

Review Part 2: Inheritance Practice Problems

Important Note: Get in the habit right from the first of writing down the work necessary to solve the problems you do. You will be required to show work on your test .

I. Problems Involving One Gene (Monohybrid Crosses)

1. In cats, long hair is recessive to short hair. A true-breeding (homozygous) short-haired male is mated to a long-haired female. What will their kittens look like?
2. Two cats are mated. One of the parent cats is long-haired (recessive allele). The litter which results contains two short-haired and three long-haired kittens. What does the second parent look like, and what is its genotype?
3. Two wavy haired people (one male and one female) marry and have eight children. Of these eight, how many would you expect to be curly haired, how many wavy haired and how many straight haired, assuming that the family follows the expected predicted inheritance pattern?

II. Problems Involving Two Genes (Dihybrid Crosses)

1. A man with dark (dominant), curly (see problem I.5.) hair marries a woman with light, straight hair. Their daughter, who happens to have dark hair, marries a man with light, wavy hair. Answer the following questions about this dark-haired daughter and her family.
 - a. Draw a Punnett's square for the daughter's marriage, and predict the phenotypic ratio among the offspring of the daughter and her husband.
 - b. What is the chance that they will have a child with hair just like their father's (light and wavy)?
2. If a pure-breeding (homozygous) black (dominant), long-haired (recessive) cat is mated to a pure-breeding Siamese, short-haired cat, and one of their male offspring is mated to one of their female offspring, what is the chance of producing a Siamese colored, short-haired kitten?
3. In garden peas, long stems are dominant to short stems, and yellow seeds are dominant to green seeds. 100 long/yellow pea plants, all of which had one short/green parent, are interbred (bred to each other). 1600 progeny result. Please answer the following questions about these progeny.
 - a. Assuming that these two genes are unlinked, about how many long/green pea plants would you expect to find among the offspring?
 - b. What ratio of yellow to green seed color would you expect among the offspring?
 - c. What would you expect the overall phenotypic ratio among the 1600 offspring to be (taking BOTH traits - colour and stem length - into consideration)?

III. Problems Involving Sex Linkage (X-linked Genes)

1. Earl has normal color vision, while his wife Erma is colorblind. Colorblindness is an X-linked trait, and the normal allele is dominant to the colorblindness allele. If they have a large family, in what percentages of the sons would be colour blind? Daughters?

2. Ethan is colorblind. His wife, Edna, is homozygous for the normal color vision allele. If they have eight children, how many of them would you expect to be colorblind? Using Punnett squares, derive and compare the genotypic and phenotypic ratios expected for the offspring of this marriage and those expected for the offspring of the marriage described in the previous question.

IV. Problems Involving Codominant Genes (...ie: blood type problems)

1. In a particular family, one parent has Type A blood, the other has Type B. They have four children. One has Type A, one has Type B, one has Type AB, and the last has Type O. What are the genotypes of all six people in this family?

NOTE: The ABO blood type gene has three alleles. I^A and I^B are codominant; i (for Type O) is recessive to both.

2. A woman has a daughter. There are three men whom she claims might have been the father of the child. The judge in the paternity court orders that all three men, the child, and the mother have blood tests. The results are: mother, Type A; Daughter, Type O; Man #1, Type AB; Man #2, Type B; Man #3, Type O. The mother claims that this proves that Man #3 must be the little girl's father.
 - a. Is the mother correct? Why or why not?
 - b. The judge isn't satisfied, so he asks for the medical records of the people involved. He discovers that the little girl is colorblind. Men #'s 1 and 2 are also colorblind; Man #3 has normal color vision, as does the mother. (NOTE: Colorblindness is X-linked and recessive.) Assuming that one of these three men **must** be the father, can you now determine which of the three it is?