

TEKS B.8B: Science concepts--mechanisms of genetics. The student knows the role of nucleic acids and the principles of inheritance and variation of traits in Mendelian and non-Mendelian genetics. The student is expected to predict possible outcomes of various genetic combinations using monohybrid and dihybrid crosses, including non-Mendelian traits of incomplete dominance, codominance, sex-linked traits, and multiple alleles.

Answer

Student 4 is correct. *When you cross two heterozygous parents, the potential offspring have the following genotypic distribution.*

	Genotypic Distribution
Ratio	<i>One TT: Two Tt : One tt</i>
Fractions	<i>1/4 TT, 1/2 Tt, 1/4 tt</i>
Percentages	<i>25% TT, 50% Tt, 25% tt</i>

Teacher Notes

Representing genotypes and phenotypes in different ways is an important skill for students to practice. Genotypes and phenotypes can be represented using percentages, ratios, and fractions and may be displayed in a variety of graphical formats. If students are struggling to work through this item, suggest that they first ignore all the answer choices and simply work through the provided Punnett square to determine the probability of possible genotypes. Then, prompt students to analyze the results while considering how those results could be represented numerically in different ways. For example, if a student answers in a ratio, prompt them to consider converting the ratio to percentages or fractions. Finally, students can then compare their responses to the answer choices.

In domestic cats, tail length is coded for by a single allele where bobtails (T) are dominant and long tails (t) are recessive.

If two heterozygous cats mate, what will be the distribution of possible genotypes of the offspring?

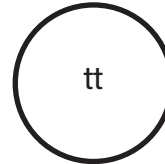
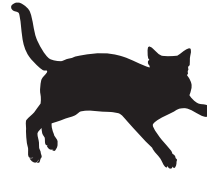
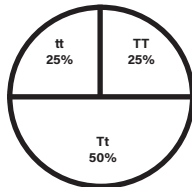
Select which student's response best represents the answer. Explain your thinking.

Student 1: 50% TT, 50% tt

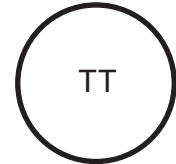
Student 2: Two Tt, Two tt

Student 3: $\frac{1}{2}$ TT, $\frac{1}{4}$ Tt, $\frac{1}{4}$ tt

Student 4:



Alleles of One Parent
Long-tailed Cat



Alleles of One Parent
Bob-tailed Cat

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Answer

1. What is the patient's genotype? *Heterozygous, or Aa (Students may use any letter.)*
2. Is the patient affected by the disorder? Explain your thinking. *Yes, the patient is affected by the disease because it is an autosomal dominant disorder. This means only one dominant allele is needed for someone to have the disorder.*
3. What does the diagnosis tell you about the patient's parents' genotypes or phenotypes? Explain your thinking. *At least one parent must be affected by the disorder. That parent could be homozygous dominant or heterozygous for the trait.*

Teacher Notes

Discussing genetics requires highly specialized vocabulary. The key to being able to answer an item relies on students' ability to process the meaning of *autosomal dominant*. *Autosomal* refers to non-sex genes or chromosomes, and *dominant* refers to an inheritance pattern that requires only one version of the allele to express a specific phenotype. Dominant phenotypes can be expressed as a result of two different genotypes, whereas recessive phenotypes can only be expressed by a single genotype in autosomal traits. Sex-linked, recessive traits may be displayed with only one copy of the allele in males.