Name: _____ Date: _____ Class period: _____

Quick Lab: How is color blindness transmitted?

Introduction: Three human genes associated with color blindness are located on the X chromosome. In males, a defective version of any one of these genes produces colorblindness, an inability to distinguish certain colors. The most common form of this disorder, red-green colorblindness, is found in about 1 in 10 males in the United States. Among females, however, colorblindness is rare –only about 1 female in 100 has colorblindness. (Refer to textbook **page 350** for more information).

Materials: 2 plastic cups, 3 white beans, Black marker, 1 red bean.

Procedure:

1. Use the marker to label one cup "father" and the other cup "mother."
2. The white bean represents the X chromosome. Use the marker to mark a dot on 1 white bean to represent the X-linked allele for colorblindness.
3. Place the marked white bean plus one unmarked white bean into the cup labeled "mother."
4. Mark a black dot on one more white bean. Place this bean and the one red bean into the cup labeled "father." The red bean represents the Y chromosome.
5. Close your eyes and pick one bean from each cup to represent how each parent contributes a sex chromosome to a fertilized egg.
6. In your data table, record the color of each bean and the sex of an individual who would carry this pair of sex chromosomes. Also record how many X-linked alleles the individual has. Put the beans back in the cups they came from.
7. In your data table, determine whether the individual would have colorblindness or not.
   ***Hint**: A female must carry two recessive traits of the colorblindness gene to be colorblind. The male must only have one recessive allele to carry the trait because the gene is on the X chromosome.*
8. Repeat steps 5 and 6 for a total of 10 trials or 10 pair of beans.

Data and Observations:

DATA TABLE:

Trails	Description of beans	Number of X-linked traits	Genotype of offspring	Gender of individual	Colorblind?
Ex. #1	White w/ dot, red	1	$X^{c}Y$	Male	Yes
Ex. #2	White w/o dot, white w/ dot	1	$X^{C}X^{c}$	Female	No
Ex. #3	White w/o dot, red	0	$X^{c}Y$	Male	No

Trails	Description of beans	Number of X-linked traits	Genotype of offspring	Gender of individual	Colorblind?
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Analysis and Conclusion: (Use **page 350** in your text to help with some answers)

1. Is either parent colorblind? If so, which one?

2. Is the mother homozygous or heterozygous for colorblindness?

3. Can someone carry the gene for colorblindness and not actually be colorblind? Explain.

4. According to your data, are males or females more likely to be colorblind?

5. Based on your answer to #4, is there a logical explanation as to why this happens?

6. If you cross a male with normal vision ($X^C Y$) with a female that has normal vision but carries the colorblindness trait ($X^C X^c$), what is the probability (percent chance) that a male offspring could be colorblind? **Show your punnett square**.

7. What is the probability that a female offspring in the above situation would be colorblind?