ACS BIOCHEMISTRY PRACTICE EXAM (SAMPLE)

STUDY GUIDE

SAMPLE STUDY GUIDE WITH LIMITED QUESTIONS

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. What effects do PKA and phosphatase have on ACC (acetyl-CoA carboxylase)?

A. Inhibition by PKA and activation by phosphatase

B. Activation by PKA and inhibition by phosphatase

C. No effect on ACC activity

D. Both inhibit ACC activity

2. When glucose undergoes phosphorylation in glycolysis, what molecule is produced?

A. Fructose 6-phosphate.

B. Glucose 6-phosphate.

C. Fructose 1,6-bisphosphate.

D. Glyceraldehyde 3-phosphate.

3. What effect does CO2 binding have on hemoglobin?

A. It increases hemoglobin's oxygen affinity

B. It stabilizes the R-state of hemoglobin

C. It shifts hemoglobin to the T-state

D. It has no impact on its functionality

4. In the urea cycle, what is the initial substrate converted into carbamoyl phosphate?

A. Ornithine

B. Acetyl-CoA

C. Glutamate

D. Aspartate

5. What change occurs in Step 2 of the epinephrine signal transduction pathway?

A. GDP is replaced by ATP

B. GDP bound to α-subunit is replaced by GTP

C. The GPCR is inactivated

D. The α-subunit binds to RNA polymerase

6. What is a key characteristic of ω-oxidation in fatty acid metabolism?

A. It occurs only at one end of the fatty acid molecule.

B. It is similar to β-oxidation but occurs on both ends of the molecule.

C. It is the main pathway for all fatty acids.

D. It produces only saturated fatty acids.

7. Which component allows for the binding of PKA to various signaling proteins?

A. GAP

B. AKAP

C. RTK

D. cAMP

8. Which enzyme is responsible for the conversion of fructose 2,6-bisphosphate to fructose 6-phosphate?

A. PFK-1

B. PAT

C. FBPase-2

D. Pyruvate kinase

9. What role does the Pi-Triose Phosphate anti-porter play in plant cells?

A. It exports NADH to the cytosol

B. It helps in the export of G3P

C. It maintains Pi balance in chloroplasts and cytosol

D. It converts malate into oxaloacetate

10. During the electron transport process, which cofactor is utilized by Complex I?

A. FAD

B. NAD+

C. FMN

D. Coenzyme A

Answers

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

Explanations

1. What effects do PKA and phosphatase have on ACC (acetyl-CoA carboxylase)?

A. Inhibition by PKA and activation by phosphatase

B. Activation by PKA and inhibition by phosphatase

C. No effect on ACC activity

D. Both inhibit ACC activity

Acetyl-CoA carboxylase (ACC) plays a crucial role in fatty acid metabolism by catalyzing the conversion of acetyl-CoA to malonyl-CoA, which is a key step in fatty acid synthesis. The regulation of ACC is tightly controlled by various factors, including protein kinases and phosphatases. Protein Kinase A (PKA) primarily operates through the phosphorylation of ACC, which results in its inactivation. When cellular energy levels are low, and there is an increase in the concentration of signaling molecules like glucagon or epinephrine, PKA is activated and phosphorylates ACC, thereby inhibiting its activity. This serves to decrease fatty acid synthesis when energy needs are high. Conversely, phosphatases play a complementary role by dephosphorylating ACC. When ACC is dephosphorylated, its activity is restored, leading to increased production of malonyl-CoA, and promoting fatty acid synthesis. This dephosphorylation by phosphatases can be stimulated by conditions that indicate sufficient energy within the cell. Overall, PKA inhibits ACC through phosphorylation, while phosphatases activate it by removing phosphate groups. This dynamic regulation ensures that fatty acid synthesis is promoted when energy

2. When glucose undergoes phosphorylation in glycolysis, what molecule is produced?

A. Fructose 6-phosphate.

B. Glucose 6-phosphate.

C. Fructose 1,6-bisphosphate.

D. Glyceraldehyde 3-phosphate.

When glucose undergoes phosphorylation in glycolysis, it is converted to glucose 6-phosphate. This reaction is catalyzed by the enzyme hexokinase (or glucokinase in the liver) and is the first step in the glycolytic pathway. The phosphorylation of glucose occurs when a phosphate group from ATP is transferred to the glucose molecule. This conversion is critical because it effectively traps glucose within the cell, as glucose 6-phosphate cannot easily cross the cell membrane and is also a substrate for various metabolic pathways. The formation of glucose 6-phosphate marks the beginning of glycolysis, enabling subsequent transformations of glucose to start producing energy for the cell. This phosphorylation reaction not only aids in glucose retention within the cell but also serves to regulate metabolism by marking the molecule for further processing in glycolysis or other pathways, like the pentose phosphate pathway. Understanding this step is essential, as it highlights the importance of enzymatic regulation and energy investment in the process of glycolysis. The other molecules mentioned are products of later steps in the glycolytic pathway, thus emphasizing the significance of glucose 6-phosphate as a vital intermediate in cellular metabolism.

3. What effect does CO_2 binding have on hemoglobin?

A. It increases hemoglobin's oxygen affinity

B. It stabilizes the R-state of hemoglobin

C. It shifts hemoglobin to the T-state

D. It has no impact on its functionality

When carbon dioxide (CO_2) binds to hemoglobin, it has a significant influence on its conformation and function. CO_2 binding promotes the transition of hemoglobin from the relaxed (R-state) to the tense (T-state) conformation. The T-state is associated with lower affinity for oxygen. This is part of the Bohr effect, where increased levels of CO_2 in tissues promote oxygen release from hemoglobin, thus aiding in the delivery of oxygen to areas of high metabolic activity where CO_2 concentration is elevated. The binding of CO_2 to hemoglobin occurs primarily at the amino terminal of the globin chains, forming carbamino compounds, which facilitates the switch to the T-state. In this state, hemoglobin is less effective at binding oxygen, allowing for more efficient oxygen unloading to tissues that require it. This mechanism is crucial for effective gas exchange and maintenance of acid-base balance in the blood. The other choices do not accurately describe the impact of CO_2 on hemoglobin's functionality. Thus, the correct understanding is that CO_2 binding leads to a stabilization of the T-state, enhancing the release of oxygen where it is most needed.

4. In the urea cycle, what is the initial substrate converted into carbamoyl phosphate?

A. Ornithine

B. Acetyl-CoA

C. Glutamate

D. Aspartate

In the urea cycle, the substrate that is converted into carbamoyl phosphate is glutamate. The process begins in the mitochondria of liver cells, where ammonia (NH_3), produced primarily from the deamination of amino acids, reacts with bicarbonate (HCO_3^-) to form carbamoyl phosphate. This reaction is catalyzed by the enzyme carbamoyl phosphate synthetase I, and it requires two molecules of ATP. Glutamate plays a critical role in the urea cycle as it provides the nitrogen needed for the formation of carbamoyl phosphate. The conversion of ammonia into carbamoyl phosphate is a key step that prepares it for incorporation into the urea cycle, ultimately facilitating the detoxification of ammonia through the production of urea. Thus, the correct answer is linked to the essential function of glutamate in nitrogen metabolism, underscoring its importance in the urea cycle.

5. What change occurs in Step 2 of the epinephrine signal transduction pathway?

A. GDP is replaced by ATP

B. GDP bound to α-subunit is replaced by GTP

C. The GPCR is inactivated

D. The α-subunit binds to RNA polymerase

In Step 2 of the epinephrine signal transduction pathway, the critical change involves the replacement of GDP bound to the α-subunit of the G protein with GTP. This transition is significant because it activates the G protein, which is essential for propagating the signal initiated by the binding of epinephrine to its receptor (a G protein-coupled receptor, or GPCR). When epinephrine binds to the GPCR, a conformational change is induced in the receptor. This causes the associated G protein to exchange GDP for GTP on the α-subunit. The binding of GTP not only activates the G protein but also triggers the dissociation of the α-subunit from the β and γ subunits. The α-GTP complex can then interact with other downstream effectors in the pathway, such as adenylate cyclase, leading to the production of cyclic AMP (cAMP) and amplification of the cellular response to epinephrine. This process is foundational to how cellular signaling works, illustrating the dynamic role of G proteins in mediating signals from external stimuli to produce internal cellular responses.

6. What is a key characteristic of ω-oxidation in fatty acid metabolism?

A. It occurs only at one end of the fatty acid molecule.

B. It is similar to β-oxidation but occurs on both ends of the molecule.

C. It is the main pathway for all fatty acids.

D. It produces only saturated fatty acids.

The correct choice highlights that ω-oxidation, occurring primarily in the endoplasmic reticulum of liver and kidney cells, does indeed have similarities to β-oxidation but is distinct in its mechanism. Specifically, in ω-oxidation, the oxidation starts at the terminal carbon atom of the fatty acid, as opposed to β-oxidation, which initiates oxidation at the β-carbon (the carbon adjacent to the carboxyl group). The presence of similar enzymatic reactions and steps in both processes contributes to this comparison. In the context of fatty acid metabolism, ω-oxidation primarily serves as a minor pathway, especially for medium- and long-chain fatty acids that may have difficulty undergoing β-oxidation due to issues such as mitochondrial dysfunction. It results in the production of dicarboxylic acids, which can enter other metabolic pathways. This stands in contrast to the options that suggest limitations or incorrect characteristics of ω-oxidation, such as being exclusive to one end of the molecule or being the main pathway for all fatty acids, which does not accurately reflect its role in metabolism. Additionally, it's not focused solely on generating saturated fatty acids, as ω-oxidation can yield various fatty acid derivatives depending on the substrates involved

7. Which component allows for the binding of PKA to various signaling proteins?

A. GAP

B. AKAP

C. RTK

D. cAMP

The binding of Protein Kinase A (PKA) to various signaling proteins is facilitated by A-kinase anchoring proteins (AKAPs). These proteins serve as scaffolds that localize PKA to specific regions within the cell, ensuring that the kinase is in proximity to its substrates and other signaling molecules. AKAPs contain specific binding domains that interact with the regulatory subunits of PKA, thereby anchoring the holoenzyme complex (the regulatory and catalytic subunits of PKA) to particular locations in the cell. This spatial organization is crucial because it allows for efficient signaling by concentrating the activity of PKA and its substrate proteins. For instance, PKA can phosphorylate target proteins involved in processes such as metabolism, gene expression, and cell division, based on the localized signal received. The other components mentioned serve different roles in cellular signaling. For example, GAP (GTPase-activating protein) is involved in the regulation of GTPases, which are important for various signaling pathways but do not specifically bind PKA. Receptor Tyrosine Kinases (RTKs) are involved in signal transduction through phosphorylation of tyrosine residues but do not interact directly with PKA for localization. Cyclic AMP (cAMP

8. Which enzyme is responsible for the conversion of fructose 2,6-bisphosphate to fructose 6-phosphate?

A. PFK-1

B. PAT

C. FBPase-2

D. Pyruvate kinase

The enzyme responsible for the conversion of fructose 2,6-bisphosphate to fructose 6-phosphate is fructose bisphosphatase-2 (FBPase-2). This enzyme plays a crucial role in the regulation of glucose metabolism, particularly in gluconeogenesis. Fructose 2,6-bisphosphate is a potent allosteric regulator of the glycolytic enzyme phosphofructokinase-1 (PFK-1) and also has an inverse relationship with fructose bisphosphatase-1 (FBPase-1), which is involved in gluconeogenesis. When fructose 2,6-bisphosphate is present, it promotes glycolysis by activating PFK-1 while inhibiting FBPase-1, thus reducing the conversion of fructose 1,6-bisphosphate back to fructose 6-phosphate. Conversely, the action of FBPase-2 converts fructose 2,6-bisphosphate to fructose 6-phosphate, thereby reducing the levels of fructose 2,6-bisphosphate and promoting gluconeogenesis. In summary, FBPase-2 is specifically tasked with converting fruct

9. What role does the Pi-Triose Phosphate anti-porter play in plant cells?

A. It exports NADH to the cytosol

B. It helps in the export of G3P

C. It maintains Pi balance in chloroplasts and cytosol

D. It converts malate into oxaloacetate

The Pi-Triose Phosphate anti-porter plays a critical role in maintaining the phosphate (Pi) balance between chloroplasts and the cytosol in plant cells. During photosynthesis, the triose phosphate (G3P) produced in the chloroplasts needs to be transported to the cytosol for various metabolic processes, including the synthesis of carbohydrates. The anti-porter functions by exchanging triose phosphates for inorganic phosphate, thus allowing the export of G3P while importing Pi to balance the concentrations on both sides of the membrane. This balance of Pi is essential because it ensures that the appropriate levels of phosphate are available for downstream metabolic processes, such as ATP synthesis and phosphorylation reactions that are vital for energy metabolism and biosynthesis in the plant cell. Without this balance provided by the Pi-Triose Phosphate anti-porter, the efficiency of photosynthesis and the overall metabolism of the plant could be compromised. The focus of this mechanism emphasizes the importance of phosphate transport and energy management within plant cells, highlighting the anti-porter's role in optimizing both chloroplast and cytosolic functions.

10. During the electron transport process, which cofactor is utilized by Complex I?

A. FAD

B. NAD+

C. FMN

D. Coenzyme A

Complex I of the electron transport chain, also known as NADH:ubiquinone oxidoreductase, primarily utilizes FMN (flavin mononucleotide) as a cofactor. During the process, electrons from NADH are transferred to FMN, which is then reduced to FMNH2. This step is crucial because it helps initiate the transfer of electrons through the complex towards coenzyme Q (ubiquinone), facilitating subsequent proton pumping and contributing to the establishment of the proton gradient that is crucial for ATP synthesis. FMN plays a vital role in this process because it can accept and donate electrons, effectively functioning as a mediator between the now-reduced NADH and the further electron carriers in the chain. Its ability to exist in multiple oxidation states enhances its suitability for this rapid electron transfer, supporting the overall efficiency of cellular respiration and energy production.

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://acsbiochem.examzify.com

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