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Math Lab

Calculating Mendel's Ratios

Background

You can calculate the ratios Mendel obtained in the F_2 generation for the characters he studied.

Data Table

Characters	F_2 generation results		Ratio
Flower color	705 purple	224 white	3.15:1
Seed color	6,022 yellow	2,001 green	
Seed shape	5,474 round	1,850 wrinkled	
Pod color	428 green	152 yellow	
Pod shape	882 round	299 constricted	
Flower position	651 axial	207 top	
Plant height	787 tall	277 dwarf	

Analysis

1. **Calculate** the ratio for each contrasting trait to complete the table above. Use colon form.
2. **State** the ratio for each pair of contrasting traits in words and as a fraction. For example, *3.15 purple flower to one white flower.*

3. **Critical Thinking**
   Interpreting Results Do the data confirm a 3:1 ratio in the F_2 generation for each of the characters he studied?

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a. What is the purpose of this figure?

_____

b. The passage states that both parents are heterozygous for coat color. What does this statement mean?

_____

_____

c. How can you use the information in the figure to determine the coat color of the parents?

_____

_____

d. What are the genotypes of predicted homozygous offspring?

_____

_____

e. What is the probable genotypic ratio of the cross represented in the graphic?

_____

f. What is the probable phenotypic ratio of the cross represented in the graphic?

_____

Read the question and write your answer in the space provided.

SKILL: Vocabulary Development

2. The prefix *pheno-* is derived from a Greek term meaning "to show." How does knowledge of this word part aid in decoding the term *phenotype*?

_____

_____

_____

Circle the letter of the word or phrase that best completes the statement.

3. Another Punnett square yielded 2 black : 2 brown. This is an example of a

a. genotypic ratio.
b. probability equation.
c. percentage.
d. phenotypic ratio.

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Skills Worksheet

Genetics

ANALYZING EXPERIMENTS

Part of Gregor Mendel's hypotheses of inheritance proposed that when two contrasting traits occur together, one of them may be completely expressed, while the other may have no observable effect on the organism's appearance. He called the expressed trait dominant and the unexpressed trait recessive. In his genetic experiments, Mendel studied seven contrasting traits of peas. One of the traits he studied was the trait for seed shape. Mendel found that there are two forms of the trait for seed shape—wrinkled and round. In an experiment to determine which form of this trait was dominant, Mendel performed the following experiment:

A. Mendel allowed the plants to self-fertilize to produce the homozygous P generations.

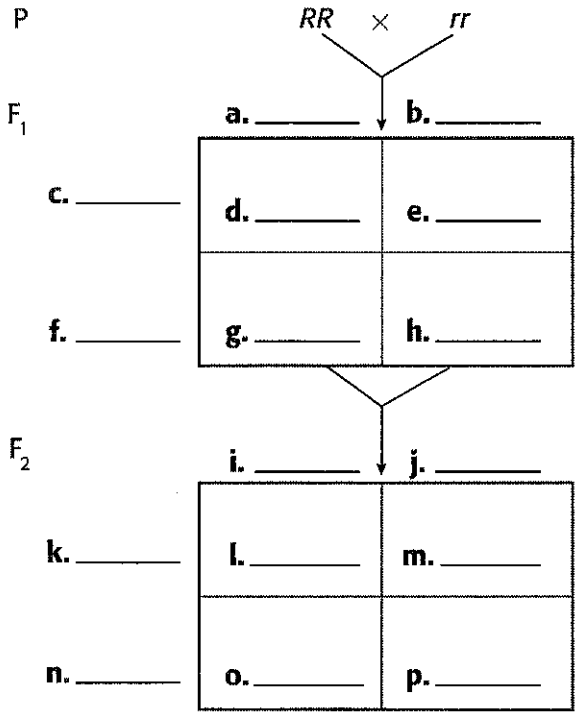
B. Mendel then performed a cross between the homozygous plants with round seeds (*RR*) and homozygous plants with wrinkled seeds (*rr*) to produce the F_1 generation.

C. Mendel then allowed the F_1 plants to self-fertilize to produce the F_2 generation.

D. Mendel analyzed the results of the crosses to determine the genotypes and phenotypes present.

Use the information above to answer questions 1–5.

1. To determine the results of this experiment, complete the Punnett squares below by writing the correct allele(s) in the space provided.



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FUNDAMENTALS OF GENETICS

Section 9-2: Genetic Crosses

Read the passage below, which covers topics from your textbook. Answer the questions that follow.

Biologists use a diagram called a **Punnett square** to aid them in predicting the probable distribution of inherited traits in the offspring.

In rabbits, the allele for black coat color (*B*) is dominant over the allele for brown coat color (*b*). The Punnett square below shows the predicted results of crossing two rabbits that are both heterozygous (*Bb*) for coat color. As you can see, 1/4 (25 percent) of the offspring are predicted to have the genotype *BB*, 1/2 (50 percent) are predicted to have the genotype *Bb*, and 1/4 (25 percent) are predicted to have the genotype *bb*. Thus, 3/4 (75 percent) of the offspring resulting from this cross are predicted to have a black coat. One-fourth (25 percent) of the offspring are predicted to have a brown coat. The ratio of the genotypes that appear in offspring is called the **genotypic ratio.** The ratio of the offspring's phenotypes is called the **phenotypic ratio.**

Read each question and write your answer in the space provided.

SKILL: Interpreting Graphics

1. The figure below is a Punnett square. Using the information provided in the passage and the figure, answer the questions that follow.

(Bb)

(Bb)

	B	b
B	BB	Bb
b	Bb	bb

continued on the next page . . .

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Data Lab

Analyzing a Test Cross

Background

You can use a test cross to determine whether a plant with purple flowers is heterozygous (*Pp*) or homozygous dominant (*PP*). Fill in the boxes in each Punnett square shown below.

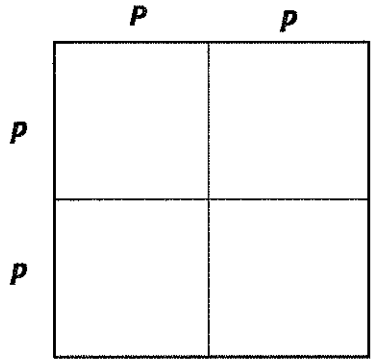

Figure A
Heterozygous (*Pp*) plant

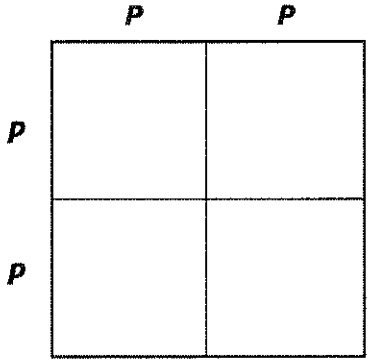

Figure B
Homozygous (*PP*) plant

Analysis

1. **Determine** what the letters at the top and side of each box represent.

2. **Determine** what the letters in each box represent.

3. **Calculate** the genotypic and phenotypic ratios that would be predicted if the parent of the unknown genotype were homozygous for the trait (Figure B).

4. **Critical Thinking**
   Predicting Outcomes If half of the offspring have white flowers, what is the genotype of the plant with purple flowers?

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