

THE FIRST OF SEEMINGLY ENDLESS GENETICS PROBLEM SETS

PART A: GENERAL QUESTIONS AND COMPLETE DOMINANCE PROBLEMS

1. How did Mendel produce purebred plants?
2. Define or explain cross pollination. How did Mendel ensure cross-pollination in his pea plants?
3. Why was it important that Mendel use pure plants for his initial experiments?
4. What is meant by a recessive trait?
5. In your own words, state Mendel's Law of Segregation.
6. Using a genetic probability table (Punnett square), illustrate the results of a cross between a hybrid tall pea plant and a purebred dwarf pea plant. What are the phenotypic and genotypic ratios?
7. In the squash plant, the gene for white fruit is dominant over the gene for yellow fruit. If a homozygous white squash plant is crossed with a homozygous yellow plant, what would be the phenotypes and genotypes of the F_1 generation? What would be the phenotypic ratio of the F_2 generation? What would be the phenotypic ratio of the backcross of a yellow F_2 with an F_1 ?
8. Two white sheep produce black offspring. What must the parent's genotype for colour be? What is the probability that the next offspring will be black? Illustrate your answer with a Punnett square.
9. In tomatoes, red fruit colour is dominant to yellow. A red-fruited tomato plant, when crossed with a yellow-fruited one, produces progeny about half of which are red-fruited and half of which are yellow-fruited. What are the genotypes of the parents?
10. In the Jimsonweed, purple flowers are dominant to white. When a particular purple-flowered Jimsonweed is self-fertilized, there are 28 purple-flowered and 10 white-flowered progeny. What proportion of the purple-flowered progeny will breed true?
11. What is the genotype of a pea plant with which a hybrid tall pea plant must be crossed to produce 50% tall and 50% dwarf pea plants? Illustrate your answer using a Punnett square.
12. Outline a possible cross to determine whether a black guinea pig is homozygous or heterozygous for the coat colour trait.
13. In sheep white colour is dominant while black is recessive. Occasionally, a black sheep appears in the flock. Black wool is worthless. How could a farmer eliminate the genes for black coat from his flock? Illustrate your answer using a Punnett square.
14. The polled (hornless) trait in cattle is dominant while the horned trait is recessive. A certain polled bull (whose name will remain anonymous) is mated with three cows. Horned cow "A" gives birth to a horned calf "a". Horned cow "B" produces a polled calf "b", while polled cow "C" produced a horned calf "c". What are the genotypes of the four parents (the bull and cows A, B, and C) and the three cows a, b and c?
15. If a heterozygous long-winged fly is mated to a homozygous long-winged fly, what proportion of the offspring would be expected to be homozygous long-winged?
16. Gray mouse fur colour is dominant to white mouse fur colour. Illustrate the cross between a purebred gray male and a purebred white female. What are the phenotypic and genotypic ratios? Does it make any difference to the phenotypic and genotypic ratios if the cross was reversed so that purebred gray females were crossed with purebred white males?
17. In guinea pigs rough coat (R) is dominant over smooth coat (r). A rough-coated guinea pig is bred to a smooth one, giving eight rough and seven smooth progeny in the F_1 .
 - a. What are the genotypes of the parents and their offspring?
 - b. If one of the rough F_1 animals is mated to its rough parent, what phenotypic and genotypic ratios would you expect?
18. In humans, the gene for brown eyes is dominant to the allele for blue eyes. A brown-eyed man married a blue-eyed woman, and they had five children (after several years, that is!). The first four children were brown-eyed, while the last was blue-eyed. What were the genotypes of the parents? Illustrate your answer using Punnett squares.
19. In garden peas, grey seed colour can be the result of homozygous or heterozygous allele combinations. Determine the genotype of the female parent in each of the crosses in the table below.

Parents Female x Male	Progeny		Female Parent Genotype
	Grey	White	
grey x white	81	82	?
grey x grey	118	39	?
grey x white	74	0	?
grey x grey	90	0	?

20. Albinism in humans is controlled by a recessive gene. From marriages between normally pigmented people known to be carriers and albinos:
 - a. What proportion of the children would be expected to be albinos?
 - b. What is the chance that any pregnancy would result in an albino child?
21. Cystic fibrosis is inherited as an autosomal recessive gene. Two parents without cystic fibrosis have two children with cystic fibrosis and three children who do not have the disease. They come to you for genetic counseling.
 - a. What is the chance that their next child will have cystic fibrosis?
 - b. Their non-affected children are concerned about being heterozygous. What is the chance that a given non-affected child in the family is heterozygous?

THE END . . . FOR NOW