AP BIOLOGY
EVOLUTION
ACTIVITY #2

NAME_____

DATE_____HOUR_____

HARDY-WEINBERG THEOREM

POPULATION

GENE POOL

HARDY-WEINBERG THEOREM

HARDY-WEINBERG EQUILIBRIUM

REQUIRED CONDITIONS FOR HARDY-WEINBERG EQUILIBRIUM	

HARDY-WEINBERG EQUATION

HARDY-WEINBERG SAMPLE PROBLEM

QUESTIONS:

1. Match the definition with the correct term.

A.	Gene pool	C.	Population genetics
B.	Population	D.	Species

_____ Study of genetic variation within a population

_____ Localized group of individuals belonging to the same species

_____ Group of populations that have the potential to interbreed

_____ Total aggregate of genes in a population at any one time

2. State the Hardy-Weinberg Theorem.

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3. Write the Hardy-Weinberg equation and define each of the variables.

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4. Hardy-Weinberg equilibrium is maintained only if the population meets each of 5 conditions. List these 5 conditions.

Condition #1:_____

Condition #2:_____

Condition #3:_____

Condition #4:_____

Condition #5:_____

5. If a population has the following genotype frequencies, AA = 0.42, Aa = 0.46, and aa = 0.12, what are the allele frequencies? Show your work and circle your answers.

6. In a population with two alleles, B and b, the allele frequency of B is 0.8. What would be the frequency of heterozygotes if the population is in Hardy-Weinberg equilibrium? Show your work and circle your answer.

7. In a population that is in Hardy-Weinberg equilibrium, 16% of the population show a recessive trait. What percent show the dominant trait? Show your work and circle your answer.

8. 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.

    a. What is the frequency of each allele? Show your work and circle your answers.

b. What percentage of the population has each of the genotypes? Show your work and circle your answers.

c. How many Pangorians are heterozygous for antennae shape? Show your work and circle your answer.

d. The great ruler of Pangoria has determined that Pangorians born with straight antennae have a greater tendency toward violent behavior than do those with corkscrew antennae. He also had determined that neutering stops the violent behavior. He decrees that all Pangorians born with straight antennae shall be neutered shortly after birth. In general, what will happen to the allele frequencies in the population over the next six generations?

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9. You collect 100 samples from a large butterfly population. Fifty 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.

What are the allele frequencies for the coloration gene in this population? Show your work and circle your answers.

Is this population in Hardy-Weinberg equilibrium? Explain your answer.

10. A recessive mutation causes short sightedness (ss) in cats. The frequency of homozygous wild type (+/+), heterozygous (+/s) and homozygous recessive (ss/ss) individuals was assessed in two populations of cats. The data is shown in the chart below.

CAT POPULATION	**+ / +**	**+ / ss**	**ss / ss**
Country cats	0.49	0.42	0.09
City cats	0.52	0.45	0.03

a. Are the two populations in Hardy-Weinberg equilibrium? Explain.

b. If one population is not, what might cause this deviation?

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11. Another classification of blood group antigens is known as MN. Individuals are either homozygous for M (MM) or N (NN), or they express both antigens (MN). You are studying the distribution of alleles in a population of people. You determine that 90 people are MM, 60 are MN, and 50 are NN. Assign symbols for the allelic frequency of the M and N alleles in the population. Determine the frequency of each allele. Based on the allelic frequencies, determine (out of 200 individuals) the number of individuals in the population that are **expected** for each genotype. Test, by chi square, whether the population is in Hardy-Weinberg equilibrium. Show your work and circle your answer.

12. For an X-linked recessive trait, 9% of the females in the population are affected. What percent of the males would be affected? What percentage of the population is represented by carriers? Show your work and circle your answers.

13. You have been commissioned to study the genetic make-up of an ancient tribe of Arabs whose descendents live in northern Saudi Arabia. They hire you to test for the frequencies of a number of well-known genetic traits. The only hitch is that these people won't let any outsiders go near the women. "No problem" you say, "as long as I can test the men to determine the allele frequencies, I can figure out the gene frequencies in women. That is, if the mode of inheritance is known, and if we can assume Hardy-Weinberg equilibrium." Prove you can by completing the following chart.

TRAIT	**Mode of Inheritance**	**Frequency of trait in males**	**P**	**Q**	**Frequency of trait in females**
PTC taster	Autosomal dominant	0.75			
Blue eyes	Autosomal recessive	0.09			
Color-blindness	X-recessive	0.05			
Xg blood type	X-dominant	0.40			
Pattern baldness	Autosomal dominant in males, recessive in females	0.36			