Name: Answers Period____

Hardy-Weinberg Practice Problems

Directions: Answer all of the following questions on a separate sheet of lined paper. You must show all work!

1. This is a classic data set on wing coloration in the scarlet tiger moth (panazia dominula) Coloration in this species has been previously shown to behave as a single - locus, two - allele system with incomplete dominance. Data for 1612 individuals are given below:
   a. White - spotted (AA) = 1469
   b. Intermediate (Aa) = 138
   c. Little spotting (aa) = 5

   Calculate the following frequencies: (f)A, (f)a, (f)AA, (f)Aa, (f)aa

   a = 0.06
   A = 0.94
   $\Sigma = 1$
   aa = 0.0036
   AA = 0.8836
   Aa 0.1128
   $\Sigma = 1$

2. In a population with two alleles for a particular locus, B and b, the allele frequency of B is 0.7. What would be the frequency of heterozygotes if the population is in Hardy-Weinberg equilibrium? $2(B)(b) = 2(0.7)(0.3) = 0.42$

3. In a population that is in Hardy-Weinberg equilibrium, 16% of the individuals show the recessive trait. What is the frequency of the dominant allele in the population? $\sqrt{q^2} = \sqrt{16}$ $q = 0.4$ $p = 1-(0.4)$ $p = 0.6$

4. Phenylketonuria is a severe form of mental retardation due to a rare autosomal recessive allele. About one in 10,000 newborn Caucasians are affected withthis disease. Calculate the frequency of the carriers. $2pq = 0.0198$

   $\sqrt{q^2} = \sqrt{\frac{1}{10000}}$
   $q = 0.01$
   $p = 0.99$

5. On a hillside there are 100 flowering plants. One gene pair controls flower height. Tall (T) is incompletely dominant over short (T^1). There are 81 tall plants, 18 medium plants, and 1 short plant. What is the frequency of each allele in the population? $q = 0.1$ $p = 0.9$ $\sqrt{q^2} = \sqrt{\frac{1}{100}}$ $q = 0.1$

6. a) 50,000 infants have been tested for PKU. 7,000 have elevated levels of phenylalanine in their blood (inability to breakdown phenylalanine is completely recessive to the ability to break it down). What is the frequency of the PKU allele in the population? $\sqrt{q^2} = \sqrt{\frac{7000}{50000}}$

   $q = 0.37$

b) Five years later, 50,000 more infants are tested and 8,000 have high levels of phenylalanine. What is the allele frequency now? $\sqrt{q^2} = \sqrt{\frac{8000}{50000}}$ $q = 0.4$

c) In another 5 years, 50,000 more infants are tested and 10,000 have high levels of phenylalanine. What is the frequency of the allele now? $\sqrt{q^2} = \sqrt{\frac{10000}{50000}}$ $q = 0.45$

d) Has evolution occurred? yes, allele frequencies are changing.

7. In the tropical rainforest, there is a species of bird that has a variable tail length. Long is incompletely dominant over short. In one population of 2.000 birds, 614 birds have long tails, 973 birds have medium length tails, and 413 birds have short tails. What is the frequency of each allele in the population? $\sqrt{q^2} = \sqrt{\frac{413}{2000}}$ $q = 0.45$ $p = 0.55$

8. In a given nonevolving population, 20% of the alleles for a given gene are recessive (s). What percentage of individuals in this population have the dominant phenotype?

$q = 0.2$
$p = 0.8$

a) 4%
b) 32%
c) 64%
d) 80%
e) 96%

Dominant Phenotype $= p^2 + 2pq$
$= (0.8)^2 + 2(0.8)(0.2)$
$= 0.96$

9. In a given nonevolving population, 51% of the individuals display the dominant phenotype. What proportion of the alleles in this population are dominant?

a) 0.09
b) 0.3
c) 0.49
d) 0.51
e) 0.7

$\sqrt{q^2} = \sqrt{0.49}$
$q = 0.7$
$p = 0.3$

10. It is discovered that 128 out of 200 individuals in a population display the dominant phenotype. Assuming the Hardy-Weinberg equation holds for this population, what proportion of individuals in this population display the heterozygous phenotype?

a) 0.18
b) 0.28
c) 0.38
d) 0.48
e) 0.58

$\sqrt{q^2} = \sqrt{\frac{72}{200}}$
$q = 0.6$
$p = 0.4$

$2pq = 2(0.4)(0.6)$
$= 0.48$