LESSON MAKER PRO

Predict the Peas

Use Punnett squares to predict traits in offspring.

HIGH SCHOOL · BIO.3B.1

BIO.3B.1 "Demonstrate Mendel's law of dominance and segregation using mathematics to predict phenotypic and genotypic ratios by constructing Punnett squares with both homozygous and heterozygous allele pairs."

NAME _____ DATE _____

ALLELES AND ODDS

Each parent passes one allele for a gene to an offspring. Put one parent's alleles across the top of a Punnett square and the other's down the side, then combine them in each box. A dominant allele shows when paired with a recessive allele; count the four boxes to find genotype and phenotype ratios.

WORKED EXAMPLE

In a model flower, purple petals (P) are dominant to white petals (p). Cross PP with pp. Find the genotype ratio PP:Pp:pp and the phenotype ratio purple:white.

PP × PP

	P	**P**
p	Pp	Pp
p	Pp	Pp

1. PP can pass on P, and pp can pass on p.
2. Combine one allele from each parent in every box. All four boxes show Pp.
3. Count the genotypes and the traits they produce.

Answer: Genotype ratio PP:Pp:pp = 0:4:0. Phenotype ratio purple:white = 4:0.

PRACTICE 6 problems

1 In pea plants, tall stems (T) are dominant to short stems (t). Complete the square for Tt × tt. Give the genotype ratio Tt:tt and the phenotype ratio tall:short.

PUNNETT SQUARE

	_____	_____
_____	_____	_____
_____	_____	_____

ANSWER _____

2 In pea plants, round seeds (R) are dominant to wrinkled seeds (r). Complete the square for Rr × Rr. Give the genotype ratio RR:Rr:rr and the phenotype ratio round:wrinkled.

PUNNETT SQUARE

	_____	_____
_____	_____	_____
_____	_____	_____

ANSWER _____

3 In pea plants, green pods (G) are dominant to yellow pods (g). Complete the square for GG × Gg. Give the genotype ratio GG:Gg and the phenotype ratio green:yellow.

PUNNETT SQUARE

	_____	_____
_____	_____	_____
_____	_____	_____

ANSWER _____

4 In pea plants, purple flowers (V) are dominant to white flowers (v). Complete the square for vv × vv. What genotype will the offspring have? Give the phenotype ratio purple:white.

PUNNETT SQUARE

	_____	_____
_____	_____	_____
_____	_____	_____

ANSWER _____

5 In pea plants, yellow seeds (Y) are dominant to green seeds (y). Complete the square for Yy × Yy. What fraction of offspring will have yellow seeds? What fraction will be homozygous?

PUNNETT SQUARE

	_____	_____
_____	_____	_____
_____	_____	_____

ANSWER _____

6 In pea plants, inflated pods (I) are dominant to constricted pods (i). Complete the square for Ii × Ii. Give the genotype ratio II:Ii:ii. Of the offspring with inflated pods, what fraction are heterozygous?

PUNNETT SQUARE

	_____	_____
_____	_____	_____
_____	_____	_____

ANSWER _____

APPLY IT Show your work

1 An after-school greenhouse club grows pea seedlings to sell. Tall stems (T) are dominant to short stems (t). Complete the square for Tt × tt. Give the genotype ratio Tt:tt. If the club grows 80 seedlings, about how many should have tall stems?

PUNNETT SQUARE

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_____	_____	_____
_____	_____	_____

ANSWER _____

2 A school garden team saves seeds from two pea plants. Round seeds (R) are dominant to wrinkled seeds (r), and both parents are Rr. Complete the square. Give the phenotype ratio round:wrinkled. If 120 seeds sprout, about how many should come from wrinkled seeds?

PUNNETT SQUARE

	_____	_____
_____	_____	_____
_____	_____	_____

ANSWER _____

CHALLENGE One step up

In pea plants, purple flowers (Q) are dominant to white flowers (q). A purple-flowered plant is crossed with a white-flowered plant. About half their offspring have white flowers. Identify both parents' genotypes, complete the square, and explain why the purple-flowered parent cannot be QQ.

PUNNETT SQUARE

	_____	_____
_____	_____	_____
_____	_____	_____

WORK SPACE AND ANSWER

Predict the Peas

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	In pea plants, tall stems (T) are dominant to short stems (t). Complete the square for Tt × tt. Give the genotype ratio Tt:tt and the phenotype ratio tall:short.	**Tt:Tt:tt:tt in the four boxes. Tt:tt = 1:1; tall:short = 1:1.**
2	In pea plants, round seeds (R) are dominant to wrinkled seeds (r). Complete the square for Rr × Rr. Give the genotype ratio RR:Rr:rr and the phenotype ratio round:wrinkled.	**RR, Rr, Rr, rr. RR:Rr:rr = 1:2:1; round:wrinkled = 3:1.**
3	In pea plants, green pods (G) are dominant to yellow pods (g). Complete the square for GG × Gg. Give the genotype ratio GG:Gg and the phenotype ratio green:yellow.	**GG, Gg, GG, Gg. GG:Gg = 1:1; green:yellow = 4:0.**
4	In pea plants, purple flowers (V) are dominant to white flowers (v). Complete the square for vv × vv. What genotype will the offspring have? Give the phenotype ratio purple:white.	**All four boxes are vv. All offspring are vv; purple:white = 0:4.**
5	In pea plants, yellow seeds (Y) are dominant to green seeds (y). Complete the square for Yy × Yy. What fraction of offspring will have yellow seeds? What fraction will be homozygous?	**YY, Yy, Yy, yy. Yellow seeds: 3/4; homozygous (YY or yy): 1/2.**
6	In pea plants, inflated pods (I) are dominant to constricted pods (i). Complete the square for Ii × Ii. Give the genotype ratio II:Ii:ii. Of the offspring with inflated pods, what fraction are heterozygous?	**II, Ii, Ii, ii. II:Ii:ii = 1:2:1; 2/3 of offspring with inflated pods are heterozygous.**

PART 2 · APPLY IT

1. **Tt:tt = 1:1; about 40 seedlings should have tall stems.** Two of the four boxes are Tt and two are tt. Half of 80 is 40.
2. **Round:wrinkled = 3:1; about 30 seedlings should come from wrinkled seeds.** The four boxes are RR, Rr, Rr, and rr, so 1/4 of the seeds should be wrinkled. One-fourth of 120 is 30.

CHALLENGE

The parents are Qq and qq; the square has two Qq boxes and two qq boxes, giving half the offspring white flowers. A QQ parent crossed with qq would produce only Qq offspring, all with purple flowers.

Accept equivalent ratios, such as 2:2 for 1:1, and either orientation for parent alleles in a completed square. Expected numbers in the word problems are predictions, not guaranteed outcomes.