Punnett Square Review

1. In pea plants, tall (T) plants are dominant over short (t) plants. Complete the following crosses and give the genotypic and phenotypic ratios of offspring.
	1. TT x tt
	2. Tt x tt
	3. Tt x Tt
2. In pea plants, purple flowers (P) are dominant over white (p) flowers. Complete the following crosses and give the genotypic and phenotypic ratios of offspring.
	1. A heterozygous purple plant is crossed with a homozygous purple plant.
	2. A cross between two pea plants produces offspring in which approximately 50% of the flowers are white and 50% are purple. What are the genotypes of the parents? Show punnett square to support your answer.
	3. A cross between two purple pea plants yields approximately 25% of the offspring exhibiting white flowers. What are the genotypes of the parents? Show punnett square to support your answer.
3. A widow’s peak in humans is determined by a dominant/recessive inheritance. A person who is purebred for widow’s peak is crossed with a person who is purebred for no widow’s peak. All of the offspring have a widow’s peak. Which trait is dominant and which is recessive? Show punnett square to support your answer.
4. In guinea pigs, black fur is dominant. If a black guinea pig is crossed with a white guinea pig and the litter contains a white offspring, the genotype of the black-haired parent is probably? Show punnett square to support your answer.
5. In minks, brown is dominant over silver-blue color.
	1. What offspring would you predict if you crossed a homozygous brown mink with a silver-blue mink? Show punnett square to support your answer.
	2. What would the genotypic and phenotypic ratios of two F2 generation mink from the above problem be if they were crossed? Show punnett square to support your answer.
6. In snapdragons, red is not completely dominant over white flowers.
	1. What color flowers would you expect when you cross a red flower with a white flower? What would be the genotypic and phenotypic ratios of the offspring be?
	2. Cross two of the F1 generation from above. What would be the genotypic and phenotypic ratios of the offspring be?
7. In dragons, the ability to breath fire is a recessive trait. Homozygous dominant dragons cannot produce fire or smoke at all. Heterozygous dragons can produce smoke, but no fire.
	1. Cross a fire breathing dragon with a homozygous dominant dragon. What would be the genotypic and phenotypic ratios of the offspring be?
	2. Cross two smoke-producing only dragons. Are any of the offspring able to produce fire? Show punnett square to support your answer.
8. In cattle, red and white hair are codominant. The heterozygous condition is roan colored (contains both red hair and white hair)
	1. Cross a red cow and a white cow. What would be the genotypic and phenotypic ratios of the offspring be?
	2. Would it be possible to have any red cattle when two roan cattle are crossed? Show punnett square to support your answer.
9. In Guinea pigs, the genotype (BB) is black, and the genotype (bb) is white color, and (Bb) is grey color, The gene (B) and (b) are sex-linked.
	1. What type of offspring are to be expected in a cross between a black female and a white male?
	2. A heterozygous female is crossed with a white male. What are the expected genotypic and phenotypic ratios of the offspring?
	3. Would it ever be possible to produce a male with grey hair? Explain
10. The chart below shows the inheritance of human blood types. There are four different phenotypes possible: A, B, AB, and O. The alleles A and B are codominant, and the O allele is recessive to both A and B.

* 1. A person with IAIB is crossed with a person who is IAIA. What are the genotypic and phenotypic ratios of the offspring?
	2. A person with type AB blood is crossed with a person with type O blood. What are the genotypic and phenotypic ratios of the offspring?

**DIHYBRID PUNNETT SQUARE PRACTICE PROBLEMS**

Problem A: Suppose that black hair (B) is dominant over blonde hair (b) and brown eyes (E) are dominant over blue eyes (e).

The father has black hair (heterozygous) and brown eyes (heterozygous) and the mother has blonde hair and blue eyes.

Genotype of father – BbEe Genotype of mother - bbee

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1. What percent of the offspring will be totally heterozygous?
2. What is the phenotype ratio?
3. What percent of the offspring will have blonde hair and blue eyes?

Problem B: Using the same traits as above, cross a completely recessive person with a blonde hair and homozygous brown eyed person.

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1. What percent of the offspring will be totally heterozygous?
2. What is the phenotype ratio?
3. What percent of the offspring will have blonde hair and blue eyes?

**SEX LINKED TRAITS PRACTICE PROBLEMS**

1) Hemophilia is a disease caused by a gene found on the X chromosome. Therefore, it is referred to as a sex-linked disease. The recessive allele causes the disease. A normal man marries a woman that is heterozygous for the trait. Draw the punnett square and give the genotypic and phenotypic ratios of the offspring.

2) The bison herd on Konza Prairie has begun to show a genetic defect. Some of the males have a condition known as “rabbit hock” in which the knee of the back leg is malformed slightly. We do not yet know the genes controlling this trait but for the sake of question, we shall assume it is a sex-linked gene and that it is recessive. Now suppose that the herd bull (the dominant bull that does most of the breeding) who is normal (XR) mates with a cow that is a carrier for “rabbit hock.” What are the chances of producing a normal male? How many females will show the trait for “rabbit hock”? How many will be carriers for the disease?

3) Red-green color blindness is a sex-linked recessive trait. Suppose a man with the disease marries a normal woman. How many of their children will be color-blind? How many of their daughters will be carriers for colorblindness? (Hint: You must do two different punnett squares and will get different results for each…do you know why?)

4) Clouded leopards are medium sized, endangered species of cat, living in the very wet cloud forests of Central America. Assume that the normal spots (XD) are a dominant, sex-linked trait and that dark spots are the recessive counterpart. Suppose as a Conservation Biologist, you are involved in a clouded leopard breeding program. One year you cross a male with dark spots and a female with normal spots. She has four cubs and, conveniently, two are males and two are females. One of each of the male and female cubs have normal spots and one each have dark spots. What is the genotype of the mother? What is the genotypic ratio of the offspring?

Suppose a few years later, you cross the female cub that has normal spots with a male that also has normal spots. How many of each of the following genotypes will you have in the cubs (assume she has 4 cubs)?

XDXD

XDXd

XdXd

XDY

XdY

Will any of the cubs from this latest cross have dark spots? If so, how many of each sex? \_\_\_\_\_\_\_\_\_\_\_\_

2) Hemophilia is a recessive sex-linked disease which causes the blood to fail to clot normally. Cross a normal female who is not a carrier (grandma) with a hemophiliac male (grandpa). Of all their offspring, what is the probability they will produce a hemophiliac son? A hemophiliac daughter? A carrier daughter?

Now cross one of the daughters (mom) with a normal male (dad). What sex is the child that gets the disorder? (\*\*See how the disorder skipped a generation\*\*)