

Advanced Cross Application

Problems

Name: _____

Period: _____

Objective: To practice solving genetics problems by setting up both monohybrid and dihybrid crosses.

Part I Monohybrid Crosses: Solve each showing your work **with a Punnett Square.**

1. In rabbits pointed ears are dominant to floppy ears. A breeder has a pointed-ear female that he mates with a floppy-eared male rabbit. The resulting offspring were approximately 50% pointed-eared and 50% floppy-eared.
 - a. What are the genotypes of the parents?
 - b. How do you know this? (Why must it be true?)

2. The female from the previous question (pointed-ears) came from a litter of bunnies that had a mix of bunnies with pointed-ears and floppy-ears. The father rabbit had pointed-ears.
 - a. What were the genotypes of the parents of the female?
 - b. What was the phenotype of the mother of the female?

3. Mendel mated pea plants to track the traits. He mated a round seeded plant with a wrinkled seeded plant, and found that round seeds were dominant.
 - a. If he were to mate two recessive plants, what percentage of offspring would be homozygous?
 - b. From the cross above the offspring would have which phenotype?

4. In horses chesnut (red) coat color is dominant to white coat color. A horse breeder has a chesnut stallion and wants to know the genotype of the stallion.
 - a. What are the possible genotypes of the stallion?
 - b. How could the breeder determine the genotype of the stallion?

5. In Chihuahuas black noses are dominant to pink noses. A Chihuahua breeder is planning a litter. The breeder plans on using a female dog that has a pink nose, and a male that has a black nose.
 - a. What are the possible genotypes of the offspring?
 - b. What are the possible phenotypes of the offspring?
 - c. The dog with the black nose came from parents that both had black noses. Could he have siblings with pink noses? Explain.
 - d. If the black nosed dog is heterozygous;
 - i. What would be the expected genotypic ratio for the offspring?
 - ii. What would be the expected phenotypic ratio for the offspring?
6. Sickle Cell anemia is a recessive trait that causes blood cells to be misshaped. A woman who has no history of sickle cell anemia marries a man whose father had sickle cell anemia.
 - a. What is their likelihood of having children with sickle cell anemia?
7. A strong independent woman decides she wants a child. She decides to use a sperm donor. The woman has normal skin but her father was albino. She does not know the genetics of the sperm donor.
 - a. What is the probability of her having an albino child? Show your crosses
8. In guinea pigs, the allele for short hair is dominant.
 - a. If all of the guinea pigs in a litter are born short haired what are the possible genotypes of the parents?
 - b. A second cross is made using babies from the litter; $\frac{3}{4}$ of the babies are short haired while $\frac{1}{4}$ are long haired. Can you now determine the exact genotypes of the parents, if so what are they?
 - c. Two short haired guinea pigs are mated several times. Out of 100 offspring, 50 of them have long hair. What are the probable genotypes of the parents?

Part II Dihybrid Crosses: Be sure to explain yourself thoroughly.

9. A red-haired man with blue eyes marries a brown-haired woman with green eyes. They have 10 children, 6 of whom have brown hair; the other 4 have red hair. 7 of the children have green eyes, and 3 of them have blue eyes.
- a. Which hair phenotype is dominant?
 - b. Which eye phenotype is dominant?
 - c. What is the expected genotypic ratio for **hair color** of the offspring from the red haired man and the woman?
 - d. What is the expected genotypic ratio for **eye color** of the offspring from the red haired man and the woman?
 - e. What are the possible allele combinations in the gametes of the man?
 - f. What are the possible allele combinations in the gametes of the woman?
 - g. Demonstrate the probabilities of the hair and eye color combinations in the offspring of this couple by completing a dihybrid cross.

- h. A red haired woman appears at their door with a brown haired toddler claiming that the red haired man is the father. Could he be? Explain your answer.

10. A tall pea plant with white flowers is crossed with a short plant that has purple flowers. All 72 offspring are tall with purple flowers.
- Which height phenotype is dominant?
 - Which flower color phenotype is dominant?
 - What is the expected genotypic ratio for **height** of the offspring?
 - What is the expected genotypic ratio for **flower color** of the offspring?
 - What is the genotype of the tall parent plant?

- What is the genotype of the short parent plant?
- What is/are the genotype/s of the offspring?
- Predict the percentage of F₂ offspring when the tall-purple

F₁'s are allowed to self-pollinate:

- Tall with purple flowers:
 - Tall with white flowers:
 - Short with purple flowers:
 - Short with white flowers:
- What is the phenotypic ratio of the offspring?

11. In guinea pigs curly hair is dominant to straight hair, and brown hair is dominant to white hair. A white, straight haired guinea pig mates with a brown, curly-haired animal. They have two litters, in the first litter all five babies have brown hair, but three are curly and two have straight hair. The second litter consists of six more brown offspring, two are curly and four are straight haired.

- What are the genotypes of the parents?
- What are the genotypes of the offspring?
- What is the probability of having a litter of 3 brown curly haired guinea pigs? (HINT: A litter is conceived and born AT THE SAME TIME)
