Biology – Energy, Enzymes, Cellular Respiration, Photosynthesis, and Metabolic Pathways Practice Test (Sample)

Study Guide

BY EXAMZIFY

Everything you need from our exam experts!

Notice: Examzify makes every reasonable effort to obtain accurate, complete, and timely information about this product from reliable sources.

Table of Contents

Introduction

Preparing for a certification exam can feel overwhelming, but with the right tools, it becomes an opportunity to build confidence, sharpen your skills, and move one step closer to your goals. At Examzify, we believe that effective exam preparation isn’t just about memorization, it’s about understanding the material, identifying knowledge gaps, and building the test-taking strategies that lead to success.

This guide was designed to help you do exactly that.

Whether you’re preparing for a licensing exam, professional certification, or entry-level qualification, this book offers structured practice to reinforce key concepts. You’ll find a wide range of multiple-choice questions, each followed by clear explanations to help you understand not just the right answer, but why it’s correct.

The content in this guide is based on real-world exam objectives and aligned with the types of questions and topics commonly found on official tests. It’s ideal for learners who want to:

- **Practice answering questions under realistic conditions,**
- **Improve accuracy and speed,**
- **Review explanations to strengthen weak areas, and**
- **Approach the exam with greater confidence.**

We recommend using this book not as a stand-alone study tool, but alongside other resources like flashcards, textbooks, or hands-on training. For best results, we recommend working through each question, reflecting on the explanation provided, and revisiting the topics that challenge you most.

Remember: successful test preparation isn’t about getting every question right the first time, it’s about learning from your mistakes and improving over time. Stay focused, trust the process, and know that every page you turn brings you closer to success.

Let’s begin.

How to Use This Guide

This guide is designed to help you study more effectively and approach your exam with confidence. Whether you're reviewing for the first time or doing a final refresh, here's how to get the most out of your Examzify study guide:

1. Start with a Diagnostic Review

Skim through the questions to get a sense of what you know and what you need to focus on. Your goal is to identify knowledge gaps early.

2. Study in Short, Focused Sessions

Break your study time into manageable blocks (e.g. 30 – 45 minutes). Review a handful of questions, reflect on the explanations.

3. Learn from the Explanations

After answering a question, always read the explanation, even if you got it right. It reinforces key points, corrects misunderstandings, and teaches subtle distinctions between similar answers.

4. Track Your Progress

Use bookmarks or notes (if reading digitally) to mark difficult questions. Revisit these regularly and track improvements over time.

5. Simulate the Real Exam

Once you're comfortable, try taking a full set of questions without pausing. Set a timer and simulate test-day conditions to build confidence and time management skills.

6. Repeat and Review

Don't just study once, repetition builds retention. Re-attempt questions after a few days and revisit explanations to reinforce learning. Pair this guide with other Examzify tools like flashcards, and digital practice tests to strengthen your preparation across formats.

There's no single right way to study, but consistent, thoughtful effort always wins. Use this guide flexibly, adapt the tips above to fit your pace and learning style. You've got this!

Questions

1. **Which plant type fixes carbon through a four-carbon compound to minimize photorespiration?**
   - A. CAM plants
   - B. C3 plants
   - C. C4 plants
   - D. All plants

2. **What is the direct source of energy for ATP produced by ATP synthase?**
   - A. The NADH directly provides ATP
   - B. Light energy
   - C. The proton gradient
   - D. The chemical energy from glucose

3. **Which region of a chloroplast captures light energy?**
   - A. The stroma.
   - B. The outer membrane.
   - C. The thylakoid membrane.
   - D. The chloroplast DNA.

4. **What is the overall flow of electrons in the light reactions?**
   - A. The flow is from water to NADPH.
   - B. The flow is from NADPH to water.
   - C. The flow is from oxygen to water.
   - D. The flow is from NADPH to ATP.

5. **Which plant type fixes carbon at night to reduce water loss?**
   - A. C3 plants
   - B. CAM plants
   - C. C4 plants
   - D. All plants

6. In photosynthesis, the energy stored as ATP and NADPH as a result of light-dependent reactions is later used in which process?
   A. The Calvin cycle.
   B. Fermentation.
   C. Glycolysis in the cytoplasm.
   D. Oxidative phosphorylation.

7. What is the function of photosystem I in noncyclic photosynthesis?
   A. Photosystem I reduces NADP+.
   B. Photosystem I splits water.
   C. Photosystem I captures carbon dioxide.
   D. Photosystem I pumps protons to generate ATP directly.

8. Which of the following statements about ATP and NADPH produced during the light reactions is accurate?
   A. They are used to break down starch into glucose.
   B. They pass back to the thylakoid lumen to generate more protons.
   C. They are used by the Calvin cycle to synthesize carbohydrates.
   D. They are converted into carbon dioxide and water.

9. What is the role of NAD+ in cellular respiration?
   A. It provides phosphate groups
   B. It functions as an electron carrier
   C. It is a structural component of membranes
   D. It is the enzyme that catalyzes glucose breakdown

10. Which statement best describes autotrophs?
   A. Autotrophs rely on organic compounds produced by others.
   B. Autotrophs convert chemical energy into ATP.
   C. Autotrophs require sunlight to drive chemical energy.
   D. Autotrophs convert energy from sunlight into chemical energy.

Answers

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

Explanations

1. Which plant type fixes carbon through a four-carbon compound to minimize photorespiration?

A. CAM plants

B. C3 plants

C. C4 plants

D. All plants

Concentrating CO_2 around the enzyme that fixes carbon is how this strategy reduces wasteful photorespiration. In C4 plants, CO_2 is first fixed in the mesophyll cells by PEP carboxylase into a four-carbon compound (oxaloacetate, usually converted to malate). This four-carbon molecule is then transported to bundle-sheath cells, where it is decarboxylated to release CO_2 directly near the Calvin cycle. The locally high CO_2 concentration minimizes RuBisCO's oxygenase activity, so less carbon is lost to photorespiration. This spatial separation—fixation in one cell type and decarboxylation in another—lets C4 plants photosynthesize efficiently even when stomata are partially closed in hot, dry conditions. CAM plants also use four-carbon acids, but they do so by fixing CO_2 at night and storing it as acids, providing temporal separation. The question's mechanism—four-carbon fixation to minimize photorespiration in a daytime CO_2-rich environment—points to C4 plants.

2. What is the direct source of energy for ATP produced by ATP synthase?

A. The NADH directly provides ATP

B. Light energy

C. The proton gradient

D. The chemical energy from glucose

The direct energy source for ATP synthase is the proton gradient across the membrane, also known as the proton motive force. In respiration and photosynthesis, electron transport chains push protons across the membrane, creating a high H^+ concentration on one side and an electrical potential. When protons flow back through ATP synthase, their movement drives the rotation of the enzyme's rotor and induces conformational changes that synthesize ATP from ADP and inorganic phosphate. Light energy can initiate and sustain gradient formation in photosynthesis, but the energy actually used by ATP synthase is the stored gradient itself. Nutrients like glucose or carriers like NADH provide the energy to build that gradient, not the energy to power ATP synthase directly.

3. Which region of a chloroplast captures light energy?

A. The stroma.

B. The outer membrane.

C. The thylakoid membrane.

D. The chloroplast DNA.

Light energy capture happens in the thylakoid membrane, the internal membrane system of the chloroplast. This membrane hosts chlorophyll and other pigments arranged into photosystems that absorb light, excite electrons, and drive the electron transport chain. The resulting energy transfer creates a proton gradient across the membrane, powering ATP synthase to make ATP, and also enables NADP+ reduction to NADPH. The stroma is the surrounding fluid where the Calvin cycle uses those energy carriers to fix carbon. The outer membrane is simply a boundary, and chloroplast DNA stores genetic information rather than participating in light capture.

4. What is the overall flow of electrons in the light reactions?

A. The flow is from water to NADPH.

B. The flow is from NADPH to water.

C. The flow is from oxygen to water.

D. The flow is from NADPH to ATP.

In the light reactions, electrons originate from water. Photosystem II uses light energy to split water (photolysis), releasing oxygen as a byproduct and supplying electrons to the photosynthetic electron transport chain. These electrons travel through the chain—via plastoquinone, the cytochrome b6f complex, and plastocyanin—to photosystem I, where they are re-energized by light and ultimately reduce NADP+ to NADPH through NADP+ reductase. While this flow of electrons ends at NADPH, the light-driven proton pumping across the thylakoid membrane also creates a gradient that powers ATP synthesis. So the overall flow of electrons is from water to NADPH.

5. Which plant type fixes carbon at night to reduce water loss?

A. C3 plants

B. CAM plants

C. C4 plants

D. All plants

CAM plants fix carbon at night to reduce water loss because they open their stomata after dark when temperatures are cooler and humidity is higher, which minimizes transpiration. The carbon dioxide is fixed into organic acids (like malic acid) and stored in vacuoles overnight. During the day, the stomata stay closed to conserve water, and the stored acids release CO_2 for the Calvin cycle using the energy from daylight. This nocturnal carbon fixation is a key adaptation for surviving in dry, hot environments. In contrast, C3 plants fix CO_2 directly during the day with more water loss, and C4 plants separate carbon fixation spatially to reduce photorespiration but still transpire mainly in daylight.

6. In photosynthesis, the energy stored as ATP and NADPH as a result of light-dependent reactions is later used in which process?

A. The Calvin cycle.

B. Fermentation.

C. Glycolysis in the cytoplasm.

D. Oxidative phosphorylation.

The energy carriers ATP and NADPH produced during the light-dependent reactions power carbon fixation and sugar synthesis in the Calvin cycle. In the Calvin cycle, ATP provides the chemical energy to drive the phosphorylation steps, while NADPH supplies reducing power to convert the fixed carbon into glyceraldehyde-3-phosphate and other sugars. This process happens in the chloroplast stroma and ultimately builds carbohydrate molecules from carbon dioxide using the energy captured from light. Other processes listed are part of cellular respiration or fermentation and rely on different carriers (like NADH or FADH2) and different steps. They don't use the ATP and NADPH generated by the light reactions to fix carbon, so they aren't driven by the energy stored during photosynthesis in the way the Calvin cycle is.

7. What is the function of photosystem I in noncyclic photosynthesis?

A. Photosystem I reduces NADP+.

B. Photosystem I splits water.

C. Photosystem I captures carbon dioxide.

D. Photosystem I pumps protons to generate ATP directly.

Photosystem I's job in noncyclic photosynthesis is to use light energy to re-energize electrons and transfer them to NADP+, forming NADPH. This NADPH provides the reducing power needed to convert carbon dioxide into sugars in the Calvin cycle. It doesn't split water (that's done by Photosystem II), it doesn't fix CO2 directly (that happens in the Calvin cycle with ATP and NADPH), and it doesn't pump protons to make ATP directly (ATP comes from the proton gradient built up mainly by the earlier steps and then used by ATP synthase). So reducing NADP+ to NADPH is the key function of Photosystem I here.

8. **Which of the following statements about ATP and NADPH produced during the light reactions is accurate?**

   A. They are used to break down starch into glucose.

   B. They pass back to the thylakoid lumen to generate more protons.

   C. They are used by the Calvin cycle to synthesize carbohydrates.

   D. They are converted into carbon dioxide and water.

ATP and NADPH from the light reactions supply the energy and reducing power the Calvin cycle needs to build sugars. In the stroma, ATP provides the energy to drive the phosphorylation steps that convert fixed carbon, while NADPH donates electrons to reduce 3-phosphoglycerate to glyceraldehyde-3-phosphate. This triose phosphate can then be used to synthesize carbohydrates such as glucose, starch, or sucrose. They aren't used to break down starch, nor do they travel back into the thylakoid lumen to pump more protons, and they aren't converted into carbon dioxide and water. So using ATP and NADPH in the Calvin cycle to make carbohydrates is the correct description of their role.

9. **What is the role of NAD+ in cellular respiration?**

   A. It provides phosphate groups

   B. It functions as an electron carrier

   C. It is a structural component of membranes

   D. It is the enzyme that catalyzes glucose breakdown

The main idea is that NAD+ acts as an electron carrier in cellular respiration. During glycolysis, pyruvate oxidation, and the citric acid cycle, NAD+ accepts electrons (and a proton) to become NADH. This captures high-energy electrons that are later passed to the electron transport chain, where their energy helps pump protons across the membrane to drive ATP synthesis. NAD+ is then regenerated from NADH as electrons flow through the chain, allowing these metabolic pathways to continue. It's not a source of phosphate groups, not a membrane structural component, and not an enzyme that breaks down glucose. That carrier role is what makes NAD+ essential for energy production.

10. Which statement best describes autotrophs?

- **A. Autotrophs rely on organic compounds produced by others.**
- **B. Autotrophs convert chemical energy into ATP.**
- **C. Autotrophs require sunlight to drive chemical energy.**
- **D. Autotrophs convert energy from sunlight into chemical energy.**

Autotrophs are organisms that make their own organic molecules from inorganic sources, using energy to drive that process. The classic picture is capturing energy to build sugars: photoautotrophs harvest light energy to convert it into chemical energy stored in organic molecules. That's why the statement about converting energy from sunlight into chemical energy best describes autotrophs in the common sense—light provides the energy input for building stored chemical energy in sugars. It's true that some autotrophs (chemoautotrophs) don't rely on sunlight and instead use energy from chemical reactions, but the general concept highlighted here is the conversion of light energy into chemical energy. The other options miss key points: relying on organic compounds from others describes heterotrophs, converting chemical energy into ATP is a general cellular process not unique to autotrophs, and requiring sunlight would exclude chemoautotrophs.

Next Steps

Congratulations on reaching the final section of this guide. You've taken a meaningful step toward passing your certification exam and advancing your career.

As you continue preparing, remember that consistent practice, review, and self-reflection are key to success. Make time to revisit difficult topics, simulate exam conditions, and track your progress along the way.

If you need help, have suggestions, or want to share feedback, we'd love to hear from you. Reach out to our team at hello@examzify.com.

Or visit your dedicated course page for more study tools and resources:

https://bioenergyenzymescellrespiration.examzify.com

We wish you the very best on your exam journey. You've got this!