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

Study Guide

Everything you need from our exam experts!

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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. **What happens if there are holes in the inner membrane of mitochondria?**

   A. ATP synthesis would speed up.

   B. Oxygen would be produced.

   C. NADH would increase.

   D. It would stop ATP synthesis and electron transport.

2. **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.

3. **Which statement about glycolysis is true?**

   A. It occurs in the cytoplasm

   B. It occurs in the mitochondria

   C. It requires oxygen to proceed

   D. It uses water as a reactant

4. **During noncyclic electron flow, which component ultimately reduces NADP+ to NADPH?**

   A. Photosystem II.

   B. The water-splitting complex.

   C. Photosystem I.

   D. Cyclic electron flow.

5. **Which of the following is a plausible implication of Netrin-1 signaling disruption in colorectal tissue?**

   A. Decreased risk of cancer

   B. No effect on cell fate

   C. Immediate tissue repair

   D. Tumor formation

6. What is the function of a protein kinase?

A. Adds phosphates to proteins.

B. Removes phosphates from proteins.

C. Transports proteins across membranes.

D. Catalyzes the breakdown of ATP.

7. What is the function of a protein phosphatase?

A. Adds phosphates to proteins.

B. Removes phosphates from proteins.

C. Degrades proteins.

D. Transports proteins across membranes.

8. Which statement describes the difference between intracellular and membrane receptors?

A. An intracellular receptor cannot bind ligand.

B. A membrane receptor binds DNA directly to regulate transcription.

C. An intracellular receptor binds a ligand and can bind DNA; a membrane receptor cannot.

D. A membrane receptor is located in the cytosol and never associated with membranes.

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

A. C3 plants

B. CAM plants

C. C4 plants

D. All plants

10. What is the consequence of Netrin-1 receptor loss on signaling pathways as related to cancer risk?

A. It stabilizes the pathways

B. It disrupts signaling regulating growth and apoptosis leading to tumor formation

C. It enhances photosynthesis

D. It prevents necrosis

Answers

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

Explanations

1. What happens if there are holes in the inner membrane of mitochondria?

A. ATP synthesis would speed up.

B. Oxygen would be produced.

C. NADH would increase.

D. It would stop ATP synthesis and electron transport.

The question tests how the proton gradient across the inner mitochondrial membrane drives ATP production. Electron transport pumps protons from the matrix into the intermembrane space, building a proton-motive force (electrochemical gradient) that powers ATP synthase to convert ADP to ATP as protons flow back into the matrix. If holes appear in the inner membrane, protons would leak back into the matrix, collapsing this gradient. Without a maintained proton-motive force, ATP synthase cannot function, and the energy source driving the electron transport chain is lost too, so both ATP production and the ongoing electron transport would stop.

2. 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.

3. Which statement about glycolysis is true?

A. It occurs in the cytoplasm

B. It occurs in the mitochondria

C. It requires oxygen to proceed

D. It uses water as a reactant

Glycolysis takes place in the cytoplasm. It's the first step of glucose breakdown and does not require oxygen, so it can proceed under anaerobic conditions. During glycolysis, one glucose is split into two pyruvate molecules, yielding a net gain of 2 ATP and 2 NADH per glucose. The mitochondria aren't involved in glycolysis itself; they become important in later steps (like the citric acid cycle and oxidative phosphorylation) that rely on oxygen to harvest more energy. Also, water is produced in a step of glycolysis (2-phosphoglycerate to phosphoenolpyruvate releases water), not consumed, so using water as a reactant isn't correct.

4. During noncyclic electron flow, which component ultimately reduces NADP+ to NADPH?

A. Photosystem II.

B. The water-splitting complex.

C. Photosystem I.

D. Cyclic electron flow.

Noncyclic electron flow moves electrons from water through PSII and the electron transport chain to PSI, where light energy boosts them again and they are ultimately delivered to NADP+ to form NADPH. The key step is after electrons reach Photosystem I: the excited electrons are passed to ferredoxin and then to NADP+ via NADP+ reductase, producing NADPH. So Photosystem I is the component that ultimately reduces NADP+ to NADPH. The earlier components (the water-splitting complex and Photosystem II) supply electrons but do not directly reduce NADP+. Cyclic electron flow, on the other hand, recycles electrons to generate more ATP and does not produce NADPH.

5. Which of the following is a plausible implication of Netrin-1 signaling disruption in colorectal tissue?

A. Decreased risk of cancer

B. No effect on cell fate

C. Immediate tissue repair

D. Tumor formation

Netrin-1 helps coordinate cell survival and proper organization in colorectal epithelium by signaling through dependence receptors like DCC and UNC5. When netrin-1 is present, these receptors suppress apoptosis, helping cells persist in a controlled pattern that maintains tissue structure. If netrin-1 signaling is disrupted, the usual checks on cell fate and proliferation become destabilized. In a tissue that already carries mutations or experiences inflammatory signals, this instability can drive abnormal cell growth, loss of architectural control, and accumulation of further mutations, increasing the likelihood of neoplastic transformation and tumor formation. So tumor formation is a plausible implication because disrupting netrin-1 signaling can undermine normal regulation of cell survival and tissue organization, creating conditions that favor cancer development. The other options don't fit as well: disrupting this pathway is not expected to lower cancer risk, have no effect on cell fate, or lead to immediate, flawless tissue repair.

6. What is the function of a protein kinase?

A. Adds phosphates to proteins.

B. Removes phosphates from proteins.

C. Transports proteins across membranes.

D. Catalyzes the breakdown of ATP.

Protein kinases regulate cellular activities by transferring a phosphate group from ATP to specific amino acids on target proteins, usually serine, threonine, or tyrosine. This phosphorylation changes the protein's charge and shape, which can turn its activity on or off, alter how it interacts with other molecules, or determine where it localizes in the cell. Because phosphorylation is reversible, phosphatases can remove the phosphate, allowing precise control of signaling pathways. The other options don't describe this regulatory role: removing phosphates is done by phosphatases, transporting proteins across membranes is the job of transporter proteins, and catalyzing the breakdown of ATP is done by ATPases, not kinases.

7. What is the function of a protein phosphatase?

A. Adds phosphates to proteins.

B. Removes phosphates from proteins.

C. Degrades proteins.

D. Transports proteins across membranes.

Phosphatases catalyze the removal of phosphate groups from proteins, reversing phosphorylation and helping to turn signaling events off or tune their strength. Phosphorylation by kinases often changes a protein's activity, interactions, or location, so phosphatases reset those changes by hydrolyzing the phosphate bond. Some target serine or threonine residues, others tyrosine residues, reflecting different substrate specificities. This clearly fits the idea that the function is to remove phosphates; adding phosphates is done by kinases, degrading proteins is proteolysis, and transporting proteins across membranes is carried out by transporters.

8. Which statement describes the difference between intracellular and membrane receptors?

A. An intracellular receptor cannot bind ligand.

B. A membrane receptor binds DNA directly to regulate transcription.

C. An intracellular receptor binds a ligand and can bind DNA; a membrane receptor cannot.

D. A membrane receptor is located in the cytosol and never associated with membranes.

Localization and mechanism of signaling differentiate intracellular and membrane receptors. Intracellular receptors reside inside the cell (in the cytosol or nucleus) and bind ligands that can cross the cell membrane, such as steroid hormones. After binding, they often act directly as transcription factors and can bind to DNA to regulate gene expression. That direct DNA-binding capability is a hallmark of many intracellular receptors. Membrane receptors, by contrast, sit in the plasma membrane. They bind their ligands outside the cell and initiate signaling cascades inside the cell, typically through second messengers or phosphorylation events, which then influence cellular responses. They do not usually bind DNA directly themselves; transcriptional changes arise from downstream signaling rather than direct DNA interaction. So the statement that fits best is that an intracellular receptor binds a ligand and can bind DNA, whereas a membrane receptor cannot. The other options are inconsistent with this fundamental distinction: intracellular receptors do bind ligands, membrane receptors do not bind DNA directly, and membrane receptors are defined by their membrane localization, not by being free in the cytosol.

9. 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.

10. What is the consequence of Netrin-1 receptor loss on signaling pathways as related to cancer risk?

A. It stabilizes the pathways

B. It disrupts signaling regulating growth and apoptosis leading to tumor formation

C. It enhances photosynthesis

D. It prevents necrosis

Netrin-1 receptors act as dependence receptors that help decide cell fate based on whether netrin-1 is present. When netrin-1 is absent, these receptors can trigger apoptotic pathways; when netrin-1 binds, they promote survival and proper growth signaling. If the receptors are lost, the normal balance of growth and programmed cell death is disrupted. The pro-apoptotic signal that would eliminate stressed or misattached cells is weakened, allowing abnormal cells to survive and continue to proliferate, which raises cancer risk. This loss also perturbs growth-regulating signals, contributing to tumor formation. The other options don't fit because they describe unrelated or opposite effects: stabilizing signaling isn't the result of receptor loss, photosynthesis isn't relevant to this signaling context, and preventing necrosis doesn't capture the essential impact on apoptosis and growth control.

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!