BioBeyond – Disease Detective Practice Exam (Sample)

Study Guide

Everything you need from our exam experts!

Questions

1. **What is the percent chance that one of the offspring will have the genotype GG?**
   - **A. 25%**
   - **B. 50%**
   - **C. 75%**
   - **D. 10%**

2. **If a trait is dominant, what is a possible phenotype representation?**
   - **A. Only homozygous dominant individuals express the trait.**
   - **B. All offspring will express the trait if one parent has it.**
   - **C. Both homozygous dominant and heterozygous individuals can express the trait.**
   - **D. Recessive traits will be expressed in all cases.**

3. **What is the percent chance of one of the children having a homozygous genotype?**
   - **A. 25%**
   - **B. 50%**
   - **C. 75%**
   - **D. 100%**

4. **If both parents have normal hemoglobin, what is the likelihood of their child being a carrier of sickle cell disease?**
   - **A. 0%**
   - **B. 25%**
   - **C. 50%**
   - **D. 100%**

5. **What are Jojo's blood type genotypes?**
   - **A. AA, AO**
   - **B. AA, AA**
   - **C. AB, BO**
   - **D. BB, OO**

6. How many phenotypes are represented if two parents both have the genotype Bb?

- **A. One**
- **B. Two**
- **C. Three**
- **D. Four**

7. Which trait's probability can be determined using a Punnett square?

- **A. The likelihood of specific alleles appearing in offspring.**
- **B. The exact number of offspring produced.**
- **C. The lifespan of the offspring.**
- **D. The health of the parents.**

8. What should be filled in as the parent's alleles in a Punnett square?

- **A. Gg**
- **B. HH**
- **C. Aa**
- **D. Tt**

9. What is true about carriers of genetic disorders like hemophilia?

- **A. Carriers always express symptoms.**
- **B. Carriers do not transmit the disorder to offspring.**
- **C. Carriers can pass the disorder to their children.**
- **D. Carriers are unaffected.**

10. What is a Punnett square used for in genetics?

- **A. To measure physical traits in offspring.**
- **B. To determine the potential genetic combinations of offspring.**
- **C. To isolate specific chromosomes in a gene pool.**
- **D. To identify hereditary diseases in family history.**

Answers

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

Explanations

1. What is the percent chance that one of the offspring will have the genotype GG?

A. 25%

B. 50%

C. 75%

D. 10%

To determine the percent chance of offspring having the genotype GG, it is essential to consider the genetic makeup of the parents. Typically, if both parents are heterozygous for a trait (represented by the alleles G and g), you can use a Punnett square to visualize the potential outcomes for their offspring. When two heterozygous parents (Gg x Gg) are involved, the possible gametes from each parent are G and g. The combinations in the Punnett square lead to the following genotype possibilities for the offspring: 1. GG (homozygous dominant) 2. Gg (heterozygous) 3. gG (heterozygous) 4. gg (homozygous recessive) Counting the results from the Punnett square, there are four outcomes, with only one resulting in the GG genotype. Thus, the probability of having an offspring with the GG genotype is 1 out of 4, which is expressed as a percentage by multiplying by 100. This calculation gives you a 25% chance that one of the offspring will have the GG genotype.

2. If a trait is dominant, what is a possible phenotype representation?

A. Only homozygous dominant individuals express the trait.

B. All offspring will express the trait if one parent has it.

C. Both homozygous dominant and heterozygous individuals can express the trait.

D. Recessive traits will be expressed in all cases.

A dominant trait means that only one copy of the allele is needed for the trait to be expressed in an individual. This trait can be represented phenotypically in individuals who are either homozygous dominant or heterozygous for that trait, meaning they have two identical dominant alleles or one dominant and one recessive allele, respectively. In the case of homozygous dominant individuals, they possess two dominant alleles and thus express the dominant phenotype. Heterozygous individuals, on the other hand, will express the dominant phenotype due to the presence of at least one dominant allele, overriding the influence of the recessive allele. Therefore, individuals with either genotype will show the dominant trait in their phenotype. This understanding of dominance and phenotype representation is crucial in genetics, particularly in predicting the outcomes of crosses in Mendelian inheritance.

3. What is the percent chance of one of the children having a homozygous genotype?

A. 25%

B. 50%

C. 75%

D. 100%

To determine the percent chance of one of the children having a homozygous genotype, it's important to understand the principles of genetics, specifically focusing on allele combinations during inheritance. When two parents each contribute alleles for a particular gene, they can be either homozygous (two identical alleles, such as AA or aa) or heterozygous (two different alleles, such as Aa). The potential combinations arise from how these alleles combine. If one assumes both parents are heterozygous (Aa), then the possible genotypes for their children would be: - AA (homozygous dominant) - Aa (heterozygous) - aa (homozygous recessive) From a Punnett square analysis of Aa x Aa, you would observe the following distributions: - 25% are expected to be AA (homozygous dominant) - 50% are Aa (heterozygous) - 25% are aa (homozygous recessive) In this scenario, focusing on the homozygous genotype as a category (either AA or aa), you find that there is a total of 50% chance that a child will be homozygous (both AA and aa combine to equal

4. If both parents have normal hemoglobin, what is the likelihood of their child being a carrier of sickle cell disease?

A. 0%

B. 25%

C. 50%

D. 100%

When both parents have normal hemoglobin, the likelihood of their child being a carrier of sickle cell disease is indeed 0%. This is because sickle cell disease is caused by a mutation in the HBB gene, and being a carrier of the disease means possessing one copy of the mutated gene and one copy of the normal gene (heterozygous). If both parents have normal hemoglobin, they are homozygous for the normal version of the gene, which means they do not possess the mutated gene at all. Therefore, any child they have will inherit normal genes only from both parents, resulting in a child who also has normal hemoglobin and is not a carrier. This understanding blocks the possibility of producing a child with the sickle cell allele, hence making the chance of the child being a carrier 0%.

5. What are Jojo's blood type genotypes?

A. AA, AO

B. AA, AA

C. AB, BO

D. BB, OO

To determine Jojo's blood type genotypes, it's essential to understand how blood types are inherited. Human blood types are determined by the ABO blood group system, which includes four main types: A, B, AB, and O, based on the presence or absence of specific antigens on the surface of red blood cells. The alleles involved are A, B, and O, with A and B being co-dominant and O being recessive. The genotypes that correspond to the blood types are as follows: - Type A can have the genotypes AA or AO. - Type B can have the genotypes BB or BO. - Type AB has the genotype AB. - Type O has the genotype OO. The option that indicates two "AA" genotypes suggests that Jojo has two alleles for blood type A, giving her a blood type of A. This means that she can pass on either an A or an O allele to her offspring, inheriting blood type characteristics solely from the A allele. Choosing this option also reflects the compatibility of the potential blood types that could arise from varying combinations of parental alleles. If both of Jojo's alleles are A, it guarantees her phenotype is A, which is consistent with

6. How many phenotypes are represented if two parents both have the genotype Bb?

A. One

B. Two

C. Three

D. Four

To determine how many phenotypes are represented by parents both having the genotype Bb, we should consider the possible combinations of alleles that can result from their offspring. The genotype Bb can produce two types of gametes: B and b. When two parents of genotype Bb are crossed, the potential combinations of alleles in their offspring can be illustrated using a Punnett square. The combinations would be as follows: - BB (homozygous dominant) - Bb (heterozygous) - bB (heterozygous, but genetically identical to Bb) - bb (homozygous recessive) From these combinations, we observe three distinct genotypes: BB, Bb (or bB, which is essentially the same as Bb), and bb. Now, we must look at how these genotypes translate into phenotypes. If we assume that the B allele is dominant over the b allele, the phenotypes can be categorized as follows: - The phenotype for BB will be the same as Bb (or bB) since the dominant allele masks the effect of the recessive one. - The phenotype for bb will be distinct because it expresses the recessive traits. Thus, the distinct phenotypes represented when two Bb parents have

7. Which trait's probability can be determined using a Punnett square?

A. The likelihood of specific alleles appearing in offspring.

B. The exact number of offspring produced.

C. The lifespan of the offspring.

D. The health of the parents.

A Punnett square is a predictive tool used in genetics to determine the probability of specific traits being inherited from one generation to the next. When considering traits, the Punnett square allows one to visualize the potential combinations of alleles from the parent organisms. In the context of the correct answer, the likelihood of specific alleles appearing in offspring is assessed by inputting the genotypes of the parents into the Punnett square. Each cell in the square represents a possible genotype of the offspring, allowing for a clear understanding of the ratio of different allele combinations. This is particularly useful in studying traits governed by Mendelian inheritance patterns, such as dominant and recessive traits. The other options do not pertain directly to the function of a Punnett square. The exact number of offspring produced is not something that can be predicted solely by the genotypes of the parents and may depend on various biological and environmental factors. Similarly, the lifespan of the offspring and the health of the parents are influenced by a range of genetic and environmental variables, and while they may relate to genetic factors, they cannot be determined simply through a Punnett square analysis. Thus, the focus of the Punnett square remains on the probabilities of allele inheritance.

8. What should be filled in as the parent's alleles in a Punnett square?

A. Gg

B. HH

C. Aa

D. Tt

In a Punnett square, the alleles of the parents are represented along the top and side of the square. The choice of Gg reflects a heterozygous genotype, where one allele is dominant (G) and one is recessive (g). This representation is crucial when considering traits that follow Mendelian inheritance patterns, as it allows for the prediction of the genotypic and phenotypic ratios in the offspring based on the combinations of these alleles. Using Gg as the alleles in the Punnett square indicates that one parent has one dominant and one recessive allele, which is common in genetic crosses. This setup permits the analysis of inheritance patterns and the probability of various traits appearing in the offspring. In contrast, the other options (HH, Aa, Tt) also represent valid genotypes for different scenarios, but Gg aligns with a key aspect of demonstrating variation in breeding and the potential outcomes when looking at a single gene inheritance. Thus, using Gg provides a clear illustration of how traits may be passed down based on parental allele combinations in genetics.

9. What is true about carriers of genetic disorders like hemophilia?

A. Carriers always express symptoms.

B. Carriers do not transmit the disorder to offspring.

C. Carriers can pass the disorder to their children.

D. Carriers are unaffected.

Carriers of genetic disorders, such as hemophilia, typically possess one copy of the mutated gene but do not show symptoms of the disorder themselves. For conditions that are recessive, carriers generally do not experience the effects of the disorder because they have one normal allele that compensates for the mutated one. However, they still carry the potential to pass on the mutated gene to their offspring. In the case of hemophilia, which is often X-linked recessive, a male who has the disorder will not pass it to sons (as sons inherit the Y chromosome from their fathers), but he will pass the affected X chromosome to daughters. If a female carrier has children, there is a 50% chance that she could pass on the mutated allele to each child. Therefore, while carriers are asymptomatic regarding the disorder, they can still contribute to the genetic makeup of their children by passing on the gene responsible for the disorder. This aspect underscores the importance of understanding the genetic inheritance patterns involved with such disorders.

10. What is a Punnett square used for in genetics?

A. To measure physical traits in offspring.

B. To determine the potential genetic combinations of offspring.

C. To isolate specific chromosomes in a gene pool.

D. To identify hereditary diseases in family history.

A Punnett square is a tool used in genetics to visualize and calculate the possible genetic combinations that can occur when two organisms breed. By inputting the alleles from each parent, the Punnett square allows for a systematic representation of all potential allele combinations that their offspring could inherit. This method helps predict the probability of certain traits being expressed in the offspring based on the genetic makeup of the parents. It operates on the principles of Mendelian genetics, showcasing dominant and recessive alleles and providing insights into traits that may appear in the next generation. This predictive capability is essential for understanding inheritance patterns and can help in studies of heredity, crop breeding, and even animal husbandry. Other options, while related to genetics, do not accurately describe the primary function of a Punnett square. Measuring physical traits, isolating chromosomes, and identifying hereditary diseases are different processes involving genetic analysis but do not utilize a Punnett square for their application.