Monohybrid Cross Problems

1. The gene for tall (T) is dominant over dwarf (t) in the garden pea. A pea plant that comes from a line of plants that are all tall (true-breeding) is crossed with a dwarf pea plant.

   T allele =
   t allele =

   Parental Genotypes are
   ______ for tall (true-breeding)
   ______ for dwarf pea plants

   Using a Punnett square determine
   a. What is the phenotype of the F1 generation?
   b. What is (are) the genotypes?

2. In guinea pigs, rough coat (R) is dominant over smooth coat (r).

   Predict the genotypes and phenotypes of the offspring and give the genotypic and phenotypic ratios if a homozygous dominant guinea pig is crossed with a heterozygous guinea pig.

   R allele =
   r allele =

   Parental genotypes are
   ______ homozygous dominant guinea pig
   ______ heterozygous guinea pig

   Offspring Predictions
   Genotype:
   Phenotype:

3. In humans, a widow’s peak (W) is dominant over non-widow’s peak (w). Manual and Manuela have 12 children, 7 have a widow’s peak and 5 do not. Manual has a widow’s peak and Manuela does not.

   What are the probable genotypes of Manual and Manuela and their offspring?

   For Manual to have a widow’s peak means his two possible genotypes are:

   Manual’s genotype must be...

   Use 2 punnett squares to logically determine
   • cross out the punnet square that Does NOT give Manual and Manuela the chance of having 12 children, 7 have a widow’s peak and 5 do not
   • Circle the punnett square that Does give Manual and Manuela the chance of having 12 children, 7 have a widow’s peak and 5 do not

   What are the probable genotypes of Manual and Manuela and their offspring?

4. In humans the ability to roll your tongue (T) is dominant over the inability to roll your tongue (t). Explain how parents who can roll their tongues can have a child who cannot roll his/her tongue and give the genotypes of the parents.

   More Monohybrid problems

5. In humans, the ability to taste phenylthiourea (PTU) is dominant. “Tasters” (TT) or (Tt) perceive an extremely bitter taste of PTU, while "non tasters" (tt) experience no sensation, or taste.

   a. What are the genotypes of Mr. and Mrs. Meadowmuffin, who can taste PTU, and who have 3 children, one of whom is a non taster? (show your work with a punnett square)

   Genotypes
   Mr. Meadowmuffin:
   Mrs. Meadowmuffin:

   b. What offspring phenotypes would be expected from the following crosses and in what ratios?

   1. heterozygous x heterozygous  2. homozygous taster x heterozygous  3. heterozygous x non taster

   Offspring Phenotype ratios?

6. In humans, brown eyes (B) are dominant over blue (b). A brown-eyed man marries a blue-eyed woman and they have three children, two of which are brown-eyed and one of whom is blue-eyed.

   a. Draw the Punnett square that illustrates this marriage.
   b. What is the man’s genotype?
   c. What are the genotypes of the children?

7. In silkworms a single gene determines the color of the cocoon. The yellow cocoon allele is dominant to the white allele. What are the genotypic and phenotypic ratios of a cross between a homozygous dominant male and a heterozygous female?

   By tradition alleles use the first letter of the dominant trait
   The yellow cocoon allele will be represented by ___ & The white allele will be represented by ___

   The genotypic and phenotypic ratios of this cross are ...

8. In mice a single gene determines the color of the eyes. The black eyes allele is dominant to the red allele. What are the genotypic and phenotypic ratios of a cross between a heterozygous male and a heterozygous female? (Show all your work!)
Dihybrid Cross Problems

1. What are the possible gametes formed from the independent assortment of genes for …
   a. AABB: __________
   b. AABb: __________ or ___________
   c. AaBb: __________, __________, __________, or __________

2. In garden peas axial flower position (A) is dominant and terminal flower position (a) is recessive. Tall vine (T) is dominant and short vine (t) is recessive. A plant homozygous for tall vine and axial flowers was crossed with a plant having short vines and terminal flowers. What are the possible phenotypes and genotypes of the offspring?

   Parental Genotypes and gametes
   - For the homozygous for tall vine and axial flowers
     The genotype is ______________________
     and the possible gametes is/are ______________________
   - For the short vines and terminal flowers
     The genotype is ______________________
     and the possible gametes is/are ______________________

   Complete the dihybrid cross
   What are the possible phenotypes and genotypes of the offspring?

3. The offspring from the above problem were crossed with one another. What are the phenotypes of the offspring?

   Parental Genotypes and gametes
   - 1st parent mentioned
     The genotype is ______________________
     and the possible gametes is/are ______________________
   - 2nd parent mentioned
     The genotype is ______________________
     and the possible gametes is/are ______________________

   What are the phenotypes of the offspring?

4. In horses black hair (B) is dominant and chestnut is recessive (b). The trotting gait is dominant (T) and pacing (t) is recessive. A homozygous black pacer is crossed with a homozygous chestnut trotter. What are the possible genotypes and phenotypes of their offspring?

   Parental Genotypes and gametes
   - homozygous black pacer
     The genotype is ______________________
     and the possible gametes is/are ______________________
   - homozygous chestnut trotter
     The genotype is ______________________
     and the possible gametes is/are ______________________

   What are the possible genotypes and phenotypes of their offspring?
   Genotype:
   Phenotype:

5. In watermelons, the alleles for green color (G) and short shape (S) are dominant over the alleles for striped color (g) and long shape (s). A plant with long, striped fruits is crossed with a plant that is heterozygous for both characteristics. What genotypes and phenotypes will be found among the offspring and in what ratios?

   Parental Genotypes and gametes
   - 1st parent mentioned
     The genotype is ______________________
     and the possible gametes is/are ______________________
   - 2nd parent mentioned
     The genotype is ______________________
     and the possible gametes is/are ______________________

   What genotypes and phenotypes will be found among the offspring and in what ratios?
   Genotype ratio:
   Phenotype ratio:
Monohybrid and Dihybrid Cross Problems Review

<table>
<thead>
<tr>
<th>Dominant Traits</th>
<th>Recessive Traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freckles (F)</td>
<td>No freckles (f)</td>
</tr>
<tr>
<td>Astigmatism (A)</td>
<td>Normal vision (a)</td>
</tr>
<tr>
<td>Ability to roll tongue (R)</td>
<td>Cannot roll tongue (r)</td>
</tr>
<tr>
<td>Normal arches (A)</td>
<td>Flat feet (a)</td>
</tr>
<tr>
<td>Widow’s peak (W)</td>
<td>Straight hairline (w)</td>
</tr>
</tbody>
</table>

1. A man who has normal vision marries a woman who is heterozygous for astigmatism. What are the possible genotypes and phenotypes which their children can have?

2. Two people who have normal arches produced a child who has flat feet. 
   a. What is the genotype of the child?
   b. What is the genotype of the father?
   c. What is the genotype of the mother?
   d. Explain how you arrived at your answers.

3. A woman has a widow’s peak, but she does not know her genotype. She marries a man who has a straight hairline and they have 13 children. Nine have widow’s peaks and four have straight hairlines.
   a. What are the genotypes of the parents?
   b. What are the genotypes of the children?
   c. Explain how you arrived at your answers.

4. A couple who both have the ability to roll their tongues have a son who is also a tongue-roller. The son is very curious as to whether he is homozygous or heterozygous for the tongue-rolling trait. How would he go about finding out?

5. A man who has no freckles and flat feet marries a woman who is homozygous dominant for both traits.
   a. What is the man’s genotype?
   b. What genotype(s) will his gametes have?
   c. The woman’s genotype?
   d. What genotype(s) will her gametes have?
   e. What are the possible genotypes and phenotypes of their children for these traits?

6. A man has freckles and can’t roll his tongue. His wife has no freckles and can roll her tongue. All of their many children have freckles. About half can roll their tongues, while the other half can’t. What are the probable genotypes of the parents, and what gametes can each parent produce?

7. A man who has normal vision and a straight hairline marries a woman who has normal vision and is homozygous for tongue-rolling trait. What are the possible genotypes and phenotypes of their children for these traits?

8. A woman who has normal vision and a straight hairline has children with a man who has flat feet and a widow’s peak. One of their children has a straight hairline and normal vision, and one of their children has a widow’s peak and flat feet. What are the genotypes of the parents?

Sex-Linked Problems

1. Color blindness is a recessive, sex-linked trait \( X^c = \text{normal color vision}; \ X^{cb} = \text{colorblind} \). A man with normal color vision marries a woman with normal color vision whose father is color blind. If they have a son, what is the chance that he will be color blind?

Color blindness is carried on the ______ chromosome.

Males: Sex chromosomes are ______ so they only have ______ copy of the gene

The man with normal color vision must have the genotype ______

Females: Sex chromosomes are ______ so they have ______ copies of the gene

A woman with normal color vision whose father is color blind must have the genotype ______

If they have a son, what is the chance that he will be color blind?

3. What percentage of the male offspring produced by a father with normal vision and a color blind mother are expected to be colorblind?

Father’s genotype: 

Mothers genotype: 

Expected percentage of color blind male

4. Hemophilia is a recessive, sex-linked trait \( X^B = \text{normal blood clotting}; \ X^b = \text{hemophilia} \).

A woman carrying the gene for hemophilia marries a man who is hemophiliac. What percentage of their children can be expected to have hemophilia?

Father’s genotype: 

Mothers genotype: 

What percentage of their children can be expected to have hemophilia?

5. A man and woman with normal color vision produced two colorblind sons and two daughters with normal color vision. What are the genotypes of the parents?

Show your work

What are the genotypes of the parents?

Justify why this must be the answer
6. In cats one gene for coat color is sex-linked. ($X^B$ = black coat; $X^b$ = yellow coat; $X^B X^b$ = tortoise shell coat).

What would be the phenotypes of the offspring of a cross between a black male and a tortoise-shell female?

7. In fruit flies, white eyes is an X-linked recessive form of the trait for eye color ($X^R$ or $X^r$). Red eyes are the dominant form. A heterozygous female for eye color is crossed with a white eyed male.

a. How many of their offspring will be white-eyed females?

b. How many will be white-eyed males?

c. How many of the males will be red-eyed?

8. A human female “carrier” who is heterozygous for the recessive, sex-linked trait causing red-green color blindness, marries a color blind male. What proportion of their sons will have red-green color blindness?