Molecular Genetics Practice Exam (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. DNA's shape is described as a double what?

A. Alpha helix

B. Double helix

C. Beta sheet

D. Random coil

2. In the trp operon, what molecule acts as the corepressor by binding to the repressor?

A. Tryptase

B. Guanine

C. Tryptophan

D. Thymine

3. Which model describes DNA replication where each new double helix consists of one original strand and one newly synthesized strand?

A. Conservative

B. Dispersive

C. Semiconservative

D. Conjugative

4. What term refers to the repetitive DNA at chromosome ends that protect genetic information during cell division?

A. DNA polymerase III

B. Amino acid

C. rRNA

D. Telomere

5. Which base type has a single ring in nucleic acids?

A. Adenine

B. Guanine

C. Purine

D. Pyrimidine

6. Which genetic element in bacteria is commonly used to carry antibiotic resistance genes?

A. Chromosome

B. Plasmid

C. Nucleoid

D. Ribosome

7. What term refers to the region found at the center of a chromosome where the sister chromatids are held together?

A. Centromere

B. Telomere

C. Chromatid

D. Kinetochore

8. Type of sugar in DNA?

A. Ribose

B. Glucose

C. Mannose

D. Deoxyribose

9. Which mutation involves the two DNA strands flipping positions, or turning around?

A. Transversion

B. Deletion

C. Inversion

D. Duplication

10. Which enzyme is responsible for laying down RNA primers during DNA replication?

A. DNA polymerase

B. Ligase

C. Helicase

D. Primase

Answers

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

Explanations

1. DNA's shape is described as a double what?

A. Alpha helix

B. Double helix

C. Beta sheet

D. Random coil

DNA's shape is a double helix. It consists of two long polynucleotide strands wound around each other, with the sugar–phosphate backbones on the outside and the bases paired inside the helix. The strands run in opposite directions (antiparallel) and twist in a right-handed manner in the common form, giving the characteristic double-helix appearance. This structure explains how genetic information is stored and faithfully copied: bases pair specifically—adenine with thymine via two hydrogen bonds, and guanine with cytosine via three—holding the two strands together and enabling accurate replication. The other terms describe protein structures or unstructured regions, not DNA: an alpha helix and a beta sheet are protein secondary structures, while a random coil refers to a lack of defined structure. That's why "double helix" is the best descriptor for DNA's shape.

2. In the trp operon, what molecule acts as the corepressor by binding to the repressor?

A. Tryptase

B. Guanine

C. Tryptophan

D. Thymine

Tryptophan acts as the corepressor. When tryptophan is plentiful, it binds to the repressor protein, changing its shape so the repressor can attach to the operator region of the trp operon. This prevents RNA polymerase from initiating transcription, stopping the production of enzymes needed to synthesize tryptophan. Tryptase is not involved in this regulation, and guanine or thymine are DNA bases not functioning as the regulatory corepressor in this system.

3. Which model describes DNA replication where each new double helix consists of one original strand and one newly synthesized strand?

A. Conservative

B. Dispersive

C. Semiconservative

D. Conjugative

DNA replication that preserves one original strand in each new double helix is semiconservative replication. In this mode, the two parental DNA strands separate, and each strand serves as a template for synthesizing a new complementary strand. The result is two DNA molecules, each composed of one old (parental) strand and one newly synthesized strand. This pattern was supported by the Meselson-Stahl experiment: after one replication round, the DNA population had intermediate density consistent with one old and one new strand per molecule; after a second round, both intermediate and light densities appeared as predicted for semiconservative replication. Conservative replication would yield one molecule with both original strands and another with both new strands, which isn't what's observed. Dispersive replication would produce mixtures where both strands of each molecule contain a patchwork of old and new DNA, also not matching the data. Conjugative refers to transfer of DNA between cells, not a replication mechanism. So the semiconservative model best explains how each new double helix ends up with one original strand and one newly made strand.

4. What term refers to the repetitive DNA at chromosome ends that protect genetic information during cell division?

A. DNA polymerase III

B. Amino acid

C. rRNA

D. Telomere

The concept being tested is the protective cap at the ends of linear chromosomes that shields genetic information during replication. This cap is called a telomere, and in humans it consists of repetitive DNA sequences (such as TTAGGG) that buffer the ends from degradation and from being mistaken for breaks. Telomeres solve the end-replication problem: when DNA is copied, the very end cannot be fully replicated, so some sequence is lost with each division. Telomeres absorb this loss so essential genes remain intact. Over time, telomeres shorten in most somatic cells, acting like a cellular clock, while certain cells (and some cancers) maintain or lengthen them with the help of telomerase. Other options don't fit because they refer to non-end structures or molecules: a DNA polymerase III is an enzyme that copies DNA, amino acids are protein building blocks, and rRNA is a component of ribosomes involved in protein synthesis. None of these describe the protective repetitive DNA at chromosome ends.

5. Which base type has a single ring in nucleic acids?

A. Adenine

B. Guanine

C. Purine

D. Pyrimidine

Single-ring bases are pyrimidines. In nucleic acids, bases fall into two families: purines, which have a fused two-ring structure, and pyrimidines, which are a single ring. Adenine and guanine are purines with two rings, while cytosine, thymine, and uracil are pyrimidines with one ring. So the base type with a single ring is pyrimidine.

6. Which genetic element in bacteria is commonly used to carry antibiotic resistance genes?

A. Chromosome

B. Plasmid

C. Nucleoid

D. Ribosome

Antibiotic resistance genes are most commonly carried on plasmids, which are small, circular DNA molecules that exist separately from the bacterial chromosome and replicate independently. Because plasmids can move between bacteria through horizontal gene transfer mechanisms like conjugation, transformation, or transduction, resistance genes on these elements spread rapidly through populations. Some plasmids, called R plasmids, specifically carry multiple resistance genes, enabling a single plasmid to arm a bacterium against several drugs. The chromosome holds essential genes needed for survival, and resistance can arise from mutations there, but that does not explain how resistance traits spread so quickly between cells. The nucleoid is simply the region inside the cell where the chromosome resides, not an independent genetic element. The ribosome is the cellular machine for protein synthesis, not a unit that carries resistance genes.

7. What term refers to the region found at the center of a chromosome where the sister chromatids are held together?

A. Centromere

B. Telomere

C. Chromatid

D. Kinetochore

The centromere is the region at the center of a chromosome where the sister chromatids are held together after DNA replication. It is the site where cohesin proteins keep the chromatids together and where the kinetochore—a protein structure that attaches spindle fibers—forms to enable proper alignment and separation during cell division. Telomeres are the protective ends of chromosomes, not the central holding region. A chromatid refers to one copy of the duplicated chromosome, not the region itself. A kinetochore is the protein complex at the centromere that interfaces with spindle microtubules, facilitating movement, but the question points to the actual region that keeps the two chromatids joined, which is the centromere.

8. Type of sugar in DNA?

A. Ribose

B. Glucose

C. Mannose

D. Deoxyribose

DNA uses a five-carbon sugar called 2'-deoxyribose, which has no oxygen at the 2' position. That missing hydroxyl group is what gives DNA greater chemical stability, helping it store genetic information for long periods and survive through replication. In nucleotides, this sugar links to a phosphate and to a nitrogenous base, forming the sugar–phosphate backbone that holds the DNA strands together. If you compare to RNA, the sugar is ribose, which has a hydroxyl at the 2' position. That small difference makes RNA more reactive and less chemically stable. The other sugars listed aren't used in DNA: glucose and mannose are hexoses involved in metabolism, while ribose is the sugar used in RNA.

9. Which mutation involves the two DNA strands flipping positions, or turning around?

A. Transversion

B. Deletion

C. Inversion

D. Duplication

What this item tests is how chromosomal rearrangements change the orientation of a DNA segment. Flipping positions refers to the segment being inverted, meaning it is reversed end-to-end within the chromosome. For example, a sequence like ABCDE would become EDCBA in the same genomic location after inversion. This rearrangement changes the order and direction of the bases in that region without necessarily changing the amount of DNA. This is different from duplication, which would produce an extra copy of a segment rather than reversing its orientation. Deletion removes a segment, reducing material, and transversion is a single-base substitution where a purine is replaced by a pyrimidine or vice versa, not a large-scale rearrangement. Inversions can be pericentric (including the centromere) or paracentric (excluding the centromere) and can impact gene function or recombination, even if the total amount of DNA remains the same. The described mutation is inversion.

10. Which enzyme is responsible for laying down RNA primers during DNA replication?

A. DNA polymerase

B. Ligase

C. Helicase

D. Primase

Initiation of DNA synthesis requires an RNA primer because DNA polymerases cannot start a new strand from scratch; they can only add nucleotides to an existing 3' hydroxyl group. The enzyme that creates this primer is primase, an RNA polymerase that lays down a short RNA sequence to provide that 3' end for DNA polymerase to extend. On the leading strand, one primer suffices, while on the lagging strand primase repeatedly lays down primers for each Okazaki fragment, enabling discontinuous synthesis. After extension, the RNA primers are removed and replaced with DNA, and the nicks are sealed by ligase. In bacteria, primase is a separate enzyme (DnaG); in eukaryotes, the primase activity is part of the DNA polymerase alpha-primase complex.

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://moleculargenetics.examzify.com

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