Name_____Period_____Assignment #_____

Monohybrid Cross, Dihybrid Cross, Sex-linked Inheritance 1, and Sex-linked Inheritance 2 Problem Sets and Tutorials

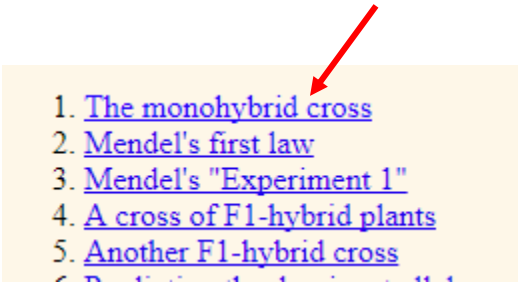
http://www.biology.arizona.edu/mendelian_genetics/mendelian_genetics.html

All answers must have some type of illustration supporting the logic of your answer

Click on Monohybrid Cross

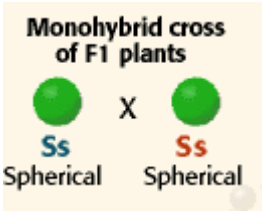
Genetics is the study of heredity and variation in organisms. We begin with a study of the monohybrid cross, invented by Mendel. In a monohybrid cross, organisms differing in only one trait are crossed. Our objective is to understand the principles that govern inheritance in plants and animals, including humans, by solving problems related to the monohybrid cross.

Click on The monohybrid cross



1)

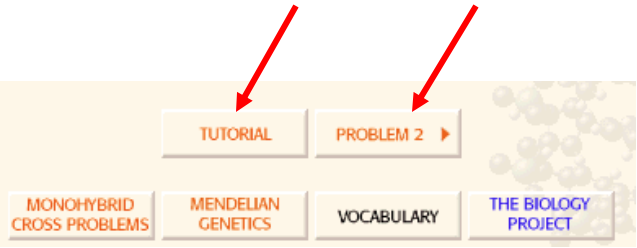
In pea plants, spherical seeds (S) are dominant to dented seeds (s). In a genetic cross of two plants that are heterozygous for the seed shape trait, what fraction of the offspring should have spherical seeds?



Show your work!

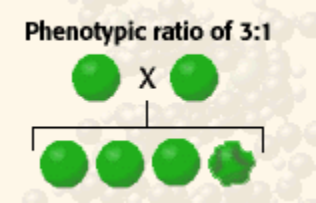
Click on TUTORIAL

Click on PROBLEM 2



2)

A phenotypic ratio of 3:1 in the offspring of a mating of two organisms heterozygous for a single trait is expected when:



Show your work!

Click on TUTORIAL

Click on PROBLEM 3

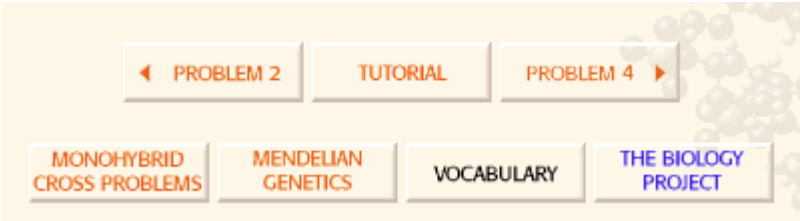
3)

In Mendel's "Experiment 1," true-breeding pea plants with spherical seeds were crossed with true-breeding plants with dented seeds. (Spherical seeds are the dominant characteristic.) Mendel collected the seeds from this cross, grew F1-generation plants, let them self-pollinate to form a second generation, and analyzed the seeds of the resulting F2 generation. The results that he obtained, and that you would predict for this experiment are:

Show your work! (Next Page)

Click TUTORIAL

Click on PROBLEM 4



4)

A genetic cross between two F1-hybrid pea plants for spherical seeds will yield what percent spherical-seeded plants in the F2 generation? (Recall, spherical-shaped seeds are dominant over dented seeds.)

Show your work!

Click TUTORIAL

Click on PROBLEM 5

5)

A genetic cross between two F1-hybrid pea plants having yellow seeds will yield what percent green-seeded plants in the F2 generation? Yellow seeds are dominant to green.

Show your work!

Click TUTORIAL

Click on PROBLEM 6

6)

When true-breeding tall stem pea plants are crossed with true-breeding short stem pea plants, all of the _____ plants, and 3/4 of the _____ plants had tall stems. Therefore, tall stems are dominant.

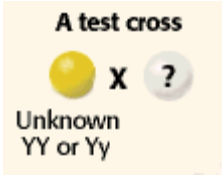
Show your work!

Click TUTORIAL

Click on PROBLEM 7

7)

To identify the genotype of yellow-seeded pea plants as either homozygous dominant (YY) or heterozygous (Yy), you could do a test cross with plants of genotype _____.



Show your work!

Click TUTORIAL

Click on PROBLEM 8

8)

A test cross is used to determine if the genotype of a plant with the dominant phenotype is homozygous or heterozygous. If the unknown is homozygous, all of the offspring of the test cross have the _____ phenotype. If the unknown is heterozygous, half of the offspring will have the _____ phenotype.

Show your work!

Click TUTORIAL

Click on PROBLEM 9

9)

In Mendel's experiments, if the gene for tall (T) plants was incompletely dominant over the gene for short (t) plants, what would be the result of crossing two Tt plants?

Show your work!

Click TUTORIAL

Click on PROBLEM 10

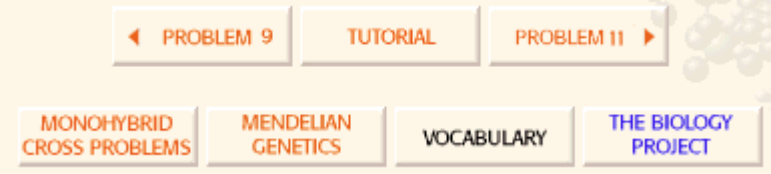
10)

A genetic cross of inbred snapdragons with red flowers with inbred snapdragons with white flowers resulted in F1-hybrid offspring that all had pink flowers. When the F1 plants were self-pollinated, the resulting F2-generation plants had a phenotypic ratio of 1 red: 2 pink: 1 white. The most likely explanation is:

Show your work!

Click TUTORIAL

Click on PROBLEM 11



11)

Human blood type is determined by codominant alleles. There are three different alleles, known as I^A, I^B, and i. The I^A and I^B alleles are co-dominant, and the i allele is recessive.

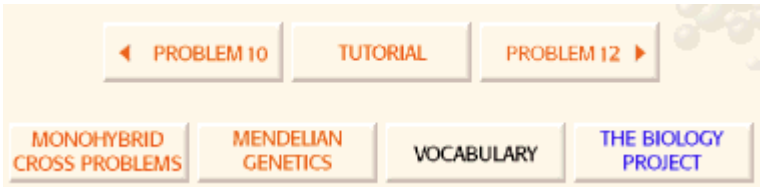
The possible human phenotypes for blood group are type A, type B, type AB, and type O. Type A and B individuals can be either homozygous (I^AI^A or I^BI^B, respectively), or heterozygous (I^Ai or I^Bi, respectively).

A woman with type A blood and a man with type B blood could potentially have offspring with which of the following blood types?

Show your work!

Click TUTORIAL

Click on PROBLEM 12



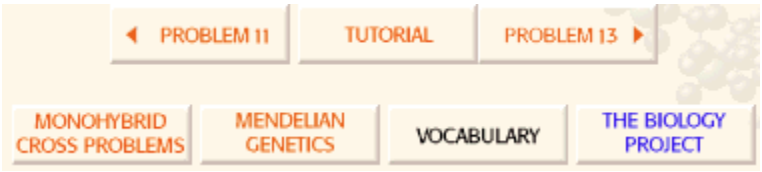
12)

Manx cats are heterozygous for a dominant mutation that results in no tails (or very short tails), large hind legs, and a distinctive gait. The mating of two Manx cats yields two Manx kittens for each normal, long-tailed kitten, rather than three-to-one as would be predicted from Mendelian genetics. Therefore, the mutation causing the Manx cat phenotype is likely a(n) _____ allele.

Show your work! (Next Page)

Click TUTORIAL

Click on PROBLEM 13



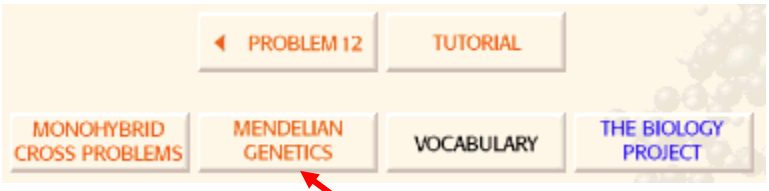
13)

What are the possible blood types of the offspring of a cross between individuals that are type AB and type O? (Hint: blood type O is recessive)

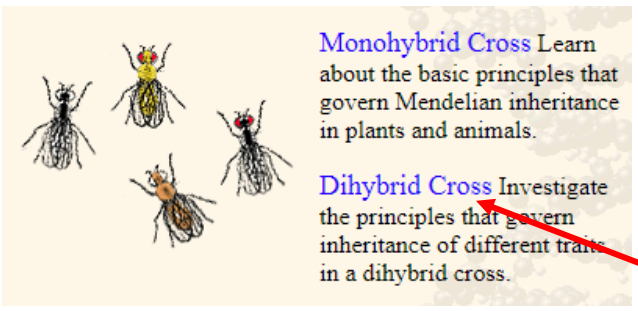
Show your work!

Click TUTORIAL

Click on MENDELLIAN GENETICS



Click on Dihybrid Cross



A dihybrid cross involves a study of inheritance patterns for organisms differing in two traits. Mendel invented the dihybrid cross to determine if different traits of pea plants, such as flower color and seed shape, were inherited independently. Our objective is to understand the principles that govern inheritance of different traits in a dihybrid cross that led Mendel to propose that alleles of different genes are assorted independently of one another during the formation of gametes.

1)

A pea plant is heterozygous for both seed shape and seed color. S is the allele for the dominant, spherical shape characteristic; s is the allele for the recessive, dented shape characteristic. Y is the allele for the dominant, yellow color characteristic; y is the allele for the recessive, green color characteristic. What will be the distribution of these two alleles in this plant's gametes?

Show your work!

Click TUTORIAL

Click on PROBLEM 2

2)

A phenotype ratio of 9:3:3:1 in the offspring of a mating of two organisms heterozygous for two traits is expected when:

Show your work!

Click TUTORIAL

Click on PROBLEM 3

3)

Which of the following genetic crosses would be predicted to give a phenotypic ratio of 9:3:3:1?

Show your work!

Click TUTORIAL

Click on PROBLEM 4

4)

The gametes of a plant of genotype SsYy should have the genotypes:

Show your work!

Click TUTORIAL

Click on PROBLEM 5

5)

Which of the following genotypes would you not expect to find among the offspring of a SsYy x ssyy test cross:

Show your work!

Click TUTORIAL

Click on PROBLEM 6

6)

The expected phenotypic ratio of the progeny of a SsYy x ssyy test cross is:

Show your work!

Click TUTORIAL

Click on PROBLEM 7

7)

In a dihybrid cross, AaBb x AaBb, what fraction of the offspring will be homozygous for both recessive traits?

Show your work!

Click TUTORIAL

Click on PROBLEM 8

Click TUTORIAL

Click on PROBLEM 8

8)

Following a SsYy x SsYy cross, what fraction of the offspring are predicted to have a genotype that is heterozygous for both characteristics?

Show your work!

Click TUTORIAL

Click on PROBLEM 9

9)

In a dihybrid cross, SsYy x SsYy, what fraction of the offspring will be homozygous for both traits?

Show your work!

Click TUTORIAL

Click on PROBLEM 10

10)

If Mendel's crosses between tall, spherical-seeded plants and short, dented-seeded plants had produced many more than 1/16 short, dented-seeded plants in the F2 generation, he might have concluded that:

Show your work!

Click TUTORIAL

Click on PROBLEM 11

11)

In Mendel's experiments, the spherical seed character (SS) is completely dominant over the dented seed character (ss). If the characters for height were incompletely dominant, such that TT are tall, Tt are intermediate and tt are short, what would be the phenotypes resulting from crossing a spherical-seeded, short (SStt) plant to a dented-seeded, tall (ssTT) plant?

Show your work!

Click TUTORIAL

Click on PROBLEM 12

12)

Two unlinked loci effect mouse hair color. **CC** or **Cc** mice are agouti. Mice with genotype **cc** are albino because all pigment production and deposition of pigment in hair is blocked. At the second locus, the **B** allele (black agouti coat) is dominant to the **b** allele (brown agouti coat). A mouse with a black agouti coat is mated with an albino mouse of genotype **bbcc**. Half of the offspring are albino, one quarter are black agouti, and one quarter are brown agouti. What is the genotype of the black agouti parent?

Show your work!

Click TUTORIAL

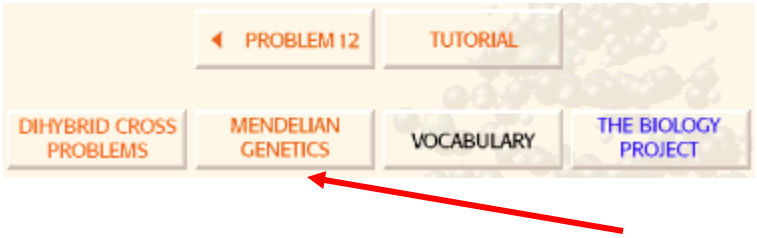
Click on PROBLEM 13

13)

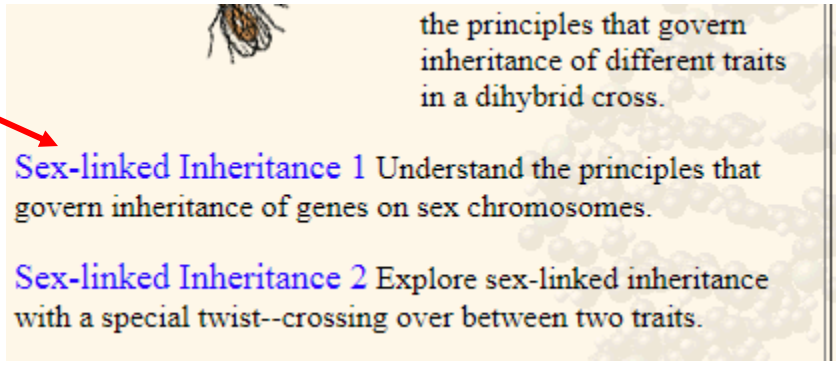
Two unlinked loci effect mouse hair color. **AA** or **Aa** mice are agouti. Mice with genotype aa are albino because all pigment production is blocked, regardless of the phenotype at the second locus. At the second locus, the **B** allele (agouti coat) is dominant to the **b** allele (black coat). What would be the result of a cross between two agouti mice of genotype **AaBb**?
Show your work!

Click TUTORIAL

Click MENDELIAN GENETICS



Click Sex-linked Inheritance 1



The study of inheritance of genes located on sex chromosomes was pioneered by T. H. Morgan and his students at the beginning of the 20th century. Although Morgan studied fruit flies, the same genetic principles apply to humans. Since males and females differ in their sex chromosomes, inheritance patterns for X-chromosome linked genes vary between the sexes. Our objective is to understand the principles that govern inheritance of genes on sex chromosomes.

1)

In a cross between a white-eyed female fruit fly and red-eyed male, what percent of the female offspring will have white eyes? (White eyes are X-linked, recessive)

Show your work!

Click TUTORIAL

Click on PROBLEM 2

2)

A female Drosophila of unknown genotype was crossed with a white-eyed male fly, of genotype X^wY (w = white eye allele is recessive, w+= red-eye allele is dominant.) Half of the male and half of the female offspring were red-eyed, and half of the male and half of the female offspring were white-eyed. What was the genotype of the female fly?

Show your work!

Click TUTORIAL

Click on PROBLEM 3

3)

In a cross between a pure bred, red-eyed female fruit fly and a white-eyed male, what percent of the male offspring will have white eyes? (white eyes are **X**-linked, recessive)

Show your work!

Click TUTORIAL

Click on PROBLEM 4

4)

What is the genotype of a red-eyed, yellow-bodied female fruit fly who is homozygous for the eye color allele?
Red eyes (w+) and tan bodies (y+) are the dominant alleles. (Both traits are **X** chromosome linked).

Show your work!

Click TUTORIAL

Click on PROBLEM 5

5)

A white-eyed female fruit fly is crossed with a red-eyed male. Red eyes are dominant, and **X**-linked. What are the expected phenotypes of the offspring?

Show your work!

Click TUTORIAL

Click on PROBLEM 6

6)

Hemophilia in humans is due to an **X**-chromosome mutation. What will be the results of mating between a normal (non-carrier) female and a hemophilac male?

Show your work!

Click TUTORIAL

Click on PROBLEM 7

7)

A human female "carrier" who is heterozygous for the recessive, sex-linked trait causing red-green color blindness (or alternatively, hemophilia), marries a normal male. What proportion of their male progeny will have red-green color blindness (or alternatively, will be hemophiliac)?

Show your work!

Click TUTORIAL

Click on PROBLEM 8

8)

Women have sex chromosomes of **XX**, and men have sex chromosomes of **XY**.

Which of a man's grandparents could not be the source of any of the genes on his **Y**-chromosome?

Show your work!

Click TUTORIAL

Click on PROBLEM 9

9)

Women have sex chromosomes of **XX**, and men have sex chromosomes of **XY**.

Which of a women's grandparents could not be the source of any of the genes on either of her **X**-chromosomes?

Show your work!

Click TUTORIAL

Click on PROBLEM 10

10)

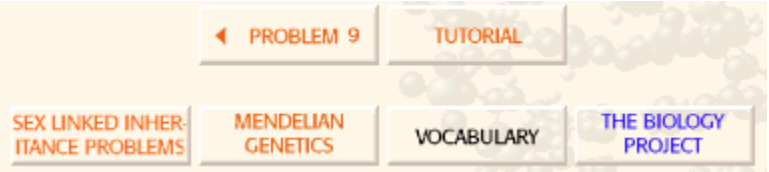
A human female "carrier" who is heterozygous for the recessive, sex-linked trait red color blindness, marries a normal male.

What proportion of their female progeny will show the trait?

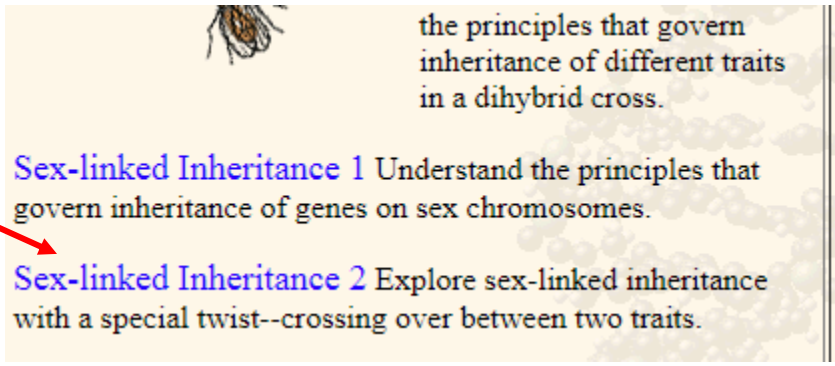
Show your work!

Click TUTORIAL

Click on MENDELIAN GENETICS



Click on Sex-linked Inheritance 2



A. H. Sturtevant, a student of T. H. Morgan, published a paper in 1913 entitled "The Linear Arrangement of Six Sex-Linked Factors in Drosophila, as Shown by Their Mode of Association" (J. Exptl. Zoology, volume 14, pages 43-59.) Sturtevant provided experimental evidence that genes were organized in a linear fashion on chromosomes by quantitiative analysis of the frequency of crossing-over between two traits carried on the **X**-chromosome of the fruit fly. This series of questions demonstrates the type of genetic cross used by Sturtevant in this study.

1)

The alleles for eye color and for body color are on the **X** chromosome of Drosophila, but not on the **Y**. Red eye color (w+) is dominant to white eye color (w), and tan body color (y+) is dominant to yellow body color (y).

What is the genotype of a yellow-bodied, red-eyed female who is homozygous for eye color?

Show your work!

Click TUTORIAL

Click on PROBLEM 2

2)

The alleles for eye color and for body color are on the **X** chromosome of Drosophila, but not on the **Y**. Red eye color (w+) is dominant to white eye color (w), and tan body color (y+) is dominant to yellow body color (y).

What is the genotype of a tan-bodied, white-eyed male?

Show your work!

Click TUTORIAL

Click on PROBLEM 3

3)

What offspring would you expect from a cross between the female Drosophila described in problem 1 (red eyes and a yellow body, homozygous recessive for the yellow body color allele and homozygous dominant for the eye color allele) and the male described in problem 2 (hemizygous for both the recessive (white) eye color allele and dominant (tan) body color allele?)

A reminder that the alleles for eye color and for body color are on the **X**chromosome of Drosophila, but not on the **Y**. Red eye color (w+) is dominant to white eye color (w), and tan body color (y+) is dominant to yellow body color (y).

Show your work! (Next Page)

Click TUTORIAL

Click on PROBLEM 4

4)

If we mated the F1 female and male flies from the cross obtained in problem 3, what male phenotype in the F2 generation would be evidence that crossing over had occured during gamete formation?

Daughters were tan-bodied, red-eyed, heterozygous for both eye and body color. The sons were yellow-bodied, red-eyed hemizygous.

Show your work!

Click TUTORIAL