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**BASIC MENDELIAN GENETICS PRACTICE PROBLEMS**

Go to [www.biology.arizona.edu](http://www.biology.arizona.edu), click on Mendelian Genetics, start with monhybrid cross. Be sure to write out your answers, not just the correct letter.

**Monohybrids**

1. In pea plants, spherical seeds (S) are dominant to dented seeds (s). In a genetic cross of two plants that are heterozygous for the seed shape trait, what fraction of the offspring should have spherical seeds?
2. A phenotypic ratio of 3:1 in the offspring of a mating of two organisms heterozygous for a single trait is expected when:
3. In Mendel's "Experiment 1," true-breeding pea plants with spherical seeds were crossed with true-breeding plants with dented seeds. (Spherical seeds are the dominant characteristic.) Mendel collected the seeds from this cross, grew F1-generation plants, let them self-pollinate to form a second generation, and analyzed the seeds of the resulting F2 generation. The results that he obtained, and that you would predict for this experiment are:
4. A genetic cross between two F1-hybrid pea plants for spherical seeds will yield what percent spherical-seeded plants in the F2 generation? (Recall, spherical-shaped seeds are dominant over dented seeds.)
5. A genetic cross between two F1-hybrid pea plants having yellow seeds will yield what percent green-seeded plants in the F2 generation? Yellow seeds are dominant to green.
6. When true-breeding tall stem pea plants are crossed with true-breeding short stem pea plants, all of the \_\_\_\_\_\_\_\_\_ plants, and 3/4 of the \_\_\_\_\_\_\_\_\_\_ plants had tall stems. Therefore, tall stems are dominant.
7. To identify the genotype of yellow-seeded pea plants as either homozygous dominant (YY) or heterozygous (Yy), you could do a test cross with plants of genotype \_\_\_\_\_\_\_.
8. A test cross is used to determine if the genotype of a plant with the dominant phenotype is homozygous or heterozygous. If the unknown is homozygous, all of the offspring of the test cross have the \_\_\_\_\_\_\_\_\_\_ phenotype. If the unknown is heterozygous, half of the offspring will have the \_\_\_\_\_\_\_\_\_\_ phenotype.
9. In Mendel's experiments, if the gene for tall (T) plants was incompletely dominant over the gene for short (t) plants, what would be the result of crossing two Tt plants?
10. A genetic cross of inbred snapdragons with red flowers with inbred snapdragons with white flowers resulted in F1-hybrid offspring that all had pink flowers. When the F1 plants were self-pollinated, the resulting F2-generation plants had a phenotypic ratio of 1 red: 2 pink: 1 white. The most likely explanation is:
11. Human blood type is determined by codominant alleles. There are three different alleles, known as IA, IB, and i. The IA and IB alleles are co-dominant, and the i allele is recessive. The possible human phenotypes for blood group are type A, type B, type AB, and type O. Type A and B individuals can be either homozygous (IAIA or IBIB, respectively), or heterozygous (IAi or IBi, respectively). A woman with type A and a man with type B could potentially have offspring with which blood types?
12. Manx cats are heterozygous for a dominant mutation that results in no tails (or very short tails), large hind legs, and a distinctive gait. The mating of two Manx cats yields two Manx kittens for each normal, long-tailed kitten, rather than three-to-one as would be predicted from Mendelian genetics. Therefore, the mutation causing the Manx cat phenotype is likely a(n) \_\_\_\_\_\_\_\_\_\_ allele.
13. What are the possible blood types of the offspring of a cross between individuals that are type AB and type O? (Hint: blood type O is recessive)

**Dihybrids**

1. A pea plant is heterozygous for both seed shape and seed color. S is the allele for the dominant, spherical shape characteristic; s is the allele for the recessive, dented shape characteristic. Y is the allele for the dominant, yellow color characteristic; y is the allele for the recessive, green color characteristic. What will be the distribution of these two alleles in this plant's gametes?
2. A phenotype ratio of 9:3:3:1 in the offspring of a mating of two organisms heterozygous for two traits is expected when:
3. Which of the following genetic crosses would be predicted to give a phenotypic ratio of 9:3:3:1?
4. The gametes of a plant of genotype SsYy should have the genotypes:
5. Which of the following genotypes would you not expect to find among the offspring of a SsYy x ssyy test cross:
6. The expected phenotypic ratio of the progeny of a SsYy x ssyy test cross is:
7. In a dihybrid cross, AaBb x AaBb, what fraction of the offspring will be homozygous for both recessive traits?
8. Following a SsYy x SsYy cross, what fraction of the offspring are predicted to have a genotype that is heterozygous for both characteristics?
9. In a dihybrid cross, SsYy x SsYy, what fraction of the offspring will be homozygous for both traits?
10. If Mendel's crosses between tall, spherical-seeded plants and short, dented-seeded plants had produced many more than 1/16 short, dented-seeded plants in the F2 generation, he might have concluded that:
11. In Mendel's experiments, the spherical seed character (SS) is completely dominant over the dented seed character (ss). If the characters for height were incompletely dominant, such that TT are tall, Tt are intermediate and tt are short, what would be the phenotypes resulting from crossing a spherical-seeded, short (SStt) plant to a dented-seeded, tall (ssTT) plant?
12. Two unlinked loci effect mouse hair color. **CC** or **Cc** mice are agouti. Mice with genotype **cc** are albino because all pigment production and deposition of pigment in hair is blocked. At the second locus, the **B** allele (black agouti coat) is dominant to the **b** allele (brown agouti coat). A mouse with a black agouti coat is mated with an albino mouse of genotype **bbcc**. Half of the offspring are albino, one quarter are black agouti, and one quarter are brown agouti. What is the genotype of the black agouti parent?
13. Two unlinked loci effect mouse hair color. **AA** or **Aa** mice are agouti. Mice with genotype **aa** are albino because all pigment production is blocked, regardless of the phenotype at the second locus. At the second locus, the **B** allele (agouti coat) is dominant to the **b** allele (black coat). What would be the result of a cross between two agouti mice of genotype AaBb?