Classical Genetics Problem Set

DIRECTIONS: *Complete these problems on a separate sheet of paper. For each question, include the question number, a completed Punnett square, and an answer to the specific question asked. There is a total of 72 points worth of questions below. You will be graded on a scale of 0-50. Therefore, the maximum grade is 144%, and the minimum passing grade is 30 points.*

1-A: In rats, black eyes (B) are dominant to red eyes (b). If a rat that is heterozygous for eye color is crossed with a red-eyed rat, what will the phenotype ratio of their offspring be?

1-B: In hamsters, having a white spot on the chest (W) is dominant to no spot (w). If a homozygous female with a white spot is crossed with a male with no spot, what % of the offspring will have a white spot?

1-C: In a species of roundworm, having a hard cuticle (H) is dominant to having a soft cuticle (h). In the lab, a nematode with a hard cuticle mates with a soft-cuticle nematode. All of the offspring have hard cuticles. What are the genotypes of the parents?

1-D: When Greggor Mendel was first investigating the genetics of pea plants, he noticed that a pure-breeding purple-flowered plant and a pure-breeding white-flowered plant always produced 100% purple-flowered offspring when crossed. If he then took those offspring and crossed two of them, what % of the offspring had white flowers?

1-E: A floppy-eared dog is crossed with a pointy-eared dog, and all of the offspring have floppy ears. What are the genotypes of the parents?

1-F: In chickens, brown feathers are dominant to white feathers. If a cross between a brown chicken and a white chicken produces 4 brown offspring and 3 white, what are the genotypes of the parents?

1-G: In goats, gray fur is dominant to red fur. If two gray goats are crossed, what is the maximum % of their offspring that could ever be red?

1-H: Tongue rolling in humans is a dominant trait. If two tongue rollers reproduce, can they have a non-rolling child?

1-I: Two brown lemmings mate. They produce 9 brown baby lemmings, and 3 white ones. What is the genotype of the parents?

1-J: In apples, red skin is dominant to green. If a heterozygous red plant is self-crossed, what % of its offspring will be green?

2-A: Rabbits may have long ears, short ears, or medium-length ears. If 2 medium-eared rabbits mate, what % of their offspring will have long ears?

2-B: Longhorn cattle may have red fur, white fur, or roan fur (which is a combination of both red and white fur). If two roan cattle mate, what % of the offspring will be white?

2-C: A type of pepper comes in three colors, red, orange, and yellow. When two orange peppers are crossed, what % of the offspring do you expect to be yellow?

2-D: Some cats have black fur, some are tan, and others are tabby, which is a combination of black and tan. If a black cat and a tabby cat mate, what % of their offspring will be tabby?

2-E: Brown bears may have straight fur, wavy fur, or curly fur. What type of inheritance is this? Do a wavy X wavy cross to illustrate.

2-F: Egrets may have white tail feathers, gray tail feathers, or white tail feathers with gray tips. When a white feathered bird and a gray feathered bird mate, what % of their offspring will have white tail feathers with gray tips?

3-A: Hemophilia is an X-linked recessive blood disorder in humans. If a hemophiliac man has a child with a normal woman, what % of his children will be hemophiliacs?

3-B: Hemophilia is an X-linked recessive blood disorder in humans. If a female carrier for hemophilia has a child with a normal man, what is the % chance that she will have a child (of either gender) that has hemophilia?

3-C: Hemophilia is an X-linked recessive blood disorder in humans. A woman is a hemophiliac. What is her father’s genotype?

3-D: In humans, there are 3 alleles that commonly determine blood type. A man with blood type A marries a woman with blood type O. They have 3 children, 2 with blood type A, and one with blood type O. what is the genotype of the father?

3-E: In humans, there are 3 alleles that commonly determine blood type. A man with blood type AB marries a woman with blood type A. What are the possible genotypes of their children?

3-F: In humans, there are 3 alleles that commonly determine blood type. A woman with blood type B gives birth to a child with blood type B. List the possible blood types the father could have had.

4-A: In pea plants, purple flower color is dominant to white flower color, and yellow seeds are dominant to green seeds. In a cross between two parents heterozygous for both traits, what is the probability of producing a white-flowered, green-seeded offspring?

4-B: in humans, having a widow’s peak is dominant to having no widow’s peak, and freckles are recessive. If a freckled woman with a widows peak has a child with a man with no freckles and no widow’s peak, is it possible for them to have a child with freckles but no widow’s peak?

4-C: In race horses, fast-twitch muscles (F) are dominant to slow-twitch muscles (f), and a black mane is dominant to brown. If a stallion homozygous for fast-twitch and heterozygous for black mane is crossed with a mare that is heterozygous for fast twitch and homozygous for black mane, what will the genotype ratio of their offspring be?

4-D: In fruit flies, red eyes are dominant to white eyes, and having wings is dominant to being wingless. If a fly heterozygous for red eyes and wings is crossed with a white-eyed fly heterozygous for wings, what fraction of the offspring will be white-eyed and wingless?

5-A: Dogs may have short hair, medium hair, or long hair. In dogs, brown eyes are dominant to blue. If a blue-eyed, long haired dog is crossed with a medium- haired dog heterozygous for brown eyes, what % of the offspring will be medium-haired and blue eyed?

5-B: In Fnords, orange skin is dominant to blue. Fnords may have 3, 4, or 5 eyes. A 5-eyed blue fnord mates with a 3-eyed heterozygous orange fnord, and they produce 1,200 offspring. How many of the offspring do you expect to be 4-eyed orange fnords?

6-A In humans, colorblindness is a recessive sex-linked trait, and blood type is determined by three different alleles. A man heterozygous for blood type A has a color blind mother. If he has children with a woman of blood type AB, who is a carrier for colorblindness, what is the probability he will have a daughter with blood type B who is a carrier for colorblindness?