

Name: _____ Date: _____ Period: _____

Determining Phenotypic, Genotypic and Gene Frequency

You are up in a coconut tree looking down at the tropical waters of an ancient volcanic caldera. The caldera teems with the elusive pygmy shark. The morph is produced by the expression of a dominant gene (D) while the rare white morph is produced by the expression of the recessive allele (d).

Determine the following phenotypic frequencies:

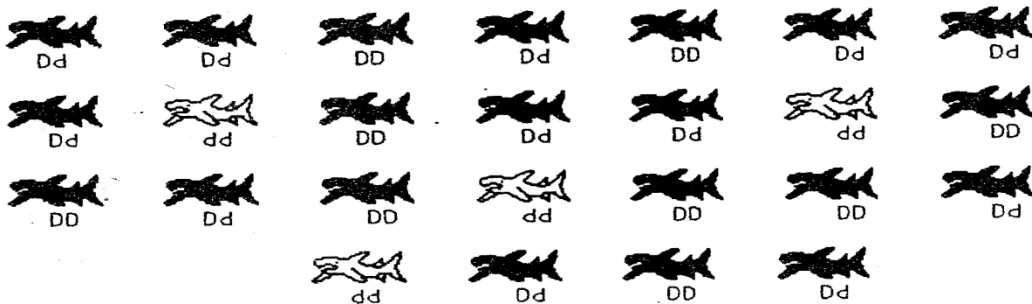
1. The frequency of the dark phenotype _____
2. The total frequency of the white phenotype _____
- Total _____

Determine the following genotype (genotypic) frequencies:

1. The frequency of the DD genotype _____
2. The frequency of the Dd genotype _____
3. The frequency of the dd genotype _____
- Total..... _____

Determine the following gene frequency:

1. The frequency of the D gene _____
2. The frequency of the d gene _____
- Total..... _____



Quick Population Genetic Problems

Or

Fun With Hardy-Weinberg!

Every year Population Genetics problems appear on the AP exam. This worksheet contains various populations of these problems. Assume that the populations in each question are in Hardy-Weinberg equilibrium.

1. The frequency of two alleles in a gene pool is 0.1 (A) and 0.9 (a). What is the percentage in the population of the heterozygous individuals?

2. Allele (B), for white wool, is dominant over allele (b), for black wool. In a sample of 900 sheep, 891 are white and 9 are black. Estimate the genotypic frequencies in this population. How many sheep are BB, Bb, and bb?

3. The allele (T), the ability to taste a particular chemical, is dominant to allele (t), the inability to taste it. At Cornell University, out of 400 surveyed students, 64 were found to be non-tasters. How many students are heterozygous for this trait?

4. In humans, Rh positive is produced by the dominant gene (R), while Rh negative blood is produced by the allele (r). If 84% of individuals are Rh positive, what are the frequencies of the alleles R & r?

5. A rare disease due to a recessive allele, which is lethal when homozygous, occurs with a frequency of one in a million. How many carriers of this allele are there in a town of 14,000?

6. A recent study has shown that 9.0% of the natives on the south pacific island of Pago Fuago possess an allergic reaction to coconuts. This reaction, which appears to be an immune response similar to hives, is thought to be due to the action of a recessive gene (h). The population of this tropical paradise is 5000.

_____ – is the frequency of the (H) gene

_____ – is the frequency of the (h) gene

_____ – is the number of the (h) genes on Pago Fuago

_____ – is the total number of homozygous, non-allergic Pago Fuagens

_____ – is the total number of Pago Fuagens who carry the (h), but are phenotypically normal

_____ – is the total number of Pago Fuagens that suffer from the irritating immune response and are forced to merely watch the other islanders frolic at the monthly coconut luaus.

More Fun with Hardy-Weinberg

1. In a population that is in Hardy-Weinberg equilibrium, if the frequency of the “A” allele is 0.75 and the frequency of the “a” allele is 0.50, then the sum of p and q will be:
a) 1.35 b) 0.65 c) 0.40 d) 0.25 e) these frequencies cannot exist
2. In a population in Hardy-Weinberg equilibrium, if the genotype frequencies are 81% AA, 18% Aa, and 1% aa. What are the frequencies of “A” and “a” alleles respectively?
a) 0.81 & 0.01 b) 0.18 & 0.18 c) 0.9 & 0.1 d) 0.09 & 0.01 e) 0.01 & 0.09
3. Tay-Sachs disease is inherited as a Mendelian recessive and occurs in Eastern European Jewish populations at a frequency of 1 per 3,600 births. Estimate the percentage of this population that are heterozygous carriers of Tay-Sachs allele.
a) 3.3% b) 1.7% c) 0.983% d) 0.06% e) 0.033%
4. For a population in Hardy-Weinberg equilibrium, all the terms of the generalizations can be calculated by knowing the value of any one of the several items. The remaining terms in the equation CANNOT be determined in the value of ___ is the only term known.
a) p b) q c) p^2 d) $2pq$ e) q^2
5. In a population in Hardy-Weinberg equilibrium, there are two alleles, “A” and “a”, for a particular gene. If the frequency of the allele is 0.4, what is the frequency of the genotype AA?
a) 0.16 b) 0.36 c) 0.40 d) 0.46 e) 0.60
6. In a population in Hardy-Weinberg equilibrium, the frequency of the dominant phenotype is represented by:
a) P^2 b) $p^2 + 2pq$ c) either p or q d) $p + q$ e) $2pq + q^2$
7. In a population in Hardy-Weinberg equilibrium, what portion of individuals are heterozygous for the allele a, if its frequency is 0.01?
a) 0.001 b) 0.01 c) 0.02 d) 0.10 e) 0.20