Genetics Worksheet #1

Do this work on a separate sheet which you need to label on the top left-hand: Name of assignment. On the top right-hand side: name, period, and date.

To get full credit you must show all your work and/or describe clearly how you got your answers. I want to see neat, well organized work. Do Punnett Squares when necessary and be sure and show how you got your different gametes to make the Punnett Squares.

1. One gene has alleles A and a; another gene has alleles B and b. For each of the following genotypes, what type(s) of gametes will be produced?
a. AA BB b. Aa BB c. Aa bb d. Aa Bb

2. Referring still to the preceding problem, what genotypes will be present in the offspring from the following matings? (Indicate the frequencies of each genotype among the offspring.)
a. AA BB x aa BB b. Aa Bb x AA Bb c. Aa Bb x aa bb d. Aa Bb x Aa Bb

3. In one experiment, Mendel crossed a true-breeding pea plant having green pods with a true-breeding pea plant having yellow pods. All of the F1 plants had green pods.
a. Which trait (green or yellow pods) is recessive? Can you explain how you arrived at your conclusion?
b. Suppose the F1 plants are self-pollinated and 135 F2 plants are produced. What phenotypes should be present in the F2 generation, and how many of the plants in that generation should show each of those phenotypes?

4. Being able to curl up the sides of your tongue into a U-shape is under control of a dominant allele at one gene locus. (When there is a recessive allele at this locus, the tongue cannot be rolled.) Having free earlobes is a trait controlled by a dominant allele at a different gene locus. (When there is a recessive allele at this locus, earlobes are attached at the jawline.) The two genes controlling tongue-rolling and free earlobes assort independently. Suppose a woman who has free earlobes and who can roll her tongue marries someone who has attached earlobes and who cannot roll his tongue. Their first child has attached earlobes and cannot roll his tongue.
a. What are the genotypes of the mother, the father, and the child?
b. If this same couple has a second child, what is the probability that it will have free earlobes and be unable to roll the tongue?

5. In mice, black is dominant over tan and short tails are dominant over long.
•Use B for black and b for tan. •Use S for short and s for long.
a. Write the genotype for a heterozygous black, short-tailed mouse.
b. Write out the genotypes of all the different gametes that a male heterozygous black, short-tailed mouse would have (i.e. list the possible genotypes of all the different sperm)
c. Write out the genotypes of all the different gametes that a female heterozygous black, short-tailed mouse would have (i.e. list the possible genotypes of all the different eggs)
d. Cross two of these individuals. Use a Punnett Square, and describe the phenotype of the offspring. Be sure to give ratios of each possible phenotype.

Genetics Worksheet #2

Things Mendel Didn't Know About or Fully Understand

1. The lubber grasshopper is a very large grasshopper, and is black with red and yellow stripes. Assume that red stripes are expressed from the homozygous S^rS^r genotype, yellow stripes are expressed from the homozygous S^yS^y genotype, and grasshoppers with both stripes are expressed from the heterozygous S^rS^y genotype.

a. What kind of inheritance is this called? Why is it called this?
b. Make a Punnett Square showing this cross between two heterozygotes.
c. What will be the phenotypic ratio of the F_1 generation resulting from a cross of two grasshoppers, both with red and yellow stripes?
d. What would be the genotypic ratio of the F_1 generation?

2. The ABO Blood system has often been employed to settle cases of disputed paternity. Suppose, as an expert in genetics, you are called to testify in a case where the mother has type A blood, the child type O blood, and the alleged father has type B blood. How would you respond to the following statements of the attorneys:
a. "Since the mother has type A blood, the type O blood of the child must have come from the father, and since my client has type B blood, he obviously could not have fathered this child." (*Made by the attorney of the alleged father)*
b. "Further tests revealed that this man is heterozygous and therefore he must be the father." (*Made by the mother's attorney)*

3. In mice, at one gene locus, the dominant allele (B) produces a dark-brown pigment; and the recessive allele (b) produces a light brown, or tan, pigment. An independently assorting gene locus has a dominant allele (C) that permits the production of all pigments. Its recessive allele (c) makes it impossible to produce any pigment at all. The pigmentless condition is called "albino."
a. A homozygous bb cc albino mouse mates with a homozygous BB CC brown mouse. In what ratios would the phenotypes and genotypes be expected in the F_1 and F_2 generations?
b. If an F_1 mouse from part (a) above were backcrossed to its albino parent, what phenotypic and genotypic ratios would be expected? Diagram the crosses in both parts (a)

Genetics Worksheet #3

1. An X-linked recessive gene c produces a red-green color blindness in humans. A normal woman whose father was color-blind marries a color-blind man. Let X^c= colorblind allele and X^C= normal allele
a. What genotypes are possible for the mother of the color-blind man?
b. What are the chances that the first child from this marriage will be a color-blind boy?
c. Of the girls produced by these parents, what percentage is expected to be color-blind?
d. Of all the children (sex unspecified) of these parents, what proportion can be expected to have normal color vision?

2. Hemophilia is a sex-linked trait where X^H gives normal blood clotting and is dominant to the hemophilia allele X^h.
a. Give the genotypes of:
i) a woman with normal blood clotting whose father had hemophilia
ii) a normal man whose father had hemophilia.
b. What is the probability that a mating between these two individuals will produce a child, regardless of sex, that has hemophilia?
c. If this couple has a daughter, what is the probability that the daughter will be a carrier of the hemophilia trait? What is the probability a daughter would have hemophilia?
d. If this couple has a son, what is the probability he will have hemophilia?

3. Explain why linked genes do not give you the same phenotypic ratios as genes that independently assort.

4. What is meant by gene linkage? What is meant by sex linked traits? Does the word "linked" or "linkage" mean the same thing in each of these cases?

5. If you do a typical Punnett Square using two linked genes you do not get the "expected" phenotypic ratio? How can you explain this?