Biology 138

Hardy-Weinberg Problems

1. In a small population, 20% is of blood group M, 50% is of blood group MN, and 30% is of blood group N. (These are the only three possible blood types.) What are the gene frequencies for the two alleles in question? (Let p = the frequency of the I^M allele, and q = the frequency of the I^N allele.)
   ↳ .452 ↳ .548
2. In humans, PKU is a genetically inherited disease where the body is not able to metabolize the amino acid phenylalanine. As a result, if babies are not diagonosed with this disease in the first month of life, they will develop severe mental retardation. If they are diagnosed within the first month, their diet can be changed and they will develop normally. PKU is a recessive trait. If one child out of every 10,000 inherits PKU, what are the allele frequencies for this trait? What percent of individuals are homozygous dominant? Heterozygous? Homozygous recessive?
   98% 1.98% .01%
3. Assume brown hair is dominant to blond hair. Also assume that these are the only two possible hair colors. In a population where 36% of the individuals have blond hair, what percent are homozygous dominant? heterozygous? homozygous recessive? What is the frequency of the two alleles?
   16% 48% 36%
   B=40% b=60%
4. A population has 8 times as many heterozygous individuals as homozygous recessive individuals. What is the frequency of the recessive gene? .2

5. In carnations, the inheritance of color is controlled by a pair of incompletely dominant alleles. Red is incompletely dominant to white. The heterozygous condition results in pink flowers. If the frequency of the red gene is 64%, what percent of the flowers are pink? 32%

1. $q^2 = .3$
   $q = .548 = I^N$
   $p+q=1$ $p=.452=I^M$
   $p^2 = .204$
   $2(p)(q) = .495$

2. $q^2 = 1/10{,}000$
   $.0001 = q^2$
   $q = .01$
   $p = .99$
   $p^2 = .9801$
   $2pq = .0198$

3. $q^2 = .36$
   $q = .6$
   $p = .4$
   $p^2 = .16$
   $2pq = .48$

4. if $q^2 = 1$, $2pq = 8$
   $\therefore p^2 = 4$, $p^2 = 16$
   totals 25 individuals
   $q^2 = 1/25 = .04$
   $q = .2$
   $p = .8$
   $p^2 = .64$
   $2pq = .32$

5. $p^2 = .64$
   $p = .8$ - red allele
   $q = .2$
   $q^2 = .04$
   $2(p)q = .32$