Punnett Square Exercises

Solving Monohybrid Punnett Squares - Answers

POSSIBLE ANSWERS TO THE CONCLUSION QUESTIONS

1. Explain why there are at least two alleles that make up the gene coding for a particular trait.
   - There are at least two alleles for every gene because each parent contributes equally to the inheritance of the offspring.

2. Explain the term "heterozygous." How can an organism have two different alleles for one single trait but only show one observable trait?
   - Heterozygous refers to two different alleles representing a single trait. For each gene, there are two alleles, one from each parent. Sometimes these alleles can be the same (homozygous) and sometimes they can be different (heterozygous). If the alleles are different, then one must be dominant, and the other recessive. The recessive allele will be masked by the expression of the dominant allele when only one trait is observable.

PRACTICE PUNNETT SQUARES: Draw all Punnett Squares with a ruler. Each side of the square should be at least 4 cm long.

3. A common recessive trait in dogs is deafness. A homozygous line of normal-hearing dogs was crossed with a homozygous line of deaf dogs. F1 and F2 generations were produced.
   a. What percentage of the F1 generation is expected to have normal hearing?
   b. What is the phenotypic ratio of the F2 generation?

F1 Generation:

	d	d
D	D d	D d
D	D d	D d

F2 Generation:

	D	d
D	D D	D d
d	D d	d d

a. 100%

b. 3:1 ratio

4. Black color in horses is dominant over chestnut color. If a homozygous black horse is mated to a chestnut horse, what percent of the offspring will be chestnut colored? Use a Punnett square to show how you derived your answer.

	b	b
B	B b	B b
B	B b	B b

0% will be chestnut colored.
(All are heterozygous; i.e., black.)

5. Construct a Punnett Square to show all possible combinations of gametes that could result from the cross of a black guinea pig that is heterozygous for black fur and a guinea pig that is homozygous recessive for white fur (which results in white fur coloration).
   a. What is the probability that the offspring will have black fur? [Answer should be a ratio.]
   b. What percent of the offspring have the possibility of being homozygous recessive?

	b	b
B	B b	B b
b	b b	b b

a. 1:1 ratio of black to white fur.

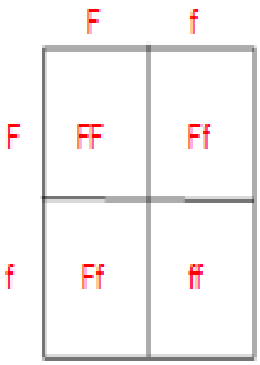
b. 50% will be homozygous recessive.

6. George is the youngest child in a family that includes 4 children. All of the children have the recessive phenotype — attached earlobes. However, both parents have unattached earlobes, the dominant trait. What are the possible genotypes for the parents? Use a Punnett square to justify your answer.

	U	u
U	UU	U u
u	U u	u u

Both parents must be heterozygous for this trait since their offspring express the recessive trait.

7. Explain why it is possible for two parents with a dominant trait, like freckles, to produce 10 children, all of whom do not have freckles. Use a Punnett square to illustrate your answer.



Both parents must be heterozygous for this trait since their offspring express the recessive trait.
If even one parent was homozygous dominant, then all the children would also have freckles. Because both parents are heterozygous, however, then there is a one-in-four chance (or 25%) that any child born will not have freckles. For those heterozygous freckled parents to have 10 children in a row without freckles is highly unlikely but IS possible.

8. A woman is homozygous dominant for short fingers. Will any of her children have long fingers? Use a Punnett square to justify your answer.

S	S	S
S	S	S

None of her children will have long fingers. The Punnett square shows that, regardless of the father's genotype, all of her offspring will receive at least one dominant allele.

9. In guinea pigs, black fur color is dominant over white fur. Describe a probable genotype for the parents of a family of 7 black and 2 white guinea pigs. Use a Punnett square to illustrate your answer. (Hint: The F1 ratio is 7:2 or approximately 3:1.)

	B	b
B	BB	Bb
b	Bb	bb

The F1 ratio of 7:2 is close to the ratio 3:1. The students should realize by now that a 3:1 ratio of phenotypes is produced by crossing heterozygous parents. The genotype of both parents may be Bb for both.

However, the parents could also be Bb x bb and have the number of offspring. Only by multiple trials could we actually definitely conclude the genotype of the parents (sample size matters).