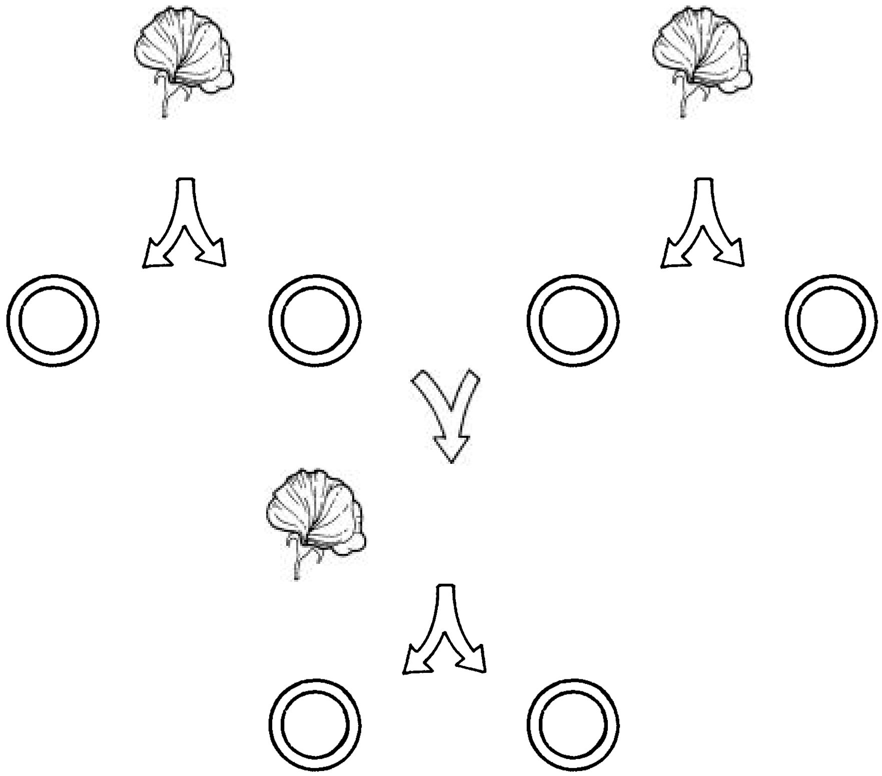
AP BIOLOGY
HEREDITY
ACTIVITY #2

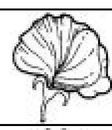
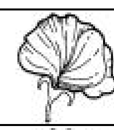
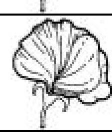
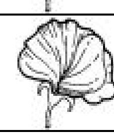
NAME____________________

DATE___________HOUR_____

MENDELIAN GENETICS

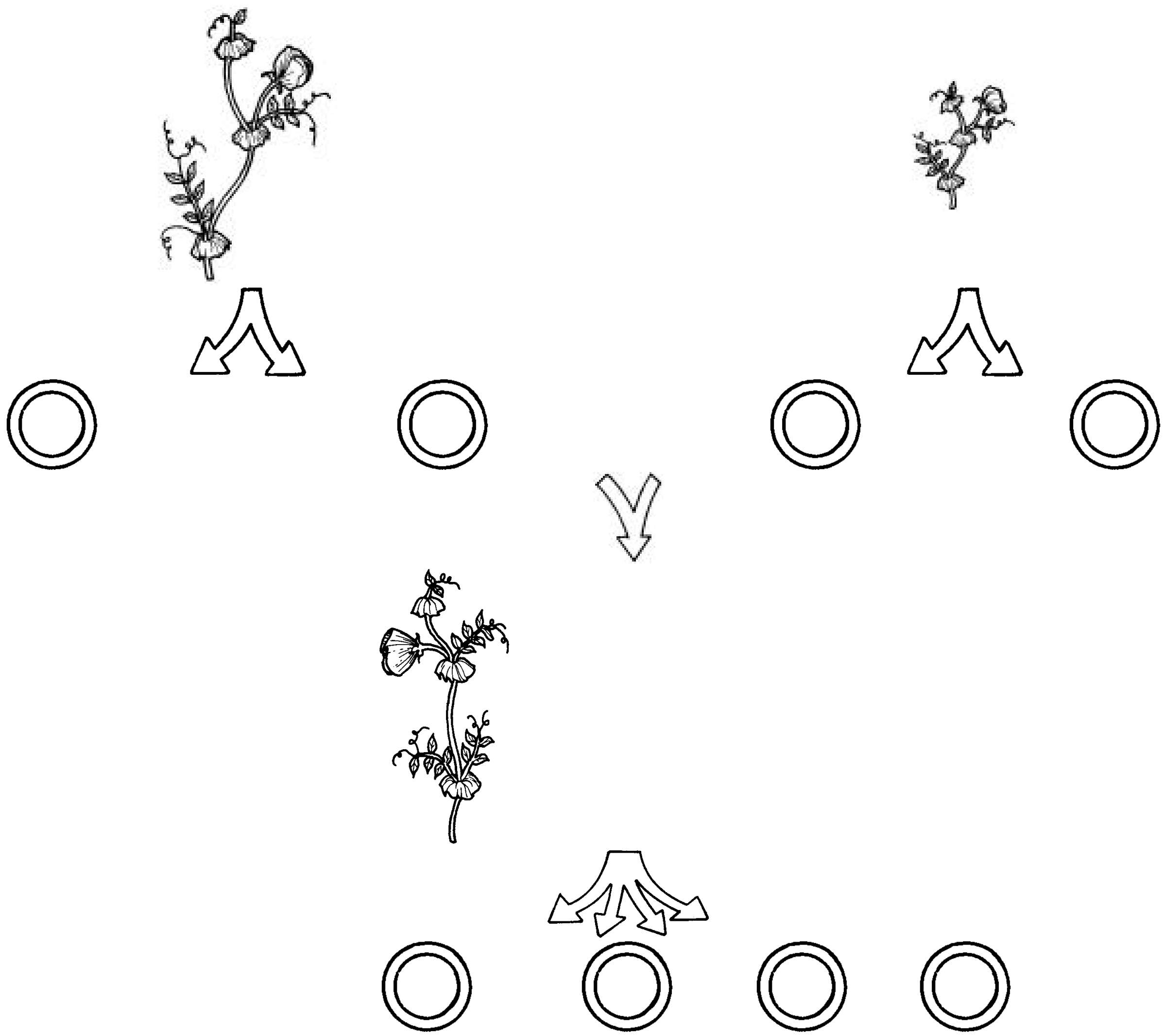
SINGLE TRAIT CROSS



LAW OF SEGREGATION:

TWO TRAIT CROSS



LAW OF INDEPENDENT ASSORTMENT

LAWS OF PROBABILITY

RULE OF MULTIPLICATION:

Example #1: You have 2 coins, what is the probability that you will flip two heads?

Example #2: What is the probability that offspring of an F_1 generation cross will be homozygous recessive? (Pp x Pp → pp)

RULE OF ADDITION:
Example #1: You have 2 coins. What is the probability that you will flip a heads and a tails?
Example #2: What is the probability that two heterozygous parents will produce heterozygous offspring? (Pp x Pp → Pp)
Example #3: What is the probability that two parents heterozygous for both height and flower color will produce tall offspring with purple flowers?

QUESTIONS:

1. State Mendel's Law of Segregation.

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2. Define and give an example of each of the following.

Term	Definition	Example
Homozygous		
Heterozygous		
Phenotype		
Genotype		

3. What is a test cross? ____

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   Explain how a test cross can be used to determine if a dominant phenotype is homozygous or heterozygous.

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4. State Mendel's Law of Independent Assortment:

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5. A student has a penny, a nickel, a dime, and a quarter. She flips them all simultaneously and checks for heads or tails. Show your work.

What is the probability that all four coins will come up heads?

____

She again flips all four coins. What is the probability that she will get four heads both times?

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What probability rule did you use to determine your answer?

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6. For the following crosses, indicate the probability of obtaining the indicated genotype in an offspring. Remember it is easiest to treat each gene separately as a monohybrid cross and then combine the probabilities.

Cross	**Offspring**	**Probability**
AAbb x AaBb	AAbb	
AaBB x AaBb	aaBB	
AABbcc x aabbCC	AaBbCc	
AaBbCc x AaBbcc	aabbcc	

7. The genotype of F_1 individuals in a tetrahybrid cross is AaBbCcDd. Assuming independent assortment of these four genes, what are the probabilities that F_2 offspring would have the following genotypes? Show your work.

a. aabbccdd ____

b. AaBbCcDd ____

c. AABBCCDD ____

d. AaBBccDd ____

e. AaBBCCdd ____

8. Flower position, stem length, and seed shape were three characters that Mendel chose to study. Each is controlled by an independently assorting gene and has dominant and recessive expression as follows:

Trait	Dominant	Recessive
Flower position	Axial (A)	Terminal (a)
Stem length	Tall(T)	Short (t)
Seed shape	Round (R)	Wrinkled (r)

If a plant that is heterozygous for all three traits were allowed to self-pollinate, what proportion of the offspring would be expected to be as follows? (NOTE: Use the rules of probability and show your work.)

a. Homozygous for the three dominant traits

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b. Homozygous for the three recessive traits

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c. Heterozygous for the three traits

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d. Homozygous for axial and tall, heterozygous for round

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9. Polydactyly (extra fingers and toes) is due to a dominant gene. A father is polydactyl, the mother has the normal phenotype, and they have had one normal child. P = polydactyl; p = normal

What is the genotype of the father?________________________________

What is the genotype of the mother?________________________________

What is the probability that a second child will have the normal number of digits? Show your work.

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10. In dogs, black (B) is dominant to chestnut (b), and solid color (S) is dominant to spotted (s). What are the genotypes of the parents that would produce a cross with 3/8 black solid, 3/8 black spotted, 1/8 chestnut solid, and 1/8 chestnut spotted puppies? (HINT: First determine what genotypes the offspring must have before you deal with the fractions.) Show your work.

11. A woman with the rare recessive disease phenylketonuria (PKU), who had been treated with a diet having low levels of the amino acid phenylalanine, was told that it was unlikely her children would inherit PKU because her husband did not have it. However, her first child had PKU.

What is the most likely explanation?___________________________________

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Assuming this explanation is true, what would be the probability of her second child having PKU? Show your work.

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12. PKU is an inherited disease determined by a recessive allele. If a woman and her husband are both carriers, what is the probability of each of the following? Show your work.

a. All three of their children will be normal

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b. One *or* more of the three children will have the disease.

____

c. All three children will be afflicted with the disease.

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d. *At least* one child will be normal.

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13. In an examination of Mendel's principles, strain of light brown mice was crossed with a strain of dark brown mice. All F_1 were dark brown. In the F_2, 42 were dark brown and 15 were light brown. Is this consistent with the law of segregation? Explain.

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14. A black guinea pig crossed with an albino one gave 12 black offspring. When the albino was crossed with a second black one, 7 blacks and 5 albinos were obtained. What is the genotype for:

a. The first black parent? ______________________________

b. The albino parent? ______________________________

c. The second black parent? ______________________________

d. The first black offspring? ______________________________

e. The second black offspring? ______________________________

Why did the two crosses produce different offspring since both involved a cross between a black parent and albino parent?

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15. In sesame plants, the one-pod condition (P) is dominant to the three-pod condition (p), and normal leaf (L) is dominant to wrinkled leaf (l). These traits are inherited independently. Determine the genotypes for the two parents for all possible matings producing the following offspring:

a. 318 one-pod normal, 98 one-pod wrinkled

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b. 323 three-pod normal, 106 three-pod wrinkled

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c. 401 one-pod normal

____

d. 150 one-pod normal, 147 one-pod wrinkled, 51 three-pod normal, 48 three-pod wrinkled

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e. 223 one-pod normal, 72 one-pod wrinkled, 76 three-pod normal, 27 three-pod wrinkled.

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16. Karen and Steve each have a sibling with sickle-cell anemia. Karen, Steve, nor any of their parents has the disease, and none of them has been tested to reveal the sickle-cell trait. Based on this incomplete information, calculate the probability that if this couple has a child, the child will have sickle-cell anemia. Show your work.