

Student Name:

Using the Hardy-Weinberg Equation

The Hardy-Weinberg principle states that the proportion of alleles will stay constant from generation to generation unless the population is evolving. We can state this another way: Allele frequencies do not change unless evolutionary forces act on the population.

The Hardy-Weinberg equation allows us to detect some allele frequencies that change from generation to generation, helping us figure out if evolution is occurring. The Hardy-Weinberg equations can be written as:

$$p^2 + 2pq + q^2 = 1$$

AND

$$p + q = 1$$

Using these equations, you can determine:

- p = the frequency of the dominant allele (X)
- q = the frequency of the recessive allele (x)
- p^2 = the percentage of homozygous dominant individuals (XX)
- q^2 = the percentage of homozygous recessive individuals (xx)
- $2pq$ = the percentage of heterozygous individuals (Xx)

Use the equations to answer the following questions.

1. You have a population where the percentage of homozygous dominant individuals is 27%. Use the equation to fill in this table.

Frequency of the dominant allele	
Frequency of the recessive allele	
% homozygous dominant	
% homozygous recessive	
% heterozygous	

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2. Sickle-cell disease (SCD) is a blood disorder. It causes an abnormality in the blood's cells shape—the cell assumes the shape of a crescent. This also inhibits the cell's ability to carry oxygen, leading to painful symptoms and even death. The person inherits the alleles for SCD from their parent. A person who is heterozygous for the sickle cell allele (Ss) often shows no symptoms of the disease and is considered a carrier. A person who is homozygous recessive for the sickle-cell allele (ss) will exhibit signs and symptoms of sickle-cell anemia. If 9% of the population exhibits signs and symptoms of the disease, what percent of the population is a carrier (heterozygous individuals)?

Frequency of the dominant allele	
Frequency of the recessive allele	
% homozygous dominant	
% homozygous recessive	
% heterozygous	

3. A large population of moths contains 35% white moths caused by the double recessive genotype, bb . What are all the allelic and genotypic frequencies for this population?

Frequency of the dominant allele	
Frequency of the recessive allele	
% homozygous dominant	
% homozygous recessive	
% heterozygous	

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4. Cystic fibrosis is a homozygous recessive condition that affects 1 in 10,000 of the Hispanic population in the United States. Calculate the frequency of the dominant allele, the frequency of the recessive allele, and the percentage of heterozygous individuals (carriers) in the Hispanic population.

Frequency of the dominant allele	
Frequency of the recessive allele	
% homozygous dominant	
% homozygous recessive	
% heterozygous	