GENERAL

ap biology chapter 11 guided reading answers

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AP Biology Chapter 11 Guided Reading Answers: A Comprehensive Study Guide

For students preparing for the Advanced Placement (AP) Biology exam, mastering Chapter 11—**Metabolism: Energy Flow in Cells**—is essential. The chapter covers the fundamental processes that sustain life, from glycolysis to the citric acid cycle and oxidative phosphorylation. Guided reading questions are designed to deepen comprehension, sharpen analytical skills, and reinforce the core concepts that frequently appear on the exam. This article offers a detailed walkthrough of the chapter, explains why guided reading is crucial, provides example answers, and shares study strategies that will help you ace the AP Biology test.

Understanding AP Biology Chapter 11

What Is Chapter 11 About?

Chapter 11 focuses on the biochemical pathways that convert food molecules into usable energy. Students learn how glucose, fatty acids, and amino acids are broken down in the cytoplasm and mitochondria to produce adenosine triphosphate (ATP), the universal energy currency. The chapter also explores how cells regulate these pathways, the role of enzymes, and the impact of metabolic disorders.

Key Biological Concepts Covered

- Glycolysis – The initial stage of glucose metabolism, occurring in the cytoplasm.
- Link Reaction – The conversion of pyruvate to acetyl-CoA before entering the citric acid cycle.
- Citric Acid Cycle (Krebs Cycle) – The series of reactions that generate NADH, FADH2, and GTP.
- Oxidative Phosphorylation – The electron transport chain and chemiosmotic coupling that produce the bulk of ATP.
- Photosynthetic Pathways – Light-dependent reactions and the Calvin cycle in autotrophs.
- Enzyme Regulation – Allosteric control, covalent modification, and feedback inhibition.
- Metabolic Pathway Integration – How catabolic and anabolic pathways are linked and balanced.

Guided Reading Questions: Why They Matter

Purpose of Guided Reading

Guided reading questions are more than a simple review exercise. They:

1. Encourage critical thinking by asking you to interpret data, analyze mechanisms, and predict outcomes.
2. Test conceptual understanding rather than rote memorization, mirroring the style of the AP exam.
3. Help you identify knowledge gaps early, allowing targeted study sessions.
4. Provide practice with multiple-choice and free-response formats that are common on the AP test.

Types of Questions You'll Encounter

Guided reading questions for Chapter 11 typically fall into the following categories:

- Diagram Interpretation – Labeling steps in glycolysis or the electron transport chain.
- Data Analysis – Interpreting enzyme kinetics or metabolic flux data.

- Conceptual Application – Predicting the effect of a mutation on ATP yield.
- Comparative Questions – Comparing aerobic vs. anaerobic pathways.
- Real-World Context – Relating metabolic disorders to clinical scenarios.

Sample Guided Reading Answers

Below, we provide detailed answers to three representative guided reading questions. These examples illustrate the depth of reasoning expected on the AP exam and serve as a template for tackling similar problems.

Question 1: Diagram Interpretation – Glycolysis

Prompt: Label the following diagram with the correct names of the enzymes and the intermediates of glycolysis, and indicate the net production of ATP and NADH.

Answer:

1. **Hexokinase** – phosphorylates glucose to glucose 6 phosphate.

2. **Phosphoglucose isomerase** – converts glucose 6 phosphate to fructose 6 phosphate.

3. **Phosphofructokinase 1 (PFK 1)** – phosphorylates fructose 6 phosphate to fructose 1,6 bisphosphate.

4. **Aldolase** – splits fructose 1,6 bisphosphate into glyceraldehyde 3 phosphate (G3P) and dihydroxyacetone phosphate (DHAP).

5. **Triose phosphate isomerase** – converts DHAP to G3P.

6. **Glyceraldehyde 3 phosphate dehydrogenase** – oxidizes G3P, producing 1,3 bisphosphoglycerate and reducing NAD+ to NADH.

7. **Phosphoglycerate kinase** – transfers a phosphate to ADP, forming ATP and 3 phosphoglycerate.

8. **Phosphoglycerate mutase** – converts 3 phosphoglycerate to 2 phosphoglycerate.

9. **Enolase** – dehydrates 2 phosphoglycerate to phosphoenolpyruvate (PEP).

10. **Pyruvate kinase** – transfers a phosphate from PEP to ADP, producing ATP and pyruvate.

Net Production: 2 ATP (substrate level phosphorylation) and 2 NADH per glucose molecule.

Question 2: Conceptual Application – Effect of PFK 1 Inhibition

Prompt:A mutation reduces the activity of phosphofructokinase 1 (PFK 1) by 50%. Predict the impact on cellular ATP yield and explain the physiological consequences in a muscle cell during intense exercise.

Answer:

PFK 1 catalyzes the committed step of glycolysis: the phosphorylation of fructose 6 phosphate to fructose 1,6 bisphosphate. A 50% reduction in its activity slows the entire glycolytic flux. Consequently:

1. **Reduced ATP Production** – Since glycolysis is the primary source of ATP during anaerobic exercise, the net ATP yield drops by roughly 50% (from 2 ATP per glucose to ~1 ATP).
2. **Accumulation of Upstream Metabolites** – Glucose 6 phosphate and fructose 6 phosphate build up, potentially leading to increased glycogen synthesis if the pathway is not saturated.
3. **Shift Toward Anaerobic Metabolism** – The muscle cell will rely more heavily on lactate production to regenerate NAD+, leading to lactic acidosis and fatigue.
4. **Compensatory Mechanisms** – The cell may upregulate alternative pathways such as the pentose

phosphate pathway to produce NADPH, but this does not compensate for ATP loss.

Physiologically, the muscle experiences decreased endurance, faster onset of muscle fatigue, and a higher likelihood of metabolic disorders such as McArdle disease, where muscle glycogen breakdown is impaired.

Question 3: Data Analysis – Electron Transport Chain Efficiency

Prompt:A researcher measures the oxygen consumption rate of isolated mitochondria under two conditions: normal and with a partial uncoupler that increases proton leak. The data show a 30% increase in oxygen consumption but a 50% decrease in ATP synthesis. Explain the biochemical basis for these observations.

Answer:

The electron transport chain (ETC) drives ATP synthesis by creating a proton gradient across the inner mitochondrial membrane. A partial uncoupler, such as FCCP, disrupts this gradient by allowing protons to re-enter the matrix without passing through ATP synthase. The consequences are:

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