Hardy-Weinberg problems (extra credit)

The following problems each assume that the population in question is in Hardy-Weinberg equilibrium, and the frequency of all alleles is stable over time. A population in H-W equilibrium must meet ALL of the following criteria:

1. It must be sufficiently large. This prevents changes in allele frequencies that may result from random events. Another way to look at this is to consider the results of tossing a coin 4 times compared to 4000 times.
2. There is no immigration or emigration. Individuals do not leave the population to join another population of the same species, or start new populations. Additionally, individuals from another population of the same species may not infiltrate the population.
3. Mate selection is random. Sexually reproducing organisms do not show preference for mates based on genetic traits.
4. There is no selection pressure. Selection pressure can be anything that favors some members of the population over others. Climate changes, limited food, predators, disease – all are examples of selection pressure on a population.
5. There are no mutations. Mutations can alter alleles or create new ones. In the absence of factors that can accelerate the mutation rate (mutagens), DNA replication is accurate 999,999,999 nucleotides per billion.

PROBLEMS (SHOW YOUR WORK):

1. Red eyes (R) are dominant to yellow eyes (r) in a population of fruit flies. If 99% of the individuals in the population have red eyes, what is the frequency of the recessive allele?
2. If 16% of the individuals in a population express the recessive allele, what is the frequency of the dominant allele?
3. If 19% of a population expresses the dominant allele, what is the frequency of the recessive allele?
4. If 84% of a population expresses the dominant allele, what percent of the population is homozygous for the dominant allele?
5. If 1% of a population expresses a recessive allele, what proportion of the population are unaffected carriers (heterozygous) of the allele?
6. If the frequency of the recessive allele (a) is .45, what is the frequency of the dominant allele (A)?
7. If 25% of a population of snakes expresses the recessive trait of purple beards, and 75% are beardless, what is the frequency of the dominant allele for beardlessness?
8. If 51% of a population of 500 long-legged bombats have a sixth toe on their left foot (a dominant trait), how many of the bombats are heterozygous?
9. 16% of a population of four-eyed unicorns expresses a recessive trait caused by a gene that codes for a protein that makes them faint at the sight of their own excrement. What is the frequency of the dominant allele in this population?
10. In a group of 10, 000 migratory redwoods, 84% express the dominant color trait (red-green). The rest express the recessive color trait of puce-green. How many trees have at least one recessive allele?
11. In the country of Fruitland, there are two types of squealing grapes. Grapes expressing the dominant trait squeal like pigs; those expressing the recessive trait squeal like trapped seagulls. The frequency of the dominant allele is .64. What percentages of grapes are homozygous dominant and homozygous recessive?
12. The mystic jungle of Kalaboom is home to a species of 1600 pygmy peacocks. 400 express a recessive trait of a red crest. What is the frequency of the dominant allele for normal blue crests? How many heterozygous peacocks will there be?