Bio 155: The Diversity of Life
Population Genetics Worksheet

Name: _____ Lab section: _____

Answer the following questions. FOR PROBLEMS REQUIRING CALCULATIONS YOU MUST SHOW WORK TO RECIEVE CREDIT. 20 pts. total.

1. Imagine a population of 100 wildflowers, some red and some yellow. The red allele, R, is dominant over the yellow allele, r. There are 36 RR plants, 48 Rr plants, and 16 rr plants in the population (1 pt. each, 3 pts. total).

    a. What are the genotypic frequencies in the population?

    b. What are the allelic frequencies in the population?

    c. Using the frequencies you calculated in b, what would Hardy-Weinberg predict the genotypic frequencies should be? Is this population in Hardy-Weinberg equilibrium?

2. The dominant ability to taste PTC comes from the allele *T*. Among a sample of 215 individuals from a population in Vancouver, 150 could detect the of PTC, and 65 could not. Calculate the allelic frequencies of *T* and *t* (2 pts.).

3. For a population in Hardy-Weinberg equilibrium, calculate the genotypic frequencies (AA, Aa, aa) if allelic are as follows (2 pts.):

Allele frequencies		Genotype frequencies		
p	*q*	*AA*	*Aa*	*aa*
0.1	0.9			
0.4	0.6			
0.75	0.25			
0.8	0.2			

4. A student tells you that dominant phenotypes should always increase in frequency over recessive phenotypes because mating between two heterozygous individuals produces $^3/_4$ offspring with the dominant trait and only $^1/_4$ offspring with the recessive trait. Is this student correct? Why or why not? (1 pt.)

5. In a large interbreeding population, 81 percent of the individuals are homozygous for a recessive character. In the absence of mutation or selection, what percentage of the next generation will be homozygous recessives? Homozygous dominants? Heterozygotes? (1 pt. each, 3 pts. total)

Homozygous recessive? _____

Homozygous dominant? _____

Heterozygous? _____

6. Genotypes of Ponderosa pine trees in Colorado were determined for a peroxidase locus and the following data obtained (1 pt. each, 3 pts. total):

Genotype	Number
PP	11
Pp	36
pp	4
Total	51

   a. Calculate the genotypic and allelic frequencies for the peroxidase locus at this population.

   b. Determine the frequencies of the three genotypes expected at Hardy-Weinberg equilibrium. Is this population in Hardy-Weinberg equilibrium?

7. Hardy-Weinberg equilibrium is only maintained if 5 different conditions are met. This really only happens in idealized populations, not in the real world. Real populations always deviate from one or more of these conditions and their gene pools change over time. Let's look at the wildflower population from question 1. For each of the scenarios below, state which of the Hardy-Weinberg conditions the population deviates from, and explain which agent of microevolution causes the gene pool to change (1 pt each, 6 pts. total).

   a. A windstorm blows in hundreds of seeds from a nearby meadow, where nearly all of the flowers are yellow.

   b. A cosmic ray hits one of the red flowers just as a developing egg cell is replicating its DNA. The DNA polymerase makes a mistake and a red allele is transformed into a yellow allele.

c. The flowers tend to grow in red or yellow patches. A landslide buries and kills a huge patch of red flowers.

d. The red pigment in the petals of the red flowers is poisonous and tends to protect the flowers from beetles that eat developing seeds. The yellow flowers are not protected in this way.

e. The bees that pollinate the flowers tend to develop a "search image". Once they start visiting flowers of a certain color, they stick to that color. So pollen from red flowers is more likely to be delivered to other red flowers, and pollen from yellow flowers is more likely to fertilize other yellow flowers.

f. Which of the above scenarios would cause the flowers to adapt to their environment?