

High School Biology: Mendelian Genetics & Punnett Squares



Use the matching sheet ID when checking answers.

Part A: Genetics Probability. Analyze the crosses and determine genotypic and phenotypic ratios.

1. In pea plants, purple flowers (P) are completely dominant over white flowers (p). If two heterozygous purple-flowered plants (Pp × Pp) are crossed, what percentage of their offspring is predicted to display white flowers?

Answer: B. 25%

A Pp × Pp Punnett square produces: 1 PP (purple), 2 Pp (purple), 1 pp (white). The homozygous recessive pp genotype represents 1 out of 4 (25%) of offspring.

2. An organism has the observable physical traits of brown fur and short ears. These observable physical characteristics represent the organism's:

Answer: A. Phenotype

Phenotype refers to the observable physical and biochemical traits of an organism, whereas genotype refers to the underlying genetic allele combination (e.g., Bb).

3. In a test cross to determine whether a black guinea pig with a dominant phenotype is homozygous dominant (BB) or heterozygous (Bb), it should be mated with an individual that is:

Answer: B. Homozygous recessive (bb)

A test cross always mates an individual of unknown dominant genotype with a known homozygous recessive (bb) individual. If any offspring show the recessive trait, the parent was heterozygous (Bb).

Part B: Genetic Terminology & Patterns Matrix. Categorize each genetic concept under the appropriate heading.

Sort these items: Homozygous (identical alleles, e.g., TT or tt) vs Heterozygous (different alleles, e.g., Tt); Law of Segregation: Two alleles for each trait separate during gamete formation in meiosis; Incomplete Dominance: Heterozygote exhibits an intermediate blended phenotype (e.g., pink snapdragons); Hemizygous X-linked recessive inheritance observed on sex chromosomes; Law of Independent Assortment: Genes for different traits sort independently during gametogenesis; Codominance: Both alleles are simultaneously fully expressed without blending (e.g., AB blood type)

Allele Combinations	Mendelian Principles	Non-Mendelian Patterns
Homozygous (identical alleles, e.g., TT or tt) vs Heterozygous (different alleles, e.g., Tt); Hemizygous X-linked recessive inheritance observed on sex chromosomes	Law of Segregation: Two alleles for each trait separate during gamete formation in meiosis; Law of Independent Assortment: Genes for different traits sort independently during gametogenesis	Incomplete Dominance: Heterozygote exhibits an intermediate blended phenotype (e.g., pink snapdragons); Codominance: Both alleles are simultaneously fully expressed without blending (e.g., AB blood type)