Name _____ Date _____

Monohybrid Crosses: Predicting Offspring with Punnett Squares and Test Crosses

Directions: In pea plants, flower color is controlled by one gene with two alleles, and the allele for purple flowers (P) is dominant to the allele for white flowers (p). Use this information to answer every question in this activity.

1. Use the word bank to complete these sentences about the gene for pea flower color.

Word bank
alleles • genotype • phenotype • gametes • chromosomes

Different forms of one gene, such as P and p, are called _____. The two alleles a plant has for this gene make up its _____. The flower color the plant shows is its _____.

2. Purple (P) is dominant to white (p), so match each pea plant genotype to the description that fits it.

Write the letter of the matching answer on each line.

1. _____ PP
2. _____ Pp
3. _____ pp

A. Heterozygous, with white flowers
B. Homozygous, with white flowers
C. Homozygous, with purple flowers
D. Heterozygous, with purple flowers

3. When a pea plant with genotype Pp makes gametes, which statement about the flower color alleles in those gametes is correct?

A. Each gamete carries both P and p, just as the parent plant does.
B. Each gamete carries only P, because P is the dominant allele.
C. Each gamete carries either P or p, and about half carry each one.
D. Each gamete carries a blended allele that is partly P and partly p.

4. Purple (P) is dominant to white (p). When a true-breeding purple plant (PP) is crossed with a white plant (pp), what will their offspring, the F1 generation, look like?

A. All of them will have purple flowers.
B. All of them will have white flowers.
C. All of them will have pale purple flowers, a blend of both.
D. About half will have purple flowers and half will have white flowers.

A Punnett Square for Two Pp Plants

Use the Punnett square, which shows every combination of alleles from the two parents, to answer these questions.

Punnett square for a cross between two pea plants with genotype Pp. Parent 1's alleles head the columns, and Parent 2's alleles start the rows. Each box shows one possible offspring genotype. Purple (P) is dominant to white (p).

Parent 2's alleles	**P from Parent 1**	**p from Parent 1**
P	PP	Pp
p	Pp	pp

5. Based on the Punnett square, what is the expected ratio of genotypes among the offspring?

A. 1 PP : 2 Pp : 1 pp B. 2 PP : 1 Pp : 1 pp C. 1 PP : 1 Pp : 1 pp D. 3 PP : 1 pp

6. In one season, the two Pp plants in this cross produce only 4 seeds. Which statement about the flower colors of those 4 seeds is correct?

A. Exactly 1 of the 4 seeds will grow into a white-flowered plant.

B. Each seed has a 1 in 4 chance of growing into a white-flowered plant.

C. Exactly 3 of the 4 seeds will grow into plants with genotype PP.

D. None of the 4 seeds can grow into a white-flowered plant, because both parents are purple.

Offspring of Two Purple Plants

In an investigation, two purple-flowered pea plants were crossed, and the flower color of each of their 400 offspring was recorded in the table.

Offspring of a cross between two purple-flowered pea plants. Purple (P) is dominant to white (p).

Flower color of offspring	Number of offspring
Purple	298
White	102
Total	400

7. Which ratio of purple to white offspring is closest to these results?

A. 1 purple : 3 white

B. 3 purple : 1 white

C. 1 purple : 1 white

D. 2 purple : 1 white

8. What must the genotypes of the two purple parent plants have been?

A. Heterozygous (Pp) and homozygous recessive (pp)

B. Homozygous dominant (PP) and heterozygous (Pp)

C. Heterozygous (Pp) and heterozygous (Pp)

D. Homozygous dominant (PP) and homozygous dominant (PP)

9. Both parents in this cross were Pp, so about how many of the 298 purple offspring are expected to be heterozygous (Pp)?

A. About 200 of them

B. About 100 of them

C. About 150 of them

D. All 298 of them

Two Test Crosses

In an investigation, Plant A and Plant B, both purple-flowered plants of unknown genotype, were each crossed with a white-flowered plant (pp), a kind of cross called a test cross.

Two test crosses. Plant A and Plant B both have purple flowers, and each was crossed with a white-flowered plant (pp). Purple (P) is dominant to white (p).

Cross	Purple offspring	White offspring
Plant A × white plant (pp)	64	0
Plant B × white plant (pp)	33	31

10. What do the test cross results show about the genotypes of Plant A and Plant B?

A. Plant B is heterozygous (Pp), and Plant A is most likely homozygous (PP).

B. Plant A is heterozygous (Pp), and Plant B is most likely homozygous (PP).

C. Both plants are homozygous (PP), since both have purple flowers.

D. Both plants are heterozygous (Pp), since both have purple flowers.