

Genetics Practice Problems Packet



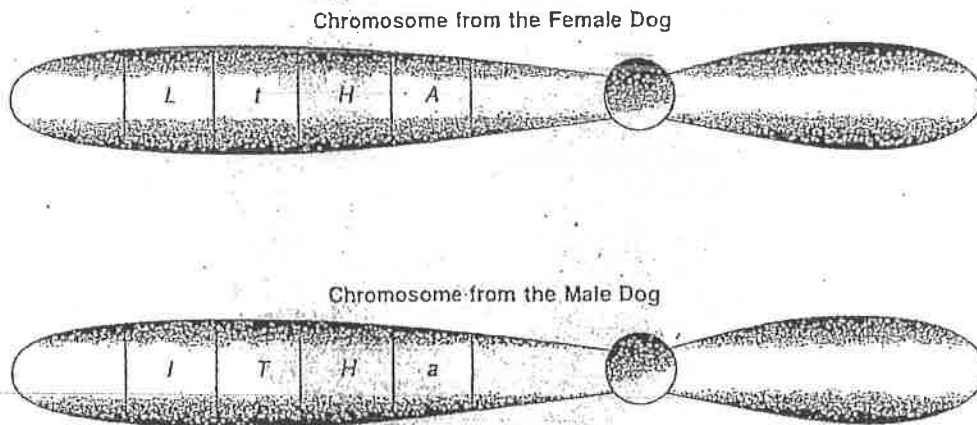
Mendel

Name: _____

Period: _____

Should This Dog Be Called Spot?

Imagine this microscopic drama. A sperm cell from a male dog fuses with an egg cell from a female dog. Each dog's gamete carries 39 chromosomes. The zygote that results from the fusion of the gametes contains 78 chromosomes—one set of 39 chromosomes from each parent. One pair of the zygote's chromosomes are shown below.



Each chromosome of the homologous pair contains alleles for the same traits. But one chromosome may have a dominant allele and the other a recessive allele. Use the drawings and the table to answer the questions.

Trait	Dominant Gene	Recessive Gene
Hair length	Short (<i>L</i>)	Long (<i>l</i>)
Hair texture	Wiry (<i>T</i>)	Silky (<i>t</i>)
Hair curliness	Curly (<i>H</i>)	Straight (<i>h</i>)
Coat pattern	Spotted (<i>A</i>)	Solid (<i>a</i>)

1. Will the new puppy have a spotted coat? Explain. _____

2. Does the female dog have a spotted coat? Explain. _____

3. Does the male dog have a spotted coat? Explain. _____

4. What will be the texture of the puppy's coat? _____

5. Will the texture of the puppy's coat resemble that of either of its parents? Explain. _____

6. Will the puppy have curly hair or straight hair? _____

7. a. Does the female dog have curly hair? _____

b. Does the male dog have curly hair? _____

8. a. Define the term heterozygous. _____

b. For which traits is the puppy heterozygous? _____

9. a. Define the term homozygous. _____

b. For which traits is the puppy homozygous? _____

10. Explain why you cannot completely describe the puppy's parents even though you can accurately describe the puppy. _____

Analyzing Inheritance

Part A: Offspring resemble their parents. Offspring inherit genes for characteristics from their parents. To learn about inheritance, scientists have experimented with breeding various plants and animals. In each experiment shown in the table, two pea plants with different characteristics were bred. Then, the offspring produced were *self-bred* to produce a second generation of offspring. Consider the data and answer the questions that follow. (Parents = P, First Generation = F₁, Second Generation = F₂)

Parents	First Generation	Second Generation
Long stems × short stems	All long	787 long: 277 short
Red flowers × white flowers	All red	705 red: 224 white
Green pods × yellow pods	All green	428 green: 152 yellow
Round seeds × wrinkled seeds	All round	5474 round: 1850 wrinkled
Yellow seeds × green seeds	All yellow	6022 yellow: 2001 green

P

F₁

F₂















- In the first generation of each experiment, what generalization can you make about the characteristics of the offspring compared to the parents' characteristics? (tell me more than, "they're different")

- What generalizations can you make about the characteristics of the second generation compared to the characteristics of the first generation? (Were ALL the characteristics shown in the second generation shown in the first generation? Explain why you think this occurred.)

- Compare the second generation characteristics to the parents' characteristics.

- How would you explain why the second generation could express all the characteristics of the parents even though the first generation did not.

Part B: Gregor Mendel was an Austrian monk who studied genetics during the mid 1850's. His experiments with pea plants laid foundations for modern genetics and gained him the title "Father of Genetics". The traits Mendel examined in pea plants included: seed shape, seed color, seed coat color, pod shape, pod color, flower position, and plant height. Each trait is controlled by a gene. In these pea plant characteristics, each trait had two different variations, or alleles. Below is a table showing the traits Mendel observed (with dominant trait listed on top of picture).

Seed Shape	Seed Color	Seed Coat Color	Pod Shape	Pod Color	Flower Position	Plant Height
Round  X 	Yellow  X 	Dark  X 	Smooth  X 	Green  X 	Axial  X 	Tall  X 
Wrinkled	Green	White	Constricted	Yellow	Terminal	Short

Complete the following chart of the traits Mendel studied knowing the rules of genetic symbolism. (Remember, dominant allele receives capital letter describing that trait while the recessive allele receives lower case of same letter. In table above, dominant traits are listed above the recessive traits.)

	Seed Shape	Seed Color	Seed Coat	Pod Shape	Pod Color	Flower placement	Plant Height
Dominant	RR / Rr						
Recessive	rr						

1. Define Dominant, Recessive, and Allele.

2. Define Genotype and Phenotype.

3. Give an example of a trait. Also, list the two alleles for that trait, label which trait is dominant and which trait is recessive.

Monohybrid Practice Problems

In wildflowers the flower color **yellow** is dominant over the flower color **orange**. Use this information to complete the following problems.

For all of the following problems make sure to show: 1)Key, 2)Cross, 3)Punnett square and 4)Your answer (if possible, written in a complete sentence)

1. Cross a homozygous dominant yellow flower with a homozygous dominant yellow flower.

Key:

Cross:



Genotypic ratio:

Phenotypic ratio:

2. Cross a homozygous dominant yellow flower with a heterozygous yellow flower.

Key:

Cross:



Genotypic ratio:

Phenotypic ratio:

3. Cross a heterozygous yellow flower with a heterozygous yellow flower.

Key:

Cross:

Genotypic ratio:

Phenotypic ratio:



4. Cross a homozygous dominant yellow flower with a homozygous recessive orange flower.

Key:

Cross:



Genotypic ratio:

Phenotypic ratio:

5. Cross a heterozygous yellow flower with a homozygous recessive orange flower.

Key:

Cross:



Genotypic ratio:

Phenotypic ratio:

6. Cross a homozygous recessive orange flower with a homozygous recessive orange flower.

Key:

Cross:

Genotypic ratio:

Phenotypic ratio:



Genetics Problems Part A

For all of the following problems make sure to show:

- 1)Key
- 2)Cross
- 3)Punnett square
- 4)Your answer written in a complete sentence.

1. In rabbits the allele for black coat color is dominant over the allele for brown coat color. What would be the results of a cross between a rabbit that is homozygous for black coat color and one homozygous for brown coat color?



2. In dogs the allele for brown coat color is dominant over the allele for white fur coat color. What would be the results of a cross between a dog that is heterozygous for brown coat color and one homozygous for white coat color?

3. In pea plants the allele for round seeds is dominant over the allele for wrinkled seeds. What would be the results of a cross between a plant that is heterozygous for round seeds and one heterozygous for round seeds?

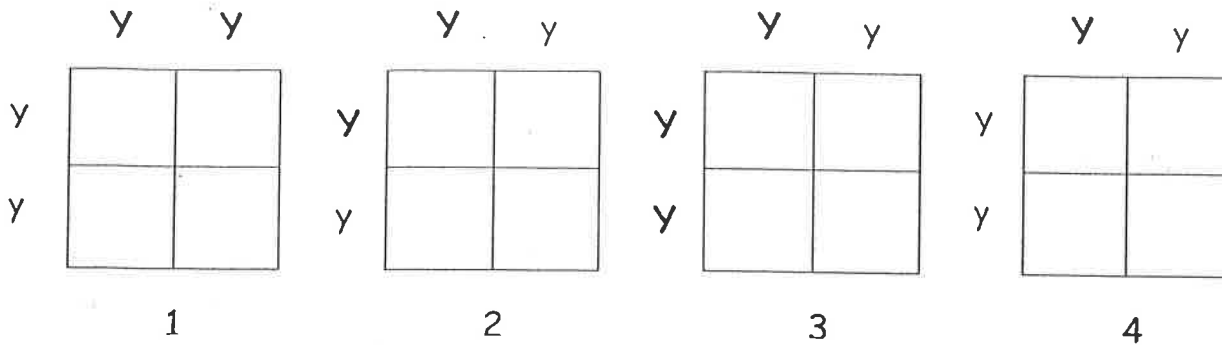


4. In guinea pigs, the allele for rough coat is dominant over the allele for smooth coat. In order for all the offspring to be smooth coated, what should the phenotype and genotype of the parents be?

5. A female guinea pig homozygous dominant for black fur color is mated with a male homozygous recessive for white fur color. In a litter of eight offspring, there would be how many black and how many white babies born?



6. In squash, the gene for yellow fruit (Y) is dominant over the gene for white fruit (y). A farmer made the crosses below with squash plants and counted all of the squash that was produced. Complete the Punnett squares below and answer the following questions about each using complete sentences.



Problem A: The farmer crossed a yellow squash plant with a white squash plant. He got 122 yellow squash and 132 white squash. Which of the above Punnett squares show the parents and offspring, which could give these results?

Problem B: The farmer crossed a yellow squash plant with a yellow squash plant. He got 299 yellow squash and 104 white squash. Which of the above Punnett squares show the parents and offspring, which could give these results?

Problem C: The farmer crossed a yellow squash plant with a white squash plant. He got 402 yellow squash and 0 white squash. Which of the above Punnett squares show the parents and offspring, which could give these results?

Problem D: The farmer crossed a yellow squash plant with a yellow squash plant. He got 403 yellow squash and 0 white squash. Which of the above Punnett squares show the parents and offspring, which could give these results?

Problem E: The farmer crossed a white squash plant with a white squash plant. What were the genotypic and phenotypic ratios of this cross? (Show all of your work, including a Punnett square)



Dominance Practice Problems

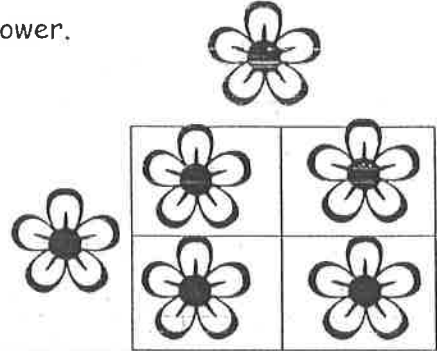
In wildflowers the flower color blue is dominant over the flower color purple. Use this information to complete the following problems.

For all of the following problems make sure to show: 1)Key, 2)Cross, 3)Punnett square #1 fill in as you normally would, 4)Punnett square #2 color the flowers in the correct colors

1. Cross a homozygous blue flower with a heterozygous blue flower.

Key:

Cross:



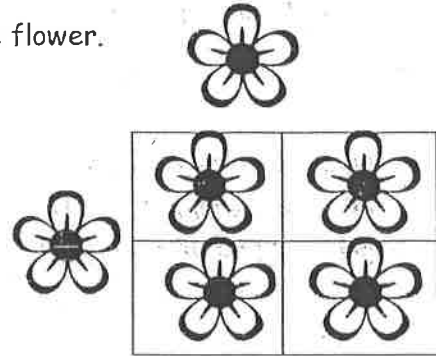
Genotypic ratio:

Phenotypic ratio:

2. Cross a heterozygous blue flower with a homozygous purple flower.

Key:

Cross:



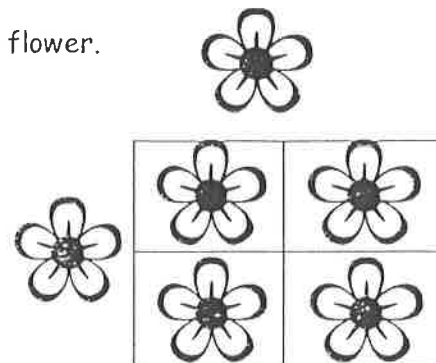
Genotypic ratio:

Phenotypic ratio:

3. Cross a heterozygous blue flower with a heterozygous blue flower.

Key:

Cross:



Genotypic ratio:

Phenotypic ratio:

Genetics Problems Part B

For all of the following problems make sure to show:

- 1)Key
- 2)Cross
- 3)Punnett square
- 4)Your answer written in a complete sentence.

1. A farmer has two tall pea plants. How can the gardener determine whether the two plants are homozygous or heterozygous for the gene determining tallness? Show two Punnett squares for this problem. What is this type of cross called?



2. A: In snapdragons the alleles for red flower color and for white flower color are incompletely dominant. Thus, a heterozygous plant has pink flowers. Show the Punnett square and genotypic and phenotypic ratios for a cross between a plant with red flowers and one with pink flowers.

B: Now show a cross between a plant with white flowers and one with pink flowers. What are the genotypic and phenotypic ratios?

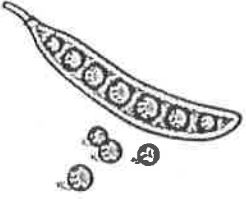


3. In certain varieties of chicken, the allele for black feathers is codominant with the allele for white feathers. Heterozygous chickens have a color described as "erminette" speckled with black and white feathers. If you cross two erminette chickens, what will the genotypic and phenotypic ratios of the offspring be?



4. For each of the following crosses that Gregor Mendel did, determine what the parents would have been. Make sure to show your Punnett squares.

A. He crossed a tall plant with a short plant. His results were 145 tall plants and 139 short plants.



B. He crossed a tall plant with a short plant. His results were 316 tall plants and 0 short plants.

C. He crossed a tall plant with a tall plant. His results were 311 tall plants and 113 short plants.



D. He crossed a tall plant with a tall plant. His results were 309 tall plants and 0 short plants.