

ALE #8. Mendelian Genetics and Inheritance Practice Problems

Answer the following questions neatly and fully in the spaces provided. **References:** [Chapter 10: Patterns of Inheritance](#) and [Chapter 13: Genetic Counseling in *Essentials of Biology* by Mader 2nd ed](#)

1. What is a chromosome?

2. What are chromosomes made of?

3. What is a gene?

4. Where are genes located?

5. What is a genotype?

6. What is a phenotype?

7. What is an allele?

8. What are homologous chromosomes?

9. What is the relationship between homologous chromosomes and alleles?

10. Define the following terms:
 - a. Homozygous dominant

 - b. Heterozygous

 - c. Homozygous recessive.

13. In cattle the polled (hornless) trait is dominant and is determined by the dominant *allele D*. The horned trait is recessive and is determined by the *allele d*. A certain polled bull is mated to three cows. Cow A, which is horned, gives birth to a polled calf. Cow B, also horned, produces a horned calf. Cow C, which is polled, produces a horned calf—this data is summarized in the table below. Determine the genotypes of the four parents. Clearly show/explain how you arrived at your answers!

Critter	Phenotype	Genotype	Phenotype of Calf produced with Bull
Cow A	Horned		Polled
Cow B	Horned		Horned
Cow C	Polled		Horned
Bull	Polled		

14. In summer squash, *white fruit color is dominant; yellow is recessive*.
- If a squash plant that is homozygous for white is crossed with a homozygous yellow, what will be the phenotype of the F₁ generation?
 - What phenotypes and their fractional amounts would be expected in the F₂ generation?
 - Suppose a *yellow squash plant* is crossed with *the white plants of the F₂*. What would be the appearance and fractional amount of the offspring from each cross—i.e. what would be the expected phenotypic ratio of each cross? Note: this question involves two *different* crosses!

<u>Cross #1</u>	<u>Cross #2</u>

- d. What is the name of the type of cross that was performed in c? _____

Dihybrid and Sex-Linked Crosses

15. In the land of Magumba there grows the fabled Bungula. In Bungulas, *Red Fur color, A*, is incompletely dominant over *Purple Fur, a*, the heterozygous condition being *Green Fur*. Long Wings, *B*, are dominant over short wings, *b*.
- a. If a pure breeding Red, short-winged Bungula is mated with a pure breeding Purple, long-winged one, what will be the Phenotypes and their expected occurrences in the F_1 generation?

b. What will be the phenotypes and their expected occurrences in the F_2 ?

16. In *Drosophila* (fruit fly) yellow body color is sex linked—yellow is recessive to normal body color. If a yellow bodied female is crossed with a normal male and (a) an F_1 female from this cross is mated with her father and (b) an F_1 male is mated with his mother, what will be the phenotypes (as to body color) and their expected occurrences in the offspring of cross (a) and cross (b)? Don't Panic! State results for the two sexes separately

Cross "a" :

Cross "b" :

Multiple Alleles and Blood Groups

17. What are the possible blood types of the children in the following families?

a. Mother: Type A blood and Father: Type A.

b. Mother: Type B blood and Father: Type AB.

c. Mother: Type A blood and Father: Type O.

18. A man is suing his wife for divorce on the grounds of infidelity. Their first child and second child, whom they both claim to be their children, are blood groups O and AB respectively. The third child, whom the man disclaims, is blood type B. Can this information be used to support the man's case? Why?

19. A mother has Type A, Rh- blood and the father has A, Rh+ blood.

a. What are all the possible genotypes of the offspring these two could produce?

b. What are all the possible phenotypes of their potential offspring?

20. A mix-up happened in the maternity ward of a hospital. **Baby X** (Blood type A) and **Baby Y** (Blood type O) lost their ID tags!! If the suspected parents have the following blood types, match the babies with the correct parents.

Couple 1: Type B and Type A

Couple 2: Type A and AB

Probability Method

21. How many different types of gametes could be generated from individuals with the following genotypes?

a. AaBb

b. AaBbCc

c. AABbCC

d. AABbCc

22. Given AaBbCC x AabbCc what are the chances of producing the following genotypes?

a. AabbCC

b. aaBbCc

c. aabbCc

d. AaBbCc

23. Suppose A = Red and a = White. B = Tall and b = Short. Given the following cross $AaBb \times aaBb$ what are the chances of producing the following phenotypes?

a. Red Tall

b. Red Short

c. White Short

24. Suppose A = Red and a = White; B = Tall and b = Short; C = Round seed and c = wrinkle seed. Given the cross of $AaBbcc \times AabbCc$ what are the chances of producing the following phenotypes?

a. Red, Tall, and Round Seed

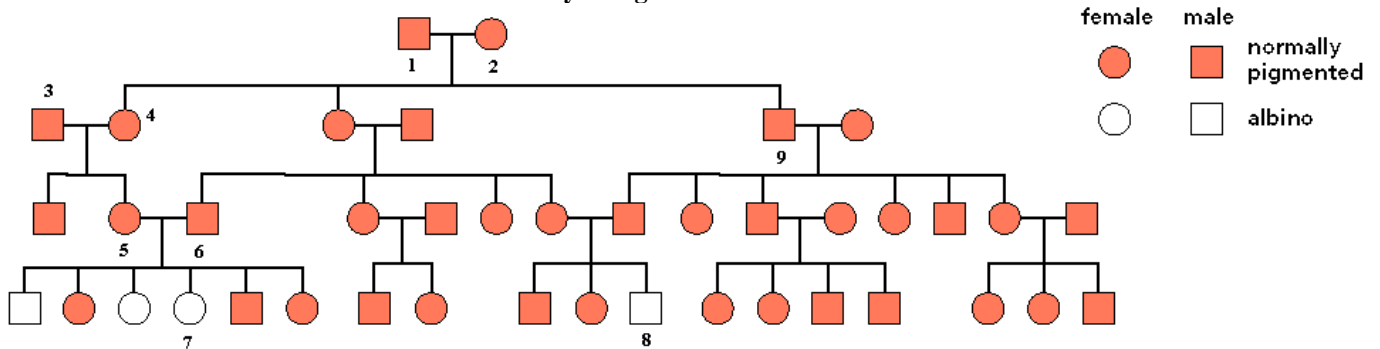
b. White, Short, and Wrinkled Seed

c. Red, Short and Wrinkled Seed

Pedigree Analysis

25. Examine the human pedigree for a family with albinism. On this pedigree, individuals that are shaded represents that they have normal skin pigmentation, while those that are not shaded in are albino—that is, they are unable to produce melanin, the substance responsible for skin pigmentation. The squares indicate the condition of the males; the circles indicate the condition of the females. Use this pedigree to answer the following 5 questions.

Family Pedigree for Albinism



- Could this characteristic be due to a sex-linked recessive allele? Defend your response.
- Could this characteristic be due to a sex-linked dominant allele? Defend your response.
- Could this characteristic be due to an autosomal dominant allele? Defend your response.
- Could this characteristic be due to an autosomal recessive allele? Defend your response.
- Determine the genotypes of the individuals below from this pedigree. Define the allele symbols below.

Allele Symbols: A = _____ a = _____

Genotype of Individual

Genotype of Individual

Individual #1 _____

Individual #6 _____

Individual #2 _____

Individual #7 _____

Individual #3 _____

Individual #8 _____

Individual #4 _____

Individual #9 _____

Individual #5 _____