NCEA Level 1 Genetics Practice Exam (Sample)

Study Guide

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Questions

1. Which base pairs with Cytosine in DNA?

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

2. What are chromosomes that are not sex chromosomes called?

- **A. Autosomes**
- **B. Haploids**
- **C. Diploids**
- **D. Gametes**

3. What are the organs that produce eggs called?

- **A. Ovaries**
- **B. Testes**
- **C. Uterus**
- **D. Semen**

4. What do you call the different forms of a gene?

- **A. Chromosomes**
- **B. Alleles**
- **C. Homozygotes**
- **D. Phenotypes**

5. What term refers to having two identical alleles for a trait?

- **A. Heterozygous**
- **B. Homozygous**
- **C. Dominant**
- **D. Recessive**

6. Which base pairs with Thymine in a DNA sequence?

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

7. What is the term for a living thing that can function independently?

A. Organism

B. Cell

C. Organ

D. Species

8. What is the result of mitosis?

A. Four genetically diverse cells

B. Two identical daughter cells

C. A single mutated cell

D. Two haploid cells

9. What is the role of amino acids in living systems?

A. They store energy

B. They are the building blocks of proteins

C. They facilitate photosynthesis

D. They act as genetic material

10. Which structure describes two strands of nucleotides wound about each other?

A. Double helix

B. Single strand

C. Chromatin

D. RNA strand

Answers

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

Explanations

1. Which base pairs with Cytosine in DNA?

A. Adenine

B. Thymine

C. Guanine

D. Uracil

Cytosine pairs with Guanine in DNA through the formation of three hydrogen bonds, which helps to stabilize the DNA double helix structure. This base pairing is a fundamental aspect of the DNA structure, adhering to the rules of complementary base pairing established by Chargaff. In this context, Adenine pairs with Thymine, and in RNA, Uracil replaces Thymine but does not interact with Cytosine in DNA. The pairing of Cytosine with Guanine ensures accurate DNA replication and the maintenance of genetic information.

2. What are chromosomes that are not sex chromosomes called?

A. Autosomes

B. Haploids

C. Diploids

D. Gametes

Chromosomes that are not sex chromosomes are called autosomes. In humans, there are 23 pairs of chromosomes, out of which 22 pairs are autosomes and 1 pair is made up of sex chromosomes (X and Y). Autosomes carry the majority of an individual's genetic information, which dictates various traits and functions, while sex chromosomes determine the biological sex of the individual. In contrast, haploids refer to cells that contain a single set of chromosomes, such as gametes (sperm and egg cells). Diploids indicate cells with two sets of chromosomes, which is the typical state for somatic cells in organisms that reproduce sexually. Gametes are specific to the reproductive process and include both sperm and egg cells, which contain half the number of chromosomes found in somatic cells. Therefore, the defining characteristic of autosomes as being non-sex chromosomes makes it the correct answer.

3. What are the organs that produce eggs called?

A. Ovaries

B. Testes

C. Uterus

D. Semen

The organs that produce eggs are called ovaries. In female biological systems, the ovaries are responsible for the development and release of eggs, which are the reproductive cells needed for fertilization. Each month during the menstrual cycle, an ovary typically releases one egg, a process known as ovulation. The ovaries also produce hormones, such as estrogen and progesterone, which are crucial for regulating the menstrual cycle and supporting reproduction. Other options refer to different reproductive structures. Testes are the male reproductive organs that produce sperm. The uterus is the organ where a fertilized egg can implant and develop into a fetus during pregnancy. Semen is the fluid that contains sperm and is expelled during ejaculation. Understanding the specific functions of each of these organs highlights the distinct roles they play in the reproductive systems of males and females.

4. What do you call the different forms of a gene?

A. Chromosomes

B. Alleles

C. Homozygotes

D. Phenotypes

The different forms of a gene are referred to as alleles. Alleles are variations of the same gene that can result in different traits or characteristics. For example, a gene that determines flower color in a plant may have an allele for red flowers and another allele for white flowers. Each plant will inherit one allele from each parent, leading to a combination that influences its traits. Understanding alleles is crucial because they contribute to genetic variation within a species. This variation can impact an organism's appearance, behavior, and overall fitness in its environment. Thus, recognizing that alleles represent the different versions of a gene helps clarify how traits are inherited and expressed in individuals.

5. What term refers to having two identical alleles for a trait?

A. Heterozygous

B. Homozygous

C. Dominant

D. Recessive

The term that refers to having two identical alleles for a trait is homozygous. In genetics, an individual is considered homozygous when both alleles at a specific locus on homologous chromosomes are the same. For example, if an individual has two alleles for a trait that are both for blue eyes, they are described as homozygous for that trait. In contrast, heterozygous describes individuals who have two different alleles for a particular trait. The terms dominant and recessive relate to how those alleles express their traits, but they do not specifically describe the genetic makeup regarding the similarity or difference of alleles. Understanding these definitions is crucial in genetics, as they help clarify how traits are inherited and expressed within organisms.

6. Which base pairs with Thymine in a DNA sequence?

A. Cytosine

B. Adenine

C. Guanine

D. Uracil

In a DNA sequence, Thymine pairs exclusively with Adenine through two hydrogen bonds. This pairing is a fundamental aspect of the DNA structure, where nitrogenous bases adhere to specific pairing rules known as complementary base pairing. Thymine, which is a pyrimidine, pairs with Adenine, a purine, ensuring the DNA double helix maintains its uniform structure. Understanding this pairing is crucial, as it plays a vital role in processes such as DNA replication and transcription. Thymine does not pair with Cytosine, Guanine, or Uracil under standard DNA conditions. Cytosine pairs with Guanine instead, which is another complementary pair in the DNA structure. Uracil is found in RNA, where it replaces Thymine, but it does not participate in base pairing in DNA itself. Thus, the correct answer is that Thymine pairs with Adenine in a DNA sequence.

7. What is the term for a living thing that can function independently?

A. Organism

B. Cell

C. Organ

D. Species

An organism is defined as any individual living entity that can perform all the necessary life processes independently. This includes being able to grow, reproduce, respond to stimuli, and maintain homeostasis. Organisms can be unicellular, such as bacteria, or multicellular, like plants and animals. The other terms do not fit this definition as they refer to specific components or classifications within biology. A cell is the basic unit of life, but it cannot function independently if it is part of a multicellular organism. An organ is a collection of tissues that work together to perform specific functions, and it relies on other organs for the complete functioning of an organism. A species is a group of similar organisms that can breed and produce fertile offspring, but it does not refer to the individual capability of functioning independently. Therefore, to encapsulate the essence of a living thing that operates on its own, the term 'organism' is the most appropriate choice.

8. What is the result of mitosis?

A. Four genetically diverse cells

B. Two identical daughter cells

C. A single mutated cell

D. Two haploid cells

Mitosis is a fundamental process of cell division that results in the formation of two daughter cells. The key characteristic of mitosis is that it is an equational division, meaning that the daughter cells maintain the same chromosome number as the original parent cell. During mitosis, the chromosomes are replicated and evenly distributed to ensure that each daughter cell receives an exact copy of the genetic material. Consequently, the result of mitosis is two cells that are genetically identical to each other and to the original parent cell. This is crucial for processes such as growth, repair, and asexual reproduction in multicellular organisms. In contrast to other forms of cell division, like meiosis, which produces genetically diverse haploid cells for sexual reproduction, mitosis serves to produce identical cells, thereby maintaining genetic consistency across cell generations.

9. What is the role of amino acids in living systems?

A. They store energy

B. They are the building blocks of proteins

C. They facilitate photosynthesis

D. They act as genetic material

Amino acids play a crucial role in living systems primarily as the building blocks of proteins. Proteins are essential macromolecules that perform a vast array of functions within organisms, including structural support, transportation of molecules, catalyzing biochemical reactions as enzymes, and regulating metabolic processes. Each protein is made up of a specific sequence of amino acids, and the unique properties of these amino acids dictate how the protein folds and functions. There are 20 different amino acids that can combine in various sequences to create the diversity of proteins found in living organisms. Hence, without amino acids, proteins could not form, making them fundamental to biological processes and the overall functioning of life. While energy storage is an important function in biology, carbohydrates and lipids primarily fulfill this role, not amino acids. Similarly, photosynthesis is a process carried out by plants and some bacteria, primarily involving pigments and other components, rather than amino acids. Lastly, genetic material refers to DNA and RNA, which encode the information necessary for the synthesis of proteins but do not include amino acids themselves. Therefore, the role of amino acids is distinctly tied to their function as the structural units of proteins.

10. Which structure describes two strands of nucleotides wound about each other?

A. Double helix

B. Single strand

C. Chromatin

D. RNA strand

The description of two strands of nucleotides wound about each other corresponds to the double helix structure. This iconic shape is most commonly associated with DNA, where two long strands of nucleotides twist around each other, creating a helical form. Each strand is composed of repeating units called nucleotides, which consist of a sugar, a phosphate group, and a nitrogenous base. The bases from each strand pair specifically (adenine with thymine and cytosine with guanine), helping to stabilize the overall double helix structure. This structure is essential for the storage and transmission of genetic information, as it allows for accurate replication during cell division and provides a means for genetic variation through processes like recombination. The stability and integrity provided by this structure are vital for the proper functioning of living organisms. Understanding the double helix is fundamental in genetics, as it serves as the basis for how genetic information is organized, duplicated, and expressed.