Answers to population genetics problems:

1. In a Hardy-Weinberg population with two alleles, *A* and *a,* that are in equilibrium, the frequency of the allele *a* is 0.4. What is the percentage of the population that is homozygous for this allele?

**If the allele frequency for *a* is 0.4, then the genotype frequency for *aa* is (0.4)(0.4) = 0.16.**

1. A population survey shows that 160 out of 250 individuals express the recessive phenotype. What percentage of the population would you predict to be heterozygotes?

**If 160 out of 250 individuals have the recessive phenotype, this equals 160/250, or 64% of the population. Therefore, the homozygous recessive genotype frequency, q2, is 0.64, and the recessive allele frequency, q, is 0.8. This means that the frequency of the dominant allele is 0.2, and the frequency of heterozygotes in this population would be 2pq = 2(0.2)(0.8) = 0.32.**

1. Consider a flower color gene represented by a dominant allele, R, and a recessive allele, *r*. A population survey finds 34 homozygous dominant, 17 homozygous recessive, and 46 heterozygous individuals. Calculate the allele frequencies of R and *r*.

**There are a total of 97 individuals in this population, and a total of 194 alleles.**

**Of the 194 alleles, 68 dominant alleles come from the homozygous individuals (2 x 34) and 46 dominant alleles come from the heterozygous individuals. Therefore, there are a total of 114 dominant alleles. The frequency for the dominant allele (R) is 114/194 = 59%.**

**The remaining 41% of the alleles must be recessive (r).**

1. In a herd of cattle, RR is red coat, Rr roan, and rr white, what is the genotypic frequency of Rr if the allelic frequency of R is .1?

**If the frequency of R = p = 0.1, then the frequency of r = q = 0.9. Therefore, the frequency of individuals with the genotype Rr must be 2pq = 2(0.1)(0.9) = 0.18.**

1. The compound phenylthiocarbamide (PTC) tastes very bitter to most people. The inability to taste PTC is controlled by a single recessive gene. In one population that was studied, about 70% of the individuals can taste PTC while 30% cannot (are non-tasters). Estimate the frequencies of the Taster (T) and nontaster (t) alleles in this population as well as the frequencies of each of the three possible genotypes.

**The frequency of the recessive genotype (tt) = 0.3 = q2. Therefore, the frequency of the recessive allele t = 0.55 (q). The frequency of the dominant tasting allele T = 0.45 (p). The frequency of individuals who are homozygous for TT = p2 = 20%. The frequency of individuals who are heterozygous Tt = 2pq = 2(0.45)(0.55) = 50%. As stated in the question, the frequency of individuals who are homozygous for the non-tasting allele tt = 30%.**

1. In a population of mice, there are 3 alleles of a gene. The allelic frequency of A is .6, B is .3, and C is .1. What is the genotypic frequency of AB?

**Although there are three alleles, we’re still using the same basic principles of Hardy-Weinberg population genetics. The frequency of a heterozygote for A & B is going to be 2 x (frequency of the A allele) x (frequency of the B allele). Therefore, 2(0.6)(0.3) = 0.36.**