

Science Olympiad Designer Genes Practice Exam (Sample)

Study Guide



Everything you need from our exam experts!

This is a sample study guide. To access the full version with hundreds of questions,

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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. Don't worry about getting everything right, 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, and take breaks to retain information better.

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.

7. Use Other Tools

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!

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Questions

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- 1. In which stage do most cells spend their lives?**
 - A. Prophase**
 - B. Interphase**
 - C. Metaphase**
 - D. Anaphase**

- 2. What does a nonsense mutation cause?**
 - A. Changes the sequence of amino acids**
 - B. Creates a longer protein**
 - C. The sequence is prematurely stopped**
 - D. Has no effect on the protein**

- 3. In genetics, what does the term 'allele' refer to?**
 - A. A type of protein**
 - B. A variant form of a gene**
 - C. A specific chromosome**
 - D. A group of genes**

- 4. Which term refers to the overall genetic composition of an organism?**
 - A. Phenotype**
 - B. Genotype**
 - C. Heterozygous**
 - D. Allele**

- 5. For humans, what is the haploid number of chromosomes?**
 - A. 23**
 - B. 46**
 - C. 22**
 - D. 44**

- 6. Which base pairs with Adenine in DNA?**
 - A. Cytosine**
 - B. Thymine**
 - C. Guanine**
 - D. Uracil**

7. What is the primary structure of DNA?

- A. Single strand**
- B. Double helix**
- C. Triple helix**
- D. Linear chain**

8. How many non-autosomal genes does a human typically possess?

- A. 0**
- B. 1**
- C. 2**
- D. 3**

9. What imaging technique allows scientists to visualize the shadow of a molecule using X-rays?

- A. X-ray Diffraction**
- B. Polymerase Chain Reaction**
- C. Gene Sequencing**
- D. Chromatography**

10. What does Mendel's second law state about the alleles of genes?

- A. The alleles of one gene are distributed independently of one another**
- B. The alleles of all genes are always expressed**
- C. The alleles of a gene are always inherited together**
- D. The alleles of one gene can influence the expression of another gene**

Answers

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

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Explanations

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1. In which stage do most cells spend their lives?

- A. Prophase
- B. Interphase**
- C. Metaphase
- D. Anaphase

Cells primarily spend their lives in interphase, which constitutes the longest phase of the cell cycle. During interphase, the cell is not actively dividing but is instead focused on growth and preparation for division. This phase is comprised of three distinct subphases: G1 (Gap 1), where the cell grows and synthesizes proteins; S (Synthesis), where DNA replication occurs; and G2 (Gap 2), where the cell continues to grow and prepares for mitosis. Most of a cell's life is spent in interphase because it is crucial for the cell to carry out its normal metabolic activities and to prepare appropriately for the subsequent process of mitosis. The activities during interphase ensure that the cell is adequately equipped with the necessary resources and genetic material to successfully divide and produce two daughter cells. In contrast, the other stages listed—prophase, metaphase, and anaphase—are all part of the mitotic phase. These stages are relatively short and involve the actual division of the cell. Because interphase encompasses preparation and growth, it is the main stage contributing to the cell's life cycle, making it the correct answer.

2. What does a nonsense mutation cause?

- A. Changes the sequence of amino acids
- B. Creates a longer protein
- C. The sequence is prematurely stopped**
- D. Has no effect on the protein

A nonsense mutation introduces a premature stop codon into the coding sequence of a gene, which results in the truncation of the resulting protein. This occurs when a nucleotide change in the DNA sequence leads to the formation of a stop codon (UAA, UAG, or UGA in mRNA), causing the ribosome to halt translation before the protein is fully synthesized. This truncated protein is likely nonfunctional because it does not contain all the necessary amino acids to carry out its intended biological role. The significance of this mutation is that it can have profound effects on the organism, particularly if the protein is essential for a critical biological function. In contrast, other types of mutations, such as missense mutations, may only change one amino acid without truncating the protein, while silent mutations do not alter the protein at all. Additionally, specific mutations could result in longer proteins, but this is not the case with nonsense mutations, which always lead to shorter polypeptides.

3. In genetics, what does the term 'allele' refer to?

- A. A type of protein
- B. A variant form of a gene**
- C. A specific chromosome
- D. A group of genes

The term 'allele' refers specifically to a variant form of a gene. Genes have specific locations on chromosomes and can exist in multiple forms in a population, each variant being an allele. For example, a gene that determines flower color in a plant might have one allele for red flowers and another for white flowers. These different alleles can lead to variations in the physical characteristics or traits of an organism. By understanding that alleles are different versions of the same gene, it becomes clear how genetic diversity arises within a species. Moreover, alleles can be dominant or recessive, influencing whether certain traits are expressed in an organism based on which alleles are present. Other options do not accurately define an allele. A type of protein is incorrect because it refers to the product of gene expression rather than the gene itself. A specific chromosome refers to the structure that contains genes but does not represent an allele directly. A group of genes is too broad and does not capture the singular concept of an allele being a specific variant of a single gene.

4. Which term refers to the overall genetic composition of an organism?

- A. Phenotype
- B. Genotype**
- C. Heterozygous
- D. Allele

The term that refers to the overall genetic composition of an organism is genotype. Genotype encompasses the specific alleles or combinations of alleles present in an individual's genetic makeup. It serves as the blueprint for the organism's traits and characteristics, although these traits may not always be expressed due to environmental influences or interactions with other genes. In contrast, phenotype refers to the observable characteristics or traits of an organism, which are determined by the genotype and other external factors. Heterozygous describes a specific condition regarding an organism's alleles, particularly when it has two different alleles for a given gene. An allele itself is a variant form of a gene that might lead to different traits. Understanding that genotype is the complete set of genes while phenotype is merely the manifestation of those genes provides clarity on the relationship between an organism's genetic material and its expressed features.

5. For humans, what is the haploid number of chromosomes?

- A. 23**
- B. 46**
- C. 22**
- D. 44**

The haploid number of chromosomes for humans is 23. This number represents the count of chromosomes in a gamete, which is a reproductive cell such as a sperm or egg. In humans, gametes are produced through the process of meiosis, which reduces the diploid number of chromosomes (46) found in somatic (body) cells by half, resulting in the haploid set. Each gamete carries one set of chromosomes, and when fertilization occurs, these two haploid sets combine to form a diploid zygote with 46 chromosomes. Understanding the haploid number is crucial in genetics, particularly in the study of inheritance and the formation of genetic diversity.

6. Which base pairs with Adenine in DNA?

- A. Cytosine**
- B. Thymine**
- C. Guanine**
- D. Uracil**

In DNA, adenine pairs specifically with thymine. This pairing occurs due to the hydrogen bonding between the two bases: adenine, which is a purine, forms two hydrogen bonds with thymine, a pyrimidine. This complementary base pairing is essential for the structure of DNA, contributing to the double helix formation and ensuring accurate replication during cell division. While cytosine and guanine can also be paired together, they do not interact with adenine. Similarly, uracil is found in RNA, where it pairs with adenine, but it is not present in DNA. Thus, thymine is the correct base that pairs with adenine in the context of DNA.

7. What is the primary structure of DNA?

- A. Single strand**
- B. Double helix**
- C. Triple helix**
- D. Linear chain**

The primary structure of DNA is best described as a double helix. This structure consists of two long strands of nucleotides that twist around each other, forming a shape reminiscent of a spiral staircase. Each strand is composed of a sugar-phosphate backbone with nitrogenous bases sticking out from it, where the bases on one strand pair specifically with complementary bases on the other strand (adenine with thymine and cytosine with guanine). The double helix configuration not only provides stability to the DNA molecule but also facilitates the processes of replication and transcription. The specific pairing of the bases is crucial for the accurate transmission of genetic information, highlighting the importance of this structure in genetics and molecular biology. In contrast, a single strand would not provide the same level of stability or functionality, a triple helix is a much rarer and less stable form of nucleic acid, and a linear chain does not account for the significant structural organization observed in double-stranded DNA. The double helix is essential for compatibility with biological processes and the overall genetics framework within living organisms.

8. How many non-autosomal genes does a human typically possess?

- A. 0**
- B. 1**
- C. 2**
- D. 3**

Humans typically possess one non-autosomal gene. This gene is located on the Y chromosome, which is one of the two sex chromosomes in humans (the other being the X chromosome). While most genes are located on the 22 pairs of autosomes, the genes located on the X and Y chromosomes are classified as non-autosomal. In human males, who possess one X and one Y chromosome, the only non-autosomal gene is found on the Y chromosome. This gene has crucial functions related to sex determination and spermatogenesis. In females, who have two X chromosomes, there are no Y-linked genes present, which reinforces the understanding that typically only one non-autosomal gene exists in the context of the entire human genome. The other potential answers misinterpret the number of non-autosomal genes. While zero suggests the absence of these genes, and options suggesting two or three would exceed the count related to non-autosomal genes in a typical human genome.

9. What imaging technique allows scientists to visualize the shadow of a molecule using X-rays?

- A. X-ray Diffraction**
- B. Polymerase Chain Reaction**
- C. Gene Sequencing**
- D. Chromatography**

The imaging technique that allows scientists to visualize the shadow of a molecule using X-rays is X-ray diffraction. This method is widely used in structural biology and chemistry to determine the arrangement of atoms within a crystal. In X-ray diffraction, a crystal of the molecule is bombarded with X-rays, which causes the rays to scatter in various directions. The pattern of this scattering can be recorded on a detector, forming a diffraction pattern. By analyzing this pattern, scientists can reconstruct the three-dimensional arrangement of atoms in the crystal, effectively creating a "shadow" or representation of the molecule's structure. This technique has been instrumental in revealing the structures of many biological macromolecules, including proteins and nucleic acids, contributing significantly to our understanding of molecular biology and biochemistry. The other options—polymerase chain reaction, gene sequencing, and chromatography—serve different purposes in molecular biology and do not utilize X-ray imaging to visualize molecular structures. Polymerase chain reaction is primarily used for amplifying DNA, while gene sequencing involves determining the order of nucleotides in a DNA molecule. Chromatography, on the other hand, is a technique used for separating compounds in a mixture based on their physical or chemical properties.

10. What does Mendel's second law state about the alleles of genes?

- A. The alleles of one gene are distributed independently of one another**
- B. The alleles of all genes are always expressed**
- C. The alleles of a gene are always inherited together**
- D. The alleles of one gene can influence the expression of another gene**

Mendel's second law, known as the Law of Independent Assortment, asserts that the alleles of different genes assort independently of one another during the formation of gametes. This means that the inheritance of one trait (or gene) does not affect the inheritance of another trait. For example, if you are considering two genes, one for seed shape and another for seed color, the allele you inherit for seed shape from one parent does not influence which allele you get for seed color; each pair of alleles segregates independently. This principle applies when the genes are located on different chromosomes or are far enough apart on the same chromosome that they assort independently during meiosis. As a result, this characteristic allows for a variety of combinations of traits in the offspring. In contrast, the other options suggest concepts that stray from Mendel's findings. The second option implies that all alleles are expressed, which is not universally true due to dominance and recessiveness influencing expression. The third option suggests that alleles are inherited together, which opposes the idea of independent assortment. Finally, the fourth option indicates that alleles from one gene can influence another, which reflects gene interactions rather than the independent assortment principle. Thus, recognizing Mendel's law is crucial

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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://sciolympiaddesignergenes.examzify.com>

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

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