

# What is Hardy-Weinberg Equilibrium?

## Worksheet

Hardy-Weinberg equilibrium states that allele frequencies ( $p$ ,  $q$ ) and genotype frequencies ( $p^2$ ,  $2pq$ ,  $q^2$ ) remain constant generation after generation in a large, randomly mating population free from mutation, migration, and selection.

$$p + q = 1$$

## Questions

1. What does  $p$  represent in the Hardy-Weinberg equation?

- A) Frequency of homozygous dominant genotype
- B) Frequency of heterozygous genotype
- C) Frequency of homozygous recessive genotype
- D) Frequency of the recessive allele

2. If the frequency of the recessive allele is  $q = 0.2$ , what is  $p$ ?

- A) 0.2
- B) 0.8
- C) 1.2
- D) 0.4

3. Which of these is NOT a condition required for Hardy-Weinberg equilibrium?

- A) Random mating
- B) No mutation
- C) Natural selection occurring
- D) Large population size

4. A population has  $q = 0.25$  (frequency of  $aa$  individuals). What is  $q$ ?

- A) 0.05
- B) 0.25
- C) 0.5
- D) 0.75

5. In a population, the frequency of the recessive allele is  $q = 0.3$ . Find all genotype frequencies.

6. 16% of a population shows the recessive phenotype ( $aa$ ). Find the allele frequencies.

7. In a population of 1,000 people, 90 are homozygous recessive ( $aa$ ). Find the number of heterozygous carriers.

8. Define: What is the Hardy-Weinberg equation?

9. Define: What does  $q$  represent?

10. Define: What conditions are required for Hardy-Weinberg equilibrium?

## Answer Key

1. A) Frequency of homozygous dominant genotype -  $p$  is the expected frequency of the AA (homozygous dominant) genotype.
2. B) 0.8 - Since  $p + q = 1$ ,  $p = 1 - 0.2 = 0.8$ .
3. C) Natural selection occurring - Natural selection changes allele frequencies, so its absence is required for equilibrium.
4. C) 0.5 -  $q = 0.25 = 0.5$ .
5.  $p = 1 - q = 1 - 0.3 = 0.7$   $p^2 = 0.7^2 = 0.49$  (AA)  $2pq = 2 \cdot 0.7 \cdot 0.3 = 0.42$  (Aa)  $q^2 = 0.3^2 = 0.09$  (aa)
6.  $q = 0.16$   $q^2 = 0.16^2 = 0.0256$   $p = 1 - 0.4 = 0.6$   $2pq = 2 \cdot 0.6 \cdot 0.4 = 0.48$  (carrier frequency)
7.  $q = 90/1000 = 0.09$   $q^2 = 0.3^2 = 0.09$   $p = 1 - 0.3 = 0.7$   $2pq = 2 \cdot 0.7 \cdot 0.3 = 0.42$  Heterozygous individuals =  $0.42 \cdot 1000 = 420$  people
8.  $p + 2q + q^2 = 1$ , where  $p$  and  $q$  are allele frequencies and  $p + q = 1$ .
9. The frequency of the homozygous recessive genotype (aa) in the population.
10. No mutation, no migration, no natural selection, random mating, and a very large population size.

### Bounlu

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