Name _____ Date _____

Dominant and Recessive Alleles in Pea Seeds

Directions: Read the passage and study the table. Some questions use the passage and table, and others ask you to apply the same ideas to new examples.

Why Some Peas Wrinkle

Some dried peas are smooth and round, and others are shriveled like raisins. In the 1850s and 1860s, Gregor Mendel grew thousands of pea plants and tracked this seed shape, along with other traits, from one generation to the next. The seed shape Mendel studied is controlled by one gene with two alleles.

An allele is one version of a gene. In this activity, R stands for the allele for round seeds and r for the allele for wrinkled seeds. A seed's genotype is the pair of alleles it carries, such as RR, Rr or rr. Its phenotype is the trait you can see, such as a round shape. A genotype with two matching alleles, like RR or rr, is homozygous, and a genotype with two different alleles, like Rr, is heterozygous.

The R allele carries instructions for an enzyme that helps a growing seed turn sugar into starch. A seed with even one R allele makes enough of this enzyme to stay round, so Rr seeds look just like RR seeds. That is why R is called dominant. The r allele is recessive, which means its trait shows only in an rr seed. An rr seed makes none of this enzyme, so it keeps more sugar. The extra sugar draws in water while the seed grows, and then the seed shrinks and wrinkles as it dries.

Dominant does not mean better or more common. Wrinkled peas taste sweeter because they hold more sugar, and many of the garden peas people grow for eating fresh are wrinkled-seeded types.

A gardener wanted to know whether two plants grown from round seeds were RR or Rr. She removed the pollen-making parts from some of their flowers before the flowers opened, so the plants could not pollinate themselves. Then she brushed those flowers with pollen from an rr plant. A cross like this, with a plant that shows the recessive trait, is called a test cross. When the pods ripened, she sorted the peas inside by shape.

Peas from each test cross, sorted by shape

Plant grown from a round seed	Pollen came from	Round peas (number)	Wrinkled peas (number)
Plant 1	An rr plant	42	0
Plant 2	An rr plant	19	23

1. Choose the meaning of each word as the passage uses it.

Write the letter of the matching answer on each line.

1. _____ Allele
2. _____ Genotype
3. _____ Phenotype
4. _____ Homozygous
5. _____ Heterozygous

Choices for question 1

A. The pair of alleles a seed carries
B. One version of a gene, such as R or r
C. The allele whose trait is the most common in a group of plants
D. Having two different alleles for a gene
E. The trait you can see in a seed, such as its shape
F. Having two matching alleles for a gene

2. In the passage, what does it mean that the R allele is dominant?

A. The R allele changes any r allele it is paired with into R.
B. A seed with even one R allele has the round trait.
C. The R allele is more common than r in every group of pea plants.
D. The R allele makes peas that are better to eat.

3. According to the passage, why is an Rr seed round?

A. It keeps more sugar than an rr seed, so it draws in more water and swells.
B. Its R allele turns its r allele into a second R allele as the seed grows.
C. Its one R allele lets it make enough of the enzyme that helps turn sugar into starch.
D. Its two alleles blend, giving it a shape halfway between round and wrinkled.

4. The passage says many garden peas grown for eating fresh are wrinkled-seeded types. What does this show about the recessive wrinkled trait?

A. Recessive traits are always rare in any group of plants.
B. The r allele has become dominant in garden peas.
C. Wrinkled-seeded peas must have at least one R allele.
D. A recessive trait can be useful, and it can be common in a group of plants.

5. Why did the gardener remove the pollen-making parts from the flowers before they opened?

A. So that the peas would ripen faster and be ready to sort
B. So that the plants would make more peas in each pod
C. So that the round-seed plants could not pass on their R alleles
D. To keep those flowers from pollinating themselves

6. Why did the gardener use pollen from an rr plant for her test crosses?

A. An rr plant can pass on only r, so a round-seed plant that carries r can give wrinkled peas.

B. Pollen from an rr plant makes every pea in the pod round.

C. Pollen from an rr plant is stronger, so it always decides the shape of the peas.

D. An rr plant passes on R about half of the time and r the rest of the time.

7. If plant 1 were Rr, how many of its 42 peas would you expect to be wrinkled, on average?

_____ peas

8. What do the pea counts from the two test crosses show about plants 1 and 2?

A. Plant 1 is most likely RR, and plant 2 is Rr.

B. Both plants are Rr, since both grew from round seeds.

C. Both plants are rr, since their pollen came from an rr plant.

D. Plant 1 is most likely Rr, and plant 2 is RR.

9. In pea plants, the allele for green pods (G) is dominant to the allele for yellow pods (g). Which choice describes a plant with the genotype Gg?

A. Homozygous, with yellow pods

B. Heterozygous, with yellow pods

C. Heterozygous, with green pods

D. Homozygous, with green pods

10. Two pea plants grown from round seeds were crossed, and some of their offspring seeds were wrinkled. What are the genotypes of the two parent plants?

A. RR and RR

B. RR and Rr

C. Rr and Rr

D. rr and rr