

**Population Genetics - Practice Problems**

1. Identify each of the variables in the Hardy-Weinberg equation.

$$p + q = 1$$

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

$p$  = frequency of the dominant allele (A)

$q$  = frequency of the recessive allele (a)

$p^2$  = frequency of homozygous dominant genotypes in a population (AA)

$2pq$  = frequency of heterozygous genotypes in a population (Aa)

$q^2$  = frequency of homozygous recessive genotypes (and phenotypes) in a population (aa)

2. What are the five assumptions of the Hardy-Weinberg Equilibrium model?

1. Random mating
2. No mutation
3. Large population size
4. No migration
5. No natural selection

3. Natural populations do not usually fit the Hardy-Weinberg Equilibrium model. What does this tell us about most natural populations?

Most natural populations are experiencing changes in the gene pool over time; they are evolving. At least one of the five assumptions of Hardy-Weinberg Equilibrium is not being met and the populations are not mating randomly, have mutations, have small population sizes, are migrating and/or are under selective pressure.

4. In a population of peppered moths, 25% of the population shows the recessive phenotype of white.

- a) Which of the variables does 25% represent?

$$q^2 = 25\% = 0.25$$

- b) Given this information, what is the frequency of recessive alleles in the population (
- $q$
- )?

$$q = \sqrt{q^2}$$

$$q = \sqrt{0.25}$$

$$q = 0.5$$

- c) What is the value of
- $p$
- ? How do you know?

$$p + q = 1$$

$$p = 1 - q$$

$$p = 1 - 0.5$$

$$p = 0.5$$

- d) If this population had 1000 moths. How many moths would be Homozygous dominant? Heterozygous? Homozygous recessive?

$$AA = np^2, \text{ where } n = \text{population size}$$

$$AA = (1000)(0.5)^2$$

$$AA = (1000)(0.25)$$

$$AA = 250 \text{ moths}$$

$$Aa = n2pq$$

$$Aa = (1000)[2(0.5)(0.5)]$$

$$Aa = (1000)(0.5)$$

$$Aa = 500 \text{ moths}$$

$$aa = nq^2$$

$$aa = (1000)(0.5)^2$$

$$aa = (1000)(0.25)$$

$$aa = 250 \text{ moths}$$

# Explore Biology Population Genetics Answer Guide

**M Woodhall**



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