Section 19.1 Review Answers

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1. No, the frequency of the homozygous dominant genotype will not be the same as the frequency of the homozygous dominant trait. The homozygous dominant trait is the same as the homozygous dominant phenotype, and will include heterozygous individuals if the inheritance pattern is one of simple dominance. If the situation is one of co-dominance or incomplete dominance, then the frequency of homozygous dominant genotype and the frequency of the homozygous dominant phenotype will be the same.

2. This change may be caused when any of the conditions underlying the Hardy-Weinberg principle are not met, but does not indicate that the principle is false.

3. 1/3000 means $q = 0.0183$ and $p = 0.9817$. Thus the frequency of the cystic fibrosis allele in Canada is 0.0183. The frequency of heterozygotes is $2pq$, or 0.0359.

4. (a) $q = 0.20$. $p = 0.80$.

(b) $q = 0.20$ and $p = 0.80$ still.

(c) The frequency of the recessive allele in the second population is 0.435, which is higher than the recessive allele frequency in the first population. While it is possible that this came from the same population as the first sample, it is highly unlikely.

5. We will assume that PKU is a recessive trait. $q = 0.002899$ and $p = 0.9971$. Therefore the frequency of heterozygous individuals is $2pq(100)$ or 0.578 %

6. $q = 0.3873$, and $p = 0.6127$ so the percentage of heterozygous individuals is $2pq(100)$ or 47.5%.

7. (a) The presence of chlorophyll is indicated by a green colour, so having chlorophyll would be the dominant phenotype. Hence $q = 0.250$ and $p = 0.750$. The frequency of homozygous dominant genotype would be p^2 or 0.563.

(b) Carriers would be heterozygotes; frequency is $2pq$. $2pq = 0.375$.

8. (a) Because allele frequencies have changed in the population over time, one or more of the conditions for genetic equilibrium were not being met and evolution occurred. However, because the frequency of the recessive allele has been the same for many

successive generations, the population has again achieved genetic equilibrium and is no longer evolving.

(b) The frequency of the recessive allele was stable for the first two generations, then increased dramatically between the second and third generations, then remained stable at this new higher frequency for the next seven generations. Possible hypotheses for this frequency pattern include sudden selection against the dominant allele by a predator, disease, or environmental conditions; and because the population is small, a chance event may have altered the gene pool.