Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_/\_\_\_/\_\_\_ Period: \_\_\_\_

Hardy-Weinberg Problem Sets

Directions: Answer the following questions using the Hardy-Weinberg equation. Be sure to express the relative frequencies as decimals (i.e., 0.16) and percentages as percentages (i.e., 16%).

Variables: Equations:

p = the frequency of the dominant allele p + q = 1

q = the frequency of the recessive allele p2 + 2pq + q2 = 1

p2 = frequency of AA (homozygous dominant) (p + q)2 = 1

2pq = frequency of Aa (heterozygous)

q2 = frequency of aa (homozygous recessive)

1. You have sampled a population in which you know that the percentage of the homozygous recessive genotype (aa) is 36%. Using that 36%, calculate the following:
2. The frequency of the “A” allele: \_\_\_\_\_\_\_\_\_
3. The frequency of the “a” allele: \_\_\_\_\_\_\_\_\_
4. The frequency of the “AA” genotype: \_\_\_\_\_\_\_\_\_
5. The frequency of the “Aa” genotype: \_\_\_\_\_\_\_\_\_
6. The frequency of the “aa” genotype: \_\_\_\_\_\_\_\_\_

2. In a population of fruit flies, 250 are homozygous dominant for red eyes and 500 are heterozygous for red eye. The remaining 250 flies have white eyes. Given this information, calculate the following:

1. The frequency of the dominant allele: \_\_\_\_\_\_\_\_\_
2. The frequency of the recessive allele: \_\_\_\_\_\_\_\_\_
3. The frequency of the homozygous dominant genotype: \_\_\_\_\_\_\_\_\_
4. The frequency of the heterozygous genotype: \_\_\_\_\_\_\_\_\_
5. The frequency of the homozygous recessive genotype: \_\_\_\_\_\_\_\_\_

3. Brown fur is dominant to white fur in mice. In a population of mice, 74% have brown fur and 26% have white fur. Based on these facts, calculate the following:

1. The frequency of the dominant allele: \_\_\_\_\_\_\_\_\_
2. The frequency of the recessive allele: \_\_\_\_\_\_\_\_\_
3. The percentage of mice that are homozygous dominant: \_\_\_\_\_\_\_\_\_
4. The percentage of mice that are heterozygous: \_\_\_\_\_\_\_\_\_
5. The percentage of mice that are homozygous recessive: \_\_\_\_\_\_\_\_\_

4. In humans, tongue rolling is dominant to non-rolling. In a population of 1000 individuals, 910 can roll their tongues while 90 cannot. Based on these facts, calculate the following:

1. The frequency of the dominant allele: \_\_\_\_\_\_\_\_\_
2. The frequency of the recessive allele: \_\_\_\_\_\_\_\_\_
3. The percentage of the population that is homozygous dominant: \_\_\_\_\_\_\_\_\_
4. The percentage of the population that is heterozygous: \_\_\_\_\_\_\_\_\_
5. The percentage of the population that is homozygous recessive: \_\_\_\_\_\_\_\_\_

5. Within a population of butterflies, the color brown (B) is dominant over the color white (b) and 40% of all butterflies are white. Given this simple information, calculate the following:

1. The frequency of the dominant allele: \_\_\_\_\_\_\_\_\_
2. The frequency of the recessive allele: \_\_\_\_\_\_\_\_\_
3. The percentage of the “BB” genotype: \_\_\_\_\_\_\_\_\_
4. The percentage of the “Bb” genotype: \_\_\_\_\_\_\_\_\_
5. The percentage of the “bb” genotype: \_\_\_\_\_\_\_\_\_

6. Approximately 1% of a given human population is lactose intolerant, a recessive condition. Based on this simple fact, calculate the following:

1. The frequency of the dominant allele: \_\_\_\_\_\_\_\_\_
2. The frequency of the recessive allele: \_\_\_\_\_\_\_\_\_
3. The percentage of the population that is homozygous dominant: \_\_\_\_\_\_\_\_\_
4. The percentage of the population that is heterozygous: \_\_\_\_\_\_\_\_\_
5. The percentage of the population that is homozygous recessive: \_\_\_\_\_\_\_\_\_
6. A Pangorian trait which results from simple Mendelian inheritance is antenna shape. Corkscrew antennae (A) are dominant over straight antennae (a). When the entire Pangorian population was screened (all 9,904 of them), 3,565 had corkscrew, while the rest had straight antennae.
   1. The frequency of the dominant allele: \_\_\_\_\_\_\_\_\_
   2. The frequency of the recessive allele: \_\_\_\_\_\_\_\_\_
   3. The percentage of the population that is homozygous dominant: \_\_\_\_\_\_\_\_\_
   4. The percentage of the population that is heterozygous: \_\_\_\_\_\_\_\_\_
   5. The percentage of the population that is homozygous recessive: \_\_\_\_\_\_\_\_\_

Hardy Weinberg Equilibrium

1. In humans, the Rh factor genetic information is inherited from our parents, but it is inherited independently of the ABO blood type alleles. In humans, Rh+ individuals have the Rh antigen on their red blood cells, while Rh− individuals do not. There are two different alleles for the Rh factor known as Rh+ and rh. Assume that a dominant gene Rh produces the Rh+ phenotype, and that the recessive rh allele produces the Rh− phenotype. In a population that is in Hardy-Weinberg equilibrium, if 160 out of 200 individuals are Rh+, calculate the frequencies of both alleles.
2. A population has 300 homozygous dominant, 150 heterozygous, and 250 homozygous recessive genotypes.
   1. Calculate the p and q frequencies for this original population.
   2. After 5 generations, the genotype frequency changes. The new population has 290 homozygous dominant, 150 heterozygous, and 260 homozygous recessive genotypes. D Is this population in Hardy-Weinberg equilibrium?
3. You collect 100 samples from a large butterfly population. 50 specimens are dark brown, 20 are speckled, and 30 are white. Coloration in this species of butterfly is controlled by one gene locus: BB individuals are brown, Bb are speckled, and bb are white.
4. What are the allele frequencies for the coloration gene in this population?
5. After 10 generations, the population now is as follows: 125 dark brown butterflies, 50 speckled butterflies, and 75 white butterflies. Is this population in Hardy-Weinberg equilibrium?
6. Rabbit’s ears can be either short or floppy, where short ears are dominant over floppy ears. There are 653 individuals in a population. 104 rabbits have floppy ears and 549 have short ears.
7. Find: the frequency of the dominant and recessive alleles and the frequency of individuals with dominant, heterozygous, and recessive genotypes.
8. The next generation of rabbits has 560 individuals with short ears and 840 individuals with floppy ears. Is the population in Hardy-Weinberg Equilibrium? Solve for p and q.
9. Scale coloration of lizards has a complete dominance relationship where green scales are dominant over blue scales. There are 1,024 individuals with the genotype GG, 512 individuals with the genotype Gg, and 64 individuals with the genotype gg.
10. Find: the frequency of the dominant and recessive alleles and the frequency of individuals with dominant, heterozygous, and recessive genotype.
11. The next generation of lizards has 1,092 individuals with green scales and 108 individuals with blue scales. Is the population in Hardy-Weinberg Equilibrium? Solve for p and q.
12. Petal coloration of pea plants has a complete dominance relationship where purple petals are dominant over white petals. There are 276 plants, 273 have purple petals.
13. Find: the frequency of the dominant and recessive alleles and the frequency of individuals with the dominant, heterozygous, and recessive genotype.
14. After 100 generations, the population of pea plants grows to 620. If the plant population is in hardy Weinberg equilibrium, how many pea plants would have white and purple flowers?