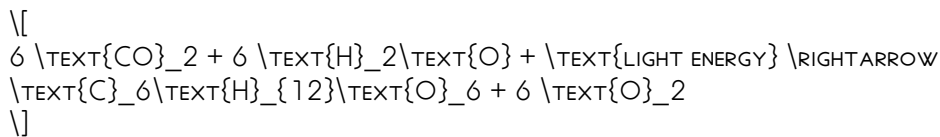
KEY STAGES OF PHOTOSYNTHESIS

PHOTOSYNTHESIS CONSISTS OF TWO MAIN STAGES:

1. **LIGHT-DEPENDENT REACTIONS:** THESE REACTIONS OCCUR IN THE THYLAKOID MEMBRANES OF THE CHLOROPLASTS AND REQUIRE SUNLIGHT. THEY CONVERT LIGHT ENERGY INTO CHEMICAL ENERGY, PRODUCING ATP AND NADPH WHILE RELEASING OXYGEN AS A BYPRODUCT.
2. **CALVIN CYCLE (LIGHT-INDEPENDENT REACTIONS):** THIS CYCLE TAKES PLACE IN THE STROMA OF THE CHLOROPLASTS AND USES ATP AND NADPH PRODUCED IN THE LIGHT-DEPENDENT REACTIONS TO CONVERT CARBON DIOXIDE INTO GLUCOSE.

PHOTOSYNTHESIS EQUATION

THE OVERALL EQUATION FOR PHOTOSYNTHESIS CAN BE SUMMARIZED AS:



THIS EQUATION EMPHASIZES THAT CARBON DIOXIDE AND WATER, IN THE PRESENCE OF LIGHT ENERGY, ARE TRANSFORMED INTO GLUCOSE AND OXYGEN.

IMPORTANCE OF PHOTOSYNTHESIS

PHOTOSYNTHESIS IS CRITICAL FOR SEVERAL REASONS:

- **OXYGEN PRODUCTION:** PHOTOSYNTHESIS GENERATES OXYGEN, WHICH IS ESSENTIAL FOR THE SURVIVAL OF AEROBIC ORGANISMS.
- **ENERGY SOURCE:** IT PROVIDES THE PRIMARY ENERGY SOURCE FOR NEARLY ALL LIVING ORGANISMS ON EARTH, EITHER DIRECTLY OR INDIRECTLY.
- **CARBON DIOXIDE REDUCTION:** PHOTOSYNTHESIS HELPS REGULATE ATMOSPHERIC CARBON DIOXIDE LEVELS, MITIGATING CLIMATE CHANGE EFFECTS.

INTERCONNECTION BETWEEN CELLULAR RESPIRATION AND PHOTOSYNTHESIS

CELLULAR RESPIRATION AND PHOTOSYNTHESIS ARE INTERCONNECTED PROCESSES THAT CYCLE ENERGY AND MATTER THROUGH ECOSYSTEMS.

HOW THEY RELATE

1. **ENERGY FLOW:** THE ENERGY CAPTURED DURING PHOTOSYNTHESIS IS STORED IN THE CHEMICAL BONDS OF GLUCOSE. THIS ENERGY IS THEN RELEASED DURING CELLULAR RESPIRATION TO FUEL CELLULAR ACTIVITIES.
2. **MATTER CYCLING:** THE PRODUCTS OF PHOTOSYNTHESIS (GLUCOSE AND OXYGEN) SERVE AS THE REACTANTS FOR CELLULAR RESPIRATION, WHILE THE PRODUCTS OF CELLULAR RESPIRATION (CARBON DIOXIDE AND WATER) ARE USED IN PHOTOSYNTHESIS.
3. **BALANCE IN ECOSYSTEMS:** TOGETHER, THESE PROCESSES CREATE A BALANCE IN THE ECOSYSTEM. PLANTS PRODUCE OXYGEN AND GLUCOSE, WHICH ANIMALS CONSUME, WHILE ANIMALS PRODUCE CARBON DIOXIDE AND WATER, WHICH PLANTS USE.

STUDY TIPS FOR UNDERSTANDING CELLULAR RESPIRATION AND PHOTOSYNTHESIS

TO MASTER THE CONCEPTS OF CELLULAR RESPIRATION AND PHOTOSYNTHESIS, CONSIDER THE FOLLOWING STUDY TIPS:

- **VISUAL AIDS:** UTILIZE DIAGRAMS TO VISUALIZE THE PROCESSES, INCLUDING FLOWCHARTS THAT ILLUSTRATE EACH STAGE OF CELLULAR RESPIRATION AND PHOTOSYNTHESIS.
- **FLASHCARDS:** CREATE FLASHCARDS FOR KEY TERMS AND EQUATIONS RELATED TO BOTH PROCESSES FOR QUICK REVIEW.
- **PRACTICE QUESTIONS:** ENGAGE IN PRACTICE QUESTIONS THAT COVER BOTH TOPICS, FOCUSING ON THE STEPS, EQUATIONS, AND SIGNIFICANCE OF EACH PROCESS.
- **GROUP STUDY:** DISCUSS AND EXPLAIN CONCEPTS WITH PEERS TO REINFORCE UNDERSTANDING AND CLARIFY DOUBTS.
- **REAL-WORLD APPLICATIONS:** RELATE THE CONCEPTS TO REAL-WORLD EXAMPLES, SUCH AS THE IMPORTANCE OF PLANTS IN OXYGEN PRODUCTION AND FOOD CHAINS.

COMMON MISCONCEPTIONS

SEVERAL MISCONCEPTIONS CAN HINDER UNDERSTANDING OF CELLULAR RESPIRATION AND PHOTOSYNTHESIS. HERE ARE A FEW TO BE AWARE OF:

- **PHOTOSYNTHESIS ONLY OCCURS DURING THE DAY:** WHILE IT IS TRUE THAT LIGHT-DEPENDENT REACTIONS REQUIRE SUNLIGHT, THE CALVIN CYCLE CAN OCCUR AT NIGHT USING STORED ATP AND NADPH.
- **ALL ORGANISMS USE PHOTOSYNTHESIS:** ONLY PHOTOSYNTHETIC ORGANISMS, SUCH AS PLANTS AND CERTAIN BACTERIA, PERFORM THIS PROCESS. ANIMALS RELY ON CELLULAR RESPIRATION TO OBTAIN ENERGY.
- **RESPIRATION IS THE SAME AS BREATHING:** CELLULAR RESPIRATION IS A BIOCHEMICAL PROCESS THAT OCCURS AT THE CELLULAR LEVEL, WHILE BREATHING IS A PHYSICAL PROCESS INVOLVING GAS EXCHANGE IN ORGANISMS.

CONCLUSION

IN SUMMARY, UNDERSTANDING **CELLULAR RESPIRATION AND PHOTOSYNTHESIS STUDY GUIDE ANSWERS** IS ESSENTIAL FOR GRASPING HOW ENERGY IS TRANSFORMED AND UTILIZED IN LIVING ORGANISMS. BOTH PROCESSES ARE VITAL FOR LIFE ON EARTH, CONTRIBUTING TO ENERGY FLOW AND MATTER CYCLING WITHIN ECOSYSTEMS. BY MASTERING THE KEY STAGES, EQUATIONS, AND SIGNIFICANCE OF THESE PROCESSES, STUDENTS CAN GAIN A DEEPER APPRECIATION OF THE BIOLOGICAL WORLD AND ITS INTERCONNECTEDNESS. REMEMBER TO UTILIZE EFFECTIVE STUDY STRATEGIES, CLARIFY MISCONCEPTIONS, AND RELATE CONCEPTS TO REAL-WORLD APPLICATIONS TO ENHANCE YOUR UNDERSTANDING.

FREQUENTLY ASKED QUESTIONS

WHAT ARE THE MAIN STAGES OF CELLULAR RESPIRATION?

THE MAIN STAGES OF CELLULAR RESPIRATION ARE GLYCOLYSIS, THE KREBS CYCLE (CITRIC ACID CYCLE), AND THE ELECTRON TRANSPORT CHAIN.

HOW DOES PHOTOSYNTHESIS DIFFER FROM CELLULAR RESPIRATION?

PHOTOSYNTHESIS CONVERTS LIGHT ENERGY INTO CHEMICAL ENERGY STORED IN GLUCOSE, WHILE CELLULAR RESPIRATION BREAKS DOWN GLUCOSE TO RELEASE ENERGY FOR CELLULAR ACTIVITIES.

WHAT IS THE ROLE OF CHLOROPHYLL IN PHOTOSYNTHESIS?

CHLOROPHYLL IS A PIGMENT THAT ABSORBS LIGHT ENERGY, PRIMARILY FROM THE BLUE AND RED WAVELENGTHS, AND IS ESSENTIAL FOR CONVERTING LIGHT ENERGY INTO CHEMICAL ENERGY DURING PHOTOSYNTHESIS.

WHAT ARE THE PRODUCTS OF GLYCOLYSIS?

THE PRODUCTS OF GLYCOLYSIS ARE 2 PYRUVATE MOLECULES, 2 ATP, AND 2 NADH.

WHAT IS THE FORMULA FOR PHOTOSYNTHESIS?

THE FORMULA FOR PHOTOSYNTHESIS IS $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{LIGHT ENERGY} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$.

WHY IS OXYGEN IMPORTANT IN CELLULAR RESPIRATION?

OXYGEN IS THE FINAL ELECTRON ACCEPTOR IN THE ELECTRON TRANSPORT CHAIN, ALLOWING FOR THE PRODUCTION OF ATP THROUGH OXIDATIVE PHOSPHORYLATION.

WHAT IS THE SIGNIFICANCE OF THE CALVIN CYCLE IN PHOTOSYNTHESIS?

THE CALVIN CYCLE IS SIGNIFICANT BECAUSE IT CONVERTS CARBON DIOXIDE AND OTHER COMPOUNDS INTO GLUCOSE, USING ATP AND NADPH PRODUCED DURING THE LIGHT-DEPENDENT REACTIONS.

HOW DO CELLULAR RESPIRATION AND PHOTOSYNTHESIS RELATE TO EACH OTHER?

CELLULAR RESPIRATION AND PHOTOSYNTHESIS ARE COMPLEMENTARY PROCESSES; THE PRODUCTS OF PHOTOSYNTHESIS (GLUCOSE AND OXYGEN) ARE THE REACTANTS FOR CELLULAR RESPIRATION, AND VICE VERSA.

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