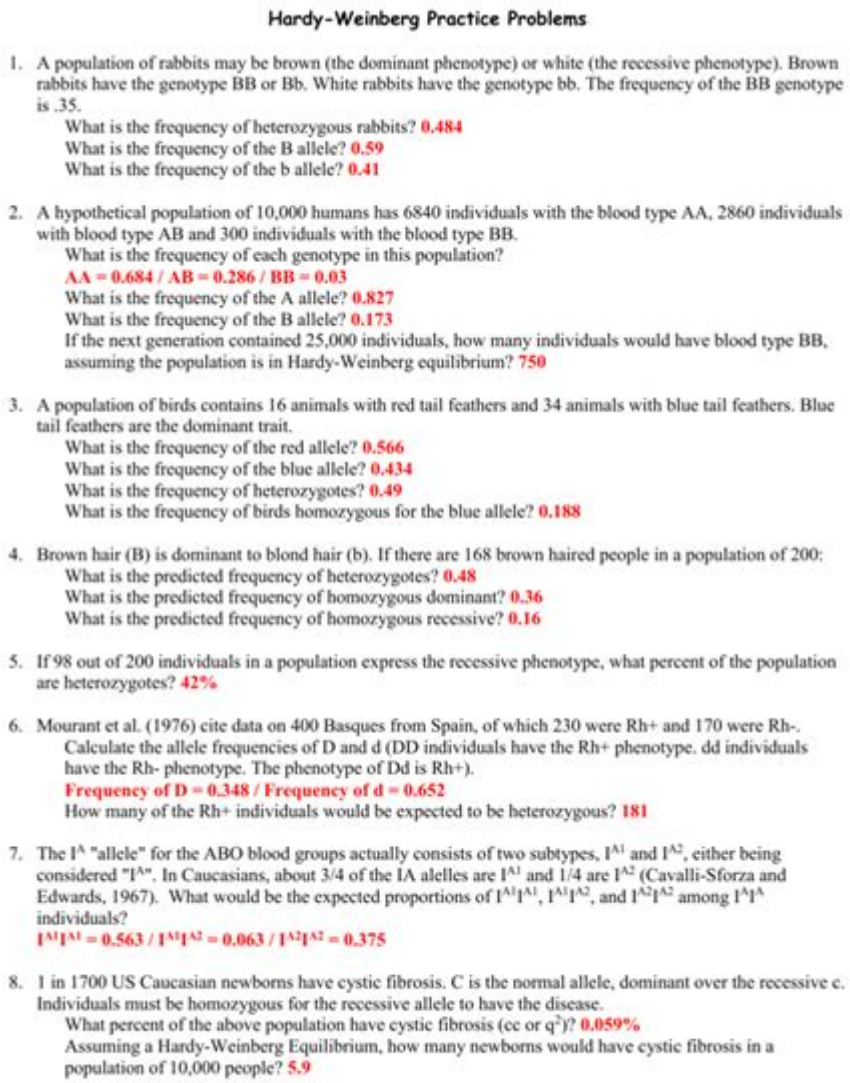
Amoeba Sisters Hardy Weinberg Worksheet Answers



Hardy-Weinberg Practice Problems

1. A population of rabbits may be brown (the dominant phenotype) or white (the recessive phenotype). Brown rabbits have the genotype BB or Bb. White rabbits have the genotype bb. The frequency of the BB genotype is .35.
   What is the frequency of heterozygous rabbits? **0.484**
   What is the frequency of the B allele? **0.59**
   What is the frequency of the b allele? **0.41**

2. A hypothetical population of 10,000 humans has 6840 individuals with the blood type AA, 2860 individuals with blood type AB and 300 individuals with the blood type BB.
   What is the frequency of each genotype in this population?
   AA = 0.684 / AB = 0.286 / BB = 0.03
   What is the frequency of the A allele? **0.827**
   What is the frequency of the B allele? **0.173**
   If the next generation contained 25,000 individuals, how many individuals would have blood type BB, assuming the population is in Hardy-Weinberg equilibrium? **750**

3. A population of birds contains 16 animals with red tail feathers and 34 animals with blue tail feathers. Blue tail feathers are the dominant trait.
   What is the frequency of the red allele? **0.566**
   What is the frequency of the blue allele? **0.434**
   What is the frequency of heterozygotes? **0.49**
   What is the frequency of birds homozygous for the blue allele? **0.188**

4. Brown hair (B) is dominant to blond hair (b). If there are 168 brown haired people in a population of 200:
   What is the predicted frequency of heterozygotes? **0.48**
   What is the predicted frequency of homozygous dominant? **0.36**
   What is the predicted frequency of homozygous recessive? **0.16**

5. If 98 out of 200 individuals in a population express the recessive phenotype, what percent of the population are heterozygotes? **42%**

6. Mourant et al. (1976) cite data on 400 Basques from Spain, of which 230 were Rh+ and 170 were Rh-.
   Calculate the allele frequencies of D and d (DD individuals have the Rh+ phenotype. dd individuals have the Rh- phenotype. The phenotype of Dd is Rh+).
   Frequency of D = 0.348 / Frequency of d = 0.652
   How many of the Rh+ individuals would be expected to be heterozygous? **181**

7. The I^A "allele" for the ABO blood groups actually consists of two subtypes, I^{A1} and I^{A2}, either being considered "I^A". In Caucasians, about 3/4 of the IA alelles are I^{A1} and 1/4 are I^{A2} (Cavalli-Sforza and Edwards, 1967). What would be the expected proportions of $I^{A1}I^{A1}$, $I^{A1}I^{A2}$, and $I^{A2}I^{A2}$ among I^AI^A individuals?
   $I^{A1}I^{A1}$ = 0.563 / $I^{A1}I^{A2}$ = 0.063 / $I^{A2}I^{A2}$ = 0.375

8. 1 in 1700 US Caucasian newborns have cystic fibrosis. C is the normal allele, dominant over the recessive c. Individuals must be homozygous for the recessive allele to have the disease.
   What percent of the above population have cystic fibrosis (cc or q^2)? **0.059%**
   Assuming a Hardy-Weinberg Equilibrium, how many newborns would have cystic fibrosis in a population of 10,000 people? **5.9**

Amoeba Sisters Hardy Weinberg Worksheet Answers are essential for students delving into population genetics and understanding the principles of Hardy-Weinberg equilibrium. This concept, named after G.H. Hardy and Wilhelm Weinberg, provides a mathematical model that describes how allele and genotype frequencies remain constant from generation to generation in a population under certain conditions. The Amoeba Sisters, a popular educational platform, has created resources to help students grasp these vital concepts, including worksheets that challenge learners to apply the Hardy-Weinberg principle in practical contexts.

Understanding the Hardy-Weinberg Principle

The Hardy-Weinberg principle serves as a foundation in population genetics, establishing the conditions under which allele frequencies in a population remain stable. The principle states that if specific conditions are met, the allele and genotype frequencies will not change from one generation to the next. These conditions include:

- No mutations occurring in the population
- No gene flow (migration) into or out of the population
- Random mating among individuals
- No genetic drift (large population size)
- No natural selection (all individuals have equal survival and reproductive success)

When these conditions are met, the allele frequencies can be predicted using the Hardy-Weinberg equation:

$p^2 + 2pq + q^2 = 1$

Where:
- p = frequency of the dominant allele
- q = frequency of the recessive allele
- p^2 = frequency of the homozygous dominant genotype
- 2pq = frequency of the heterozygous genotype
- q^2 = frequency of the homozygous recessive genotype

Using the Amoeba Sisters Hardy Weinberg Worksheet

The Amoeba Sisters provide worksheets that engage students in applying the Hardy-Weinberg principle through various scenarios. These worksheets are designed to reinforce understanding and help students practice critical thinking and problem-solving skills.

Key Components of the Worksheet

The worksheets typically include:

1. Example Problems: Real-world scenarios that require students to calculate allele frequencies, genotype frequencies, or predict changes in a population.
2. Graphical Representations: Visual aids that help illustrate concepts, such as population graphs showing shifts in allele frequencies.

3. Guided Practice: Step-by-step instructions to assist students in solving problems, making it easier to grasp the underlying concepts.
4. Reflection Questions: Questions that encourage students to think critically about the implications of the Hardy-Weinberg equilibrium and its applications in real-world biology.

Sample Problems and Answers

To illustrate how these worksheets function, let’s explore a few sample problems along with their answers.

Problem 1: In a population of 200 individuals, 36 are homozygous recessive for a trait. What are the frequencies of the alleles and genotypes?

Solution:
- First, calculate q^2 (frequency of homozygous recessive):
$q^2 = 36 / 200 = 0.18$
- Then, calculate q (frequency of the recessive allele):
$q = \sqrt{0.18} \approx 0.42$
- Now, calculate p (frequency of the dominant allele):
$p = 1 - q = 1 - 0.42 = 0.58$
- Finally, calculate the genotype frequencies:
- p^2 (homozygous dominant) = $(0.58)^2 \approx 0.34$
- 2pq (heterozygous) = 2 0.58 0.42 ≈ 0.49

Answer:
- Allele frequencies: p ≈ 0.58, q ≈ 0.42
- Genotype frequencies: Homozygous dominant ≈ 34%, Heterozygous ≈ 49%, Homozygous recessive ≈ 18%

Problem 2: If the population evolves and the frequency of the recessive allele increases to 0.5, what would be the new expected genotype frequencies?

Solution:
- Calculate q (recessive allele frequency) = 0.5
- Calculate p (dominant allele frequency) = 1 - q = 0.5
- Calculate genotype frequencies:
- $p^2 = (0.5)^2 = 0.25$ (Homozygous dominant)
- 2pq = 2 0.5 0.5 = 0.5 (Heterozygous)
- $q^2 = (0.5)^2 = 0.25$ (Homozygous recessive)

Answer:
- The new expected genotype frequencies would be:
- Homozygous dominant: 25%
- Heterozygous: 50%
- Homozygous recessive: 25%

Importance of the Hardy-Weinberg Worksheet in Education

The use of Amoeba Sisters Hardy Weinberg worksheets in educational settings is significant for several reasons:

- **Enhances Conceptual Understanding**: By engaging with practical problems, students develop a deeper understanding of genetic principles.
- **Encourages Active Learning**: Worksheets promote active participation and critical thinking, moving beyond rote memorization.
- **Supports Diverse Learning Styles**: Varied approaches, including visual aids and guided questions, cater to different learning preferences.
- **Prepares for Advanced Topics**: A solid grasp of Hardy-Weinberg equilibrium lays the groundwork for more advanced topics in genetics and evolutionary biology.

Conclusion

In summary, **Amoeba Sisters Hardy Weinberg worksheet answers** provide valuable resources for students learning about population genetics. By applying the Hardy-Weinberg principle through practical exercises, students can better understand the dynamics of allele frequencies and the factors that drive evolution. As educators continue to utilize these tools, they foster an environment where students can actively engage with the material, preparing them for future studies in genetics and beyond.

Frequently Asked Questions

What is the Hardy-Weinberg principle?

The Hardy-Weinberg principle is a fundamental concept in population genetics that describes how genetic variation will remain constant from one generation to the next in the absence of disturbing factors. It provides a model for understanding allele frequencies in a population.

How do the Amoeba Sisters explain the Hardy-Weinberg equilibrium?

The Amoeba Sisters use engaging animations and relatable examples to explain the Hardy-Weinberg equilibrium, illustrating the conditions required for a population to be in equilibrium, such as no mutations, random mating, no natural selection, extremely large population size, and no gene flow.

What types of problems can the Hardy-Weinberg worksheet from Amoeba Sisters help solve?

The Hardy-Weinberg worksheet from Amoeba Sisters helps solve problems related to calculating allele frequencies, determining genotype frequencies, and assessing whether a population is in Hardy-Weinberg equilibrium using provided data.

Why is it important to understand Hardy-Weinberg equilibrium in biology?

Understanding Hardy-Weinberg equilibrium is important because it serves as a baseline for detecting evolutionary changes in populations. It helps biologists identify factors that are influencing changes in allele frequencies, such as natural selection or genetic drift.

What kind of exercises can be found in the Amoeba Sisters Hardy-Weinberg worksheet?

The Amoeba Sisters Hardy-Weinberg worksheet includes exercises that require students to calculate the frequency of alleles and genotypes, apply the Hardy-Weinberg equation, and analyze scenarios to determine if a population meets the equilibrium conditions.

Amoeba Sisters Hardy Weinberg Worksheet Answers

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