Name _____ Date _____ Per _____
Biology

NonMendelian Genetics Problems

Show all work!

Incomplete Dominance (see page 272)

1. Cross a red (R) four-o'clock flower with a white (W) one. The heterozygous condition will produce a pink color (RW). Give F1 and F2 genotypes and phenotypes.

F1 Generation:

Genotype Ratio _____

Phenotype Ratio _____

F2 Generation:

Genotype Ratio _____

Phenotype Ratio _____

2. Cross a pink four-o'clock flower with a red one. Give genotypes and phenotypes for F1.

Genotype Ratio _____

Phenotype Ratio _____

Codominance is also displayed in the case of sickle-cell anemia in humans. Two alleles for normal cells produce normal red blood (NN), two alleles for sickle-cell (SS) produces the diseased cells that sickle or are misshapen during conditions of low blood oxygen, but the heterozygous (NS) condition causes only some of the red blood cells to be misshapen. Heterozygous (hybrid) individuals are referred to as having the sickle-cell trait or carrying the sickle cell gene (but do not suffer from the disease).

3. Suppose a husband and wife both have blood tests and are told that they each have the sickle-cell trait (are heterozygous). What would they expect for their children?

Genotype Ratio _____

Phenotype Ratio _____

Multiple Alleles Genetic Problems (see page 273)

In human blood types, three alleles exist (there are three types of alleles for blood type): the alleles for blood antigen A and blood antigen B are both dominant to the allele for no antigen O.

A person can possess only two alleles for blood type. He may have two alleles for A (homozygous type A blood = AA); he may have two alleles for antigen B (homozygous type B blood = BB); he may have two alleles for no antigen (type O blood = OO). He may have one allele for antigen A and one allele for no antigen (heterozygous for type A blood = AO); he many have one allele for antigen B and one for now antigen (heterozygous for type B blood = BO); or he may have one allele for antigen A and one allele for antigen B (type AB blood = AB).

1. A man who is heterozygous for type A blood marries a woman who is heterozygous for type B blood. What are the possibilities for their children?

Genotype Ratio _____

Phenotype Ratio _____

2. What is the probability of the children having type A blood if one parent is heterozygous for type A and the other has type AB blood?

3. Show the F1 genotypes and phenotypes from a mating of a male with type O blood and a woman homozygous for type B blood

Genotype Ratio _____

Phenotype Ratio _____

4. Could a man with type O father a child with blood type AB with a mother with blood type A? Explain.

5. Can a woman with type AB blood have a child with type O blood? Explain.

Sex Linkage Genetics Problems (see page 350-351)

Sex linkage is the situation in which the gene for the trait is carried on only the X (23rd) chromosome. Therefore, a man (XY) would only have one gene for this trait, but a woman (XX) would have two genes for the trait since she has two X chromosomes (homologous pair #23). A man has only one X chromosome and one Y chromosome which carries different genes.

For this reason, hereditary illnesses such as hemophilia and color blindness are much more common among men. (If the gene on his one X chromosome is harmful, he has no gene on another X chromosome to offset the harmful effects.) Women may be carriers (hybrid) of a hereditary defect if they are heterozygous for the trait, but will not have the disease themselves as they have one normal gene to compensate. They will, however, be able to transmit the harmful gene to their offspring. Men, on the other hand, cannot be carriers, due to the fact that they can only carry one gene.

We write the six linked trait as a superscript to the X chromosomes.

Example: Let N = normal color vision and n = red-green color blindness.

X^NX^n – What is the phenotype? Sex and vision of the person _____

X^NY – What is the phenotype? Sex and vision of the person _____

<u>Color blindness & hemophilia are six linked, recessive conditions!</u>

1. What is the probability of children being red-green color blind if a man with normal vision married a woman who is a carrier for color blindness?

% of Red-Green Color Blind Children
_____

2. What is the probability that the children will have hemophilia if the mother is a sufferer of hemophilia, but the father is normal? What % of girls will be normal, carriers, or sufferers of hemophilia? Boys?

% of Normal Girls _____

% of Carrier Girls _____

% of Normal Boys _____

% of Diseased Boys _____

3. Cross a man with hemophilia with a female who is a carrier (hybrid) of hemophilia.

Genotype Ratio _____

Phenotype Ratio _____