Name ______________________________ Date ________ Period ________

GENETICS PROBLEM SET #1

1. In silkworms, a single gene determines the color of the cocoon. Yellow (C) is dominant. White (c) is recessive. A homozygous dominant male (CC) fertilizes a homozygous recessive female (cc). Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

2. The length of fur in guinea pigs is controlled by a single gene. Short fur (F) is dominant. Long fur (f) is recessive. A heterozygous male (Ff) fertilizes a homozygous recessive female (ff). Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

3. Genes determine the color of eyes in mice. Black (E) is dominant to red (e). A heterozygous male (Ee) fertilizes a heterozygous female (Ee). Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

4. In certain trees, smooth bark (B) is dominant over wrinkled bark (b). Cross two trees that are heterozygous for smooth bark. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring. If there are 20 offspring produced, how many will have wrinkled bark?

5. A colored rabbit (Cc) was crossed with an albino rabbit (cc). Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring. If there were 12 offspring, how many will be albino? How many will be colored?

6. In chili pepper plants, the gene for ultra hot taste (H) is dominant over the gene for mild flavor (h). For each of these 3 examples, use a Punnett Square to determine the % of genotypes and phenotypes for the offspring.
   a. Hh X hh
   b. Hh X Hh
   c. Hh X HH

7. In humans, the gene for brown eyes (B) is dominant over blue eyes (b). Suppose a blue-eyed man marries a brown-eyed woman whose father was blue-eyed. Determine the % of genotypes and phenotypes for the offspring.

8. The ability to curl your tongue up on the sides (T) is dominant to not being able to roll your tongue (t). A woman who can roll her tongue marries a man who cannot. Their first child has his father's phenotype. Determine the genotypes of the mother, the father, and the child.

   - mother = ____________
   - father = ____________
   - child = ____________

9. In dogs, wire hair (S) is dominant to smooth (s). A homozygous wire-haired dog mates with a smooth-haired dog. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

10. The ability to taste the chemical PTC is determined by a single gene. The ability to taste is dominant (T). The inability to taste is recessive (t). Suppose that 2 heterozygous tasters have a large family.
    a. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.
    b. What is the likelihood that their first child will be a taster?
    c. What is the likelihood that their fourth child will be a taster?
    d. What is the likelihood that their first three children will be non-tasters?

11. Kelp, a large, multicellular type of algae, has air bladders in the blades to help them float near the surface of the ocean. Many air bladders (M) is dominant. Few air bladders (m) is recessive.
    a. What gametes would be produced by a heterozygous individual? Draw the sperm cells.
    b. What gametes would be produced by a homozygous dominant individual? Draw the egg cells.

12. Dr. Bob's new hamsters decided to mate. Gray (R) is dominant to red (r). The male is homozygous recessive for coat color. The female is heterozygous.
    a. What gametes would be produced by the male? Draw the sperm cells.
    b. What gametes would be produced by the female? Draw the egg cells.
    c. What is the probability that one of the baby hamsters would be red?
    d. If there are 8 offspring, how many would be grey?

13. In a certain plant, blue (B) flowers is dominant to white (b). You have a blue-flowered plant and a white-flowered plant.
    a. Can you be sure of both of the flowers' genotypes? If not, which one are you not sure of?
    b. If you mated them together, and all of the offspring are blue, what are their genotypes? Prove your answer with a Punnett Square.
    c. If you mated them together, and half of the offspring are blue and half are white, what are their genotypes? Prove your answer with a Punnett Square.

14. A brown-eyed man whose father was brown-eyed and whose mother was blue-eyed marries a blue-eyed woman whose father and mother were both brown-eyed. The couple has a blue-eyed son. Determine everybody's genotype.

- man =	____________	- woman =	____________
- his dad =	____________	- her dad =	____________
- his mom =	____________	- her mom =	____________
		- baby =	____________

15. In reptiles, assume that razor-sharp claws (R) are dominant over dull claws (r). Suppose 2 reptiles with razor-sharp claws (heterozygous) are mated. Using a Punnett Square, predict the number of young from a 60 egg clutch that would have razor-sharp claws. Determine the number that would have dull claws.

16. In dogs, deafness is recessive (d) to normal hearing (D). Use Punnett Squares to show how two dogs with normal hearing could produce deaf puppies. Then state the % of all of their puppies that would be deaf.

Name ____________________________________ Date ________ Period ________

GENETICS PROBLEM SET #2

1. Zinnias can occur with red (RR), pink (Rr), or white (rr) flowers. Draw a Punnett Square to show the mating between two pink flowers. Determine the % of genotypes and phenotypes for the offspring.

2. In question one, a botanist mated the 2 pink flowers to get 20 plants: 5 red, 11 pink, and 4 white. Is this acceptable? Explain your answer.

3. A rooster with grey feathers is mated with a hen of the same phenotype. Among their 30 offspring, 15 chicks are grey, 7 are black, and 8 are white.
   a. What is the name of this inheritance pattern?
   b. State the genotypes (using B and b) for grey, black, and white.
   c. What is the % of grey, black, and white chicks?
   d. Assume that a grey rooster and a black hen are mated. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

4. In northeast Kansas, there exists a creature known as a wildcat. It comes in three colors: blue (BB), red (bb), and purple (Bb). A blue wildcat is mated with a red wildcat. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

5. For the wildcats, draw the gametes (egg or sperm cells) for each of these:
   a. male blue wildcat
   b. female purple wildcat
   c. male purple wildcat
   d. female red wildcat

6. In snapdragons, the genes for color exhibit incomplete dominance. A red (RR) flower is mated with a white (rr) flower. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring. NOTE: Pink is Rr.

7. In rabbits, the genes for length of tail exhibit incomplete dominance. Rabbits can be long-tailed (LL), short-tailed (ll), or medium-tailed (Ll). For each of these 4 examples, use a Punnett Square to determine the % of genotypes and phenotypes for the offspring.
   a. short-tailed male X long-tailed female
   b. long-tailed male X medium-tailed female
   c. medium-tailed male X short-tailed female
   d. medium-tailed male X medium-tailed female

8. In rats, the genes for length of tail also exhibit incomplete dominance. Determine the genotypes and phenotypes of the PARENTS if the offspring exhibit the following phenotypes:
   a. 50% long and 50% medium
   b. 50% short and 50% medium
   c. 25% long, 50%, medium, and 25% short

Name ____________________________________ Date ________ Period ________

GENETICS PROBLEM SET #3

1. Blood type A is shown by I^AI^A or I^Ai . Blood type B is shown by I^BI^B or I^Bi. Blood type AB is shown by I^AI^B. Blood type O is shown by ii. One parent has type AB and the other has type O. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

2. For each of these 4 examples, use a Punnett Square to determine the % of genotypes and phenotypes for the offspring.

   a. I^AI^A X I^BI^B
   b. I^BI^B X I^AI^B
   c. ii X ii
   d. I^AI^B X I^AI^B

3. Mom has blood type A, and Dad has blood type B. We can't say if mom is I^AI^A or I^Ai, and if Dad is I^BI^B or I^Bi, but my siblings and I can solve the puzzle. My sister has blood type O, my brother has blood type B, and I have blood type AB. Determine the genotypes of all the people.

   - mother = ____________
   - father = ____________
   - brother = ____________
   - sister = ____________
   - me = ____________

4. Bill has blood type B. His mother has blood type O. Kelly, Bill's wife, has blood type A. Her father has blood type B. Determine everybody's genotype. Then, using a Punnett Square, determine the % of genotypes and phenotypes for Bill and Kelly's children.

   - Bill = ____________
   - his mom = ____________
   - Kelly = ____________
   - her dad = ____________

5. A man is accused in a paternity suit of being the father of a child. He has type B blood, while the mother has type AB. The child has type O. Was the baby switched at birth? Use a Punnett Square to prove your answer.

6. At a local hospital, Mr. and Mrs. Lump had a child (Bill) at the same time as Mr. and Mrs. Bump had a child (Tony). A few weeks passed and the Bumps claimed their babies were switched. They sued the hospital, and all 6 individuals were asked to get their blood tested. The results were as follows: Mr. Lump had type A, Mrs. Lump had type B, and Bill had type A. Mr. Bump had type O, Mrs. Bump had type AB, and Tony had type O. Was there a switch at the hospital?

   - Mr. Lump = ____________
   - Mrs. Lump = ____________
   - Bill = ____________
   - Mr. Bump = ____________
   - Mrs. Bump = ____________
   - Tony = ____________

7. Determine if each of these is POSSIBLE or NOT POSSIBLE. Prove each answer!

   a. an O child from a marriage of two A individuals
   b. an AB child from a marriage of an AB and an O
   c. an O child from a marriage of an AB and an O
   d. a B child from a marriage of two AB individuals

Name ________________________________ Date ________ Period ________

GENETICS PROBLEM SET #4

1. In race horses, black hair (F) and a trotting gait (G) are dominant traits. Recessive traits are chestnut hair (f) and a pacing gait (g). The genes for hair color and gait are on two different chromosomes. Determine the possible offspring from a cross between two heterozygous black trotters (FfGg). Make a Punnett Square. List the phenotypes of the offspring as fractions.

2. In fruit flies, the gene for normal size wings (W) is dominant over the gene for small wings (w). Also, the gene for normal size eyes (E) is dominant over the gene for small eyes (e). These traits are found on different chromosomes. The male fruit fly is heterozygous for both traits (WwEe). The female is homozygous recessive for both traits (wwee). Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

3. In certain bacteria that reproduce using conjugation, oval shape (O) is dominant over round shape (o). Also, thick cell walls (T) is dominant over thin cell walls (t). These traits are found on different chromosomes. Cross a heterozygous oval, thick cell-walled bacterium with a round, thin cell-walled bacterium. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

4. In guinea pigs, black coat color (B) is dominant over white (b). Short hair (H) is dominant over long (h). Rough fur (R) is dominant over smooth fur (r). These traits are found on different chromosomes. The male is homozygous dominant for color, hair, and fur. The female is recessive for color, hair, and fur. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

5. A homozygous white-haired, rough-coated male guinea pig was crossed with a pure (homozygous) black-haired, smooth-coated female guinea pig. Black (B) is dominant to white (b). Rough coats (R) are dominant to smooth coats (r). These traits are found on different chromosomes. Using a Punnett Square, determine the % of genotypes and phenotypes for the offspring.

6. Use the same genetic traits and abbreviations from question 5. Mate a heterozygous male with a heterozygous female. (They are heterozygous for BOTH traits!) Make a Punnett Square. List the phenotypes of the offspring as fractions.

7. In watermelon, the alleles for green color (G) and short shape (S) are dominant over striped color (g) and long shape (s). These traits are found on different chromosomes. Suppose a plant with long, striped fruit is mated with a plant that is heterozygous for both traits. Make a Punnett Square. List the genotypes and phenotypes of the offspring as fractions.

8. In pepper plants, green (G) is dominant to red (g) and round (R) is dominant to square (r). These traits are found on different chromosomes.

   a. What GAMETES will be produced by a heterozygous green, round plant
   b. Mate two heterozygous plants. Make a Punnett Square. List the phenotypes of the offspring as fractions.

9. In areas of the very deep and damp southeastern United States lives a giant flying "cockroach" known as a Palmetto bug. Long antennae (L) are dominant to short antennae (l). Normal wings (N) are dominant to bent wings (n). These traits are found on different chromosomes.

   a. What GAMETES will be produced by a male bug that is homozygous dominant for antennae and heterozygous for wings?
   b. What GAMETES will be produced be a female bug that is heterozygous for antennae and homozygous recessive for wings?
   c. Mate the male and female bugs together. Make a Punnett Square. List the phenotypes of the offspring as fractions.

10. In horses, black (B) is dominant to chestnut color (b). Trotting gait (T) is dominant to pacing gait (t). These traits are found on different chromosomes.

   a. What GAMETES will be produced by a female homozygous black pacer?
   b. What GAMETES will be produced by a male homozygous chestnut trotter?
   c. Mate the male and female horses together. Make a Punnett Square. List the % of genotypes and phenotypes of the offspring.

11. In turkeys, bronze color (B) is dominant to red (b). Also, normal feathers (F) is dominant to unwebbed feathers (f). Two bronze-colored parents with normal feathers were mated. They produced offspring as follows:

   - about 50% bronze-colored, normal-feathered offspring
   - about 20% bronze-colored, unwebbed-feathered offspring
   - about 20% red-colored, normal-feathered offspring
   - about 10% red-colored, unwebbed-feathered offspring

   Determine the GENOTYPES of the PARENTS.

12. Assume right-handedness (R) is dominant over left-handedness (r). Brown eyes (B) are dominant over blue eyes (b). A right-handed, blue-eyed man marries a right-handed, brown-eyed woman. One of their two children is right-handed and blue-eyed. Their other child is left-handed and brown-eyed. The man and woman get a divorce, and the man gets married again. His second wife is right-handed and brown-eyed. They have 10 children. All of their children are right-handed and brown-eyed. Determine everybody's genotype.

- Man =	____________________	- 1st Child =	____________________
- Woman =	____________________	- 2nd Child =	____________________
- 2nd Wife =	____________________	- 10 Children =	____________________

Name ___________________________________ Date ________ Period ________

GENETICS PROBLEM SET #5

NOTE: When doing sex-linked problems, you MUST list the gender of the offspring in your answers!

1. Baldness is a recessive, sex-linked trait. Use X^R to represent normal hair. Use X^r to represent baldness. Determine the % of genotypes and phenotypes of the offspring between a normal female and a bald male.

2. Baldness is a recessive, sex-linked trait. Use X^R to represent normal hair. Use X^r to represent baldness. Determine the % of genotypes and phenotypes of the offspring between a carrier female and a bald male.

3. Baldness is a recessive, sex-linked trait. Use X^R to represent normal hair. Use X^r to represent baldness. Determine the % of genotypes and phenotypes of the offspring between a carrier female and a normal male.

4. In fruit flies, white eyes are a sex-linked, recessive trait (X^r). Red eyes are dominant (X^R). Determine the % of genotypes and phenotypes of the offspring between a white-eyed female and a red-eyed male.

5. Use the information from question 4.
   a. What % of just the FEMALE offspring will have white eyes?
   b. What % of just the FEMALE offspring will have red eyes?
   c. What % of just the MALE offspring will have white eyes?
   d. What % of just the MALE offspring will have red eyes?

6. In humans, hemophilia is a sex-linked, recessive trait (X^h). Normal blood is dominant (X^H). Cross a carrier female with a normal male. Determine the % of genotypes and phenotypes of the offspring.

7. Use the information from question 6.
   a. What % of just the FEMALE offspring will have hemophilia?
   b. What % of just the FEMALE offspring will have normal blood?
   c. What % of just the MALE offspring will have hemophilia?
   d. What % of just the MALE offspring will have normal blood?

8. In humans, hemophilia is a sex-linked, recessive trait (X^h). Normal blood is dominant (X^H). Cross a hemophiliac female with a normal male. Determine the % of genotypes and phenotypes of the offspring.

9. In humans, hemophilia is a sex-linked, recessive trait (X^h). Normal blood is dominant (X^H). Cross a normal female with a hemophiliac male. Determine the % of genotypes and phenotypes of the offspring.

10. Compare your answers from questions 9 and 10. In question 9, the male was normal and the female was a hemophiliac. In question 10, the female was normal and the male was a hemophiliac. What does this teach you about sex-linked traits?

11. Colorblindness is a sex-linked, recessive trait (X^n). Normal eyesight is dominant (X^N). Cross a normal female with a colorblind male.

a. What is the overall chance (%) that they will produce a colorblind son?
b. What is the overall chance that they will produce a colorblind daughter?
c. What is the overall chance that they will produce a normal son?
d. What is the overall chance that they will produce a carrier daughter?
e. What is the overall chance that they will produce a normal daughter?

12. Colorblindness is a sex-linked, recessive trait (X^n). Normal eyesight is dominant (X^N). Cross a carrier female with a colorblind male.

a. What is the overall chance (%) that they will produce a colorblind son?
b. What is the overall chance that they will produce a colorblind daughter?
c. What is the overall chance that they will produce a normal son?
d. What is the overall chance that they will produce a carrier daughter?
e. What is the overall chance that they will produce a normal daughter?

13. Colorblindness is a sex-linked, recessive trait (X^n). Normal eyesight is dominant (X^N). Cross a carrier female with a normal male.

a. What is the overall chance (%) that they will produce a colorblind son?
b. What is the overall chance that they will produce a colorblind daughter?
c. What is the overall chance that they will produce a normal son?
d. What is the overall chance that they will produce a carrier daughter?
e. What is the overall chance that they will produce a normal daughter?

14. Retinoblastoma is caused by a dominant sex-linked trait (X^D). Normal eyesight is recessive (X^d). Mom suffers from the disease. Dad does not. Their first daughter does not inherit the disease. Their first son does inherit the disease. Their second daughter also inherits the disease. Their second son does not. Determine everybody's genotype.

- mother =	____________	- 1st daughter =	____________
- father =	____________	- 1st son =	____________
		- 2nd daughter =	____________
		- 2nd son =	____________

15. If you are a guy, which member of your family should you look at to tell if you are going to go bald? Why? Explain your answer. Choose from these people:

your mom	your mother's mom	your mother's dad
your dad	your father's mom	your father's dad

16. ✱✱✱ Wotzits are exotic (and imaginary) animals that have an X-Y system of sex determination, similar to humans. The bald trait is dominant and is sex-linked (X^B). The furry trait is recessive and is sex-linked (X^b). Pointed ears is dominant and is NOT sex-linked (E). Droopy ears is recessive and is NOT sex-linked (e). Mate a heterozygous female with a male that is heterozygous for ears and is furry.

Name ________________________________ Date ________ Period ________

FAMILY PEDIGREE PROBLEM SET

1. *the Smith family*:
   (normal inheritance)

   Susan Smith has dimples just like her mother Sally. Her brothers Stephen and Sam do not. Her father Sam Senior does not have dimples, nor does her father's father Stanley. Her father has one brother, Saul, who has a dimple. Her father's mother Sunny (her grandmother) died young, but it appears in photographs that she did have a dimple. Her mother's mother Sarah had a dimple exactly like Susan's. Sally has a sister Shirley who does not have a dimple. Sarah's husband Sandy does not have dimples.

2. *the Creeger family*:
   (normal inheritance)

   Carol is a carrier for sickle-cell anemia. Unfortunately her sister Catherine has the disease. Her father and mother Cleo and Chester do not have the disease, but Cleo's dad Curt died at a young age from the disease. Cleo's mom Caitlin has no family history of the disease. Chester's father Cobb did not have the disease, but thinks someone in the family history may have had it several generations ago. Chester's mother Corrine did not have the disease and as far as she knows, no one in her family has had it.

3. *the Brown family*:
   (blood-type inheritance)

   Barbara has blood type B. Her brother Blair has blood type O just like their mother Brenda. Brenda's mother Bessy has blood type A, while Brenda's brother Bart had type B. Barbara and Blair's father Bob died young and they have no records of his blood type, although they know his father Bill had AB blood and his mother Bunny had type A.

4. *the Jones family*:
   (sex-linked inheritance)

   John is colorblind just like his father Jim. Jim's father had normal vision. John's older brother Jerry has normal vision. John's sister Jane is colorblind which is unusual for a girl. John's mother Jill has normal vision, but her father Jacob was colorblind. Jill's mother Jan has normal vision, and has no history of colorblindness in her side of the family.

Name ________________________________ Date ________ Period ________

THE JETSONS & THE FLINTSTONES

Sickle-cell anemia is a recessive trait (s). Normal blood is a dominant trait (S).

Draw a pedigree that summarizes the following information.

List each person's name and genotype, and use shading to indicate that he or she has the disease (ss).

NOTE: Any person listed as not having the disease could still be a carrier (Ss).

Elroy Jetson has sickle-cell anemia. Neither of his parents, George and Jane, have this disease. His sister Judy also does not have sickle-cell anemia. Elroy has an affair with Rosie, who does not have the disease. Their child, Elroy Jr., also does not have the disease.

Meanwhile, Pebbles Flintstone does not have the disease. Her father, Fred, suffers from it, but her mother, Wilma, has no family history of the disease. Also in Bedrock, Bamm Bamm has sickle-cell anemia. Neither of his parents, Barney and Betty Rubble, have this genetic disease.

Pebbles and Bamm Bamm elope, and Pebbles soon becomes pregnant. Bamm Bamm Jr., their first daughter, is lucky in that she does not have sickle-cell anemia.

Bamm Bamm Jr. marries Elroy Jr., and shortly thereafter becomes pregnant. Their child, called Baby, does not have sickle-cell anemia.