

Campbell Biology Chapter 7 Study Guide

Campbell Biology Chapter 7 Study Guide Campbell Biology Chapter 7 Study Guide Cellular Respiration Harvesting Chemical Energy This study guide will help you understand the core concepts presented in Chapter 7 of Campbell Biology focusing on cellular respiration the process by which living organisms break down organic molecules to generate energy I Energy for Life What is metabolism Metabolism encompasses all chemical reactions that occur within a living organism It is a complex network of anabolic and catabolic pathways that allow organisms to maintain life grow and reproduce What is energy Energy is the ability to do work and living organisms require a constant supply of energy to sustain these processes How do organisms acquire energy Organisms obtain energy from their surroundings Autotrophs like plants convert light energy into chemical energy through photosynthesis Heterotrophs like animals obtain energy by consuming other organisms II Cellular Respiration The Breakdown of Glucose What is cellular respiration Cellular respiration is a catabolic process that breaks down glucose a simple sugar in the presence of oxygen to generate energy in the form of ATP adenosine triphosphate What is the overall equation for cellular respiration $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ Energy ATP What are the four main stages of cellular respiration 1 Glycolysis Occurs in the cytoplasm breaking down glucose into pyruvate generating a small amount of ATP and NADH a highenergy electron carrier 2 Pyruvate Oxidation Occurs in the mitochondrial matrix converting pyruvate into acetyl CoA generating NADH 3 Citric Acid Cycle Krebs Cycle Also occurs in the mitochondrial matrix oxidizing acetyl CoA and generating ATP NADH and FADH₂ another electron carrier 4 Electron Transport Chain ETC Occurs across the inner mitochondrial membrane utilizing the highenergy electrons

from NADH and FADH₂ to pump protons creating a concentration gradient that powers ATP synthesis

2 III The Role of Electron Carriers What are electron carriers Electron carriers like NADH and FADH₂ are molecules that transport high-energy electrons from one stage of cellular respiration to another How do electron carriers work They gain electrons during oxidation reactions becoming reduced and storing energy They then release these electrons during reduction reactions releasing energy

IV Oxidative Phosphorylation The Powerhouse of the Cell What is oxidative phosphorylation It is the process that produces the majority of ATP during cellular respiration driven by the movement of electrons down the electron transport chain and the proton gradient established across the mitochondrial membrane What is ATP synthase ATP synthase is a protein complex embedded in the inner mitochondrial membrane that uses the proton gradient to synthesize ATP from ADP and inorganic phosphate

V Anaerobic Respiration What is anaerobic respiration Anaerobic respiration occurs in the absence of oxygen It uses molecules other than oxygen as final electron acceptors such as sulfate or nitrate This process generates less ATP than aerobic respiration What is fermentation Fermentation is a type of anaerobic respiration that utilizes pyruvate as the final electron acceptor It occurs in the cytoplasm and generates lactic acid or ethanol depending on the organism

VI Energy Flow in Ecosystems How does cellular respiration connect to the flow of energy in ecosystems Cellular respiration is essential for energy flow in all living organisms It allows organisms to break down organic molecules and release energy which is then used for growth movement and other vital processes This energy transfer forms the basis of food chains and food webs

VII Review Questions

- 1 What are the products of glycolysis
- 2 Where in the cell does the citric acid cycle take place
- 3 What is the role of NADH and FADH₂ in cellular respiration
- 4 What is the difference between aerobic and anaerobic respiration
- 5 How does ATP synthase work
- 6 Explain the importance of electron carriers in the electron transport chain
- 3 7 Describe the relationship between cellular respiration and photosynthesis
- 8 Why is cellular respiration essential for life

VIII Key Terms Metabolism Catabolism Anabolism Cellular Respiration Glycolysis Pyruvate Oxidation Citric Acid Cycle

Electron Transport Chain Oxidative Phosphorylation ATP Synthase Electron Carriers Anaerobic Respiration Fermentation IX Additional Resources Campbell Biology Textbook 11th Edition Khan Academy Cellular Respiration Bozeman Science Cellular Respiration This study guide provides a solid framework for understanding Chapter 7 of Campbell Biology By carefully studying the material and engaging with the review questions you will be wellprepared to grasp the complexities of cellular respiration and its significance in the context of life

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