**Pre AP 11 Biology: Fruit Fly Genetics Lab**

Adapted from: <https://cb.collegeboard.org/ap-course-audit/courses/pdfs/cb-biology-lab-manual-1-24-12.pdf>

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|  | **Beginning** | **Developing** | **Accomplished** | **Exemplary** |
| **Analysis and**  **Calculations** | - Major calculation work is missing - Improper units - Difficult to follow/work not shown | - Some minor calculations missing - Some minor errors in units | - Calculations complete with proper units | - Ordered and easy to follow calculations, complete with proper units |
| **Discussion** | - Point form  - Answers are incorrect or incomplete | - Poor sentence structure(fragments)  - All answers demonstrate a minimal understanding of concepts | - Full sentences  - All answers demonstrate a complete understanding of concepts | - Clear communication through structured sentences that connect one idea to the next - All answers demonstrate a thorough, in depth understanding of concepts |

**Background Information**: Drosophila melanogaster is a fruit fly, a little insect about 3mm long, of the kind that accumulates around spoiled fruit. It is also one of the most valuable of organisms in biological research, particularly in genetics and developmental biology. Drosophila has been used as a model organism for research for almost a century, mainly because it is practical: it’s a small animal, with a short life cycle of just two weeks, and is cheap and easy to keep in large numbers. Mutant flies are those with defects in any of several thousand genes are available, and the entire genome has been sequenced.

**Terminology**:

*Wild Type –* flies that have the ‘normal’ characteristics, red eyes, normal length wing and brown bodies

*Mutant flies –* any variation from the wild type. Mutant alleles can be carried on autosomes or sex chromosomes.

**Reminder**: For genetic problems, your null hypothesis is that there will be no difference between the predicted phenotype ratio that is found with a Punnett square and the actual phenotypes seen in experimental data.

**Procedure**

Part A: Sexing Fruit Flies: <https://www.biologycorner.com/fruitflygenetics/sex.html>

1. Anesthetize and then click on the flies to see the gender. Look at their stripes. Describe the differences between male fruit flies and female fruit flies. Record the male and female numbers in a data table you create below:

Part B: Cross 1

Wild Type Female x Vestigial Winged Male: <https://www.biologycorner.com/fruitflygenetics/flash1.html>

1. a) Describe the difference in the dominant wild type and recessive vestigial wings.

b) Cross the parent generation and then cross the F1 generation. Record the results of your F2 Generation in a table you create below.

1. How are vestigial wings inherited (autosomal or sex linked)? Why do you think so?
2. Prove your prediction using a Chi Square Analysis. Use the numbers from Cross 1. Include a null and an alternate hypothesis, show all of your work in a table format, include a final statement whether you should reject or accept your null hypothesis.

Part C. Cross 2 🡪 White Eyed Female x Wild Type Male: <https://www.biologycorner.com/fruitflygenetics/flash2.html>

1. Notice the difference in eye colour. Mate the parent generation. Then mate the F1 generation. What are your expected results (include a Punnett square)? What are your experimental results? Record this in a table.
2. What is the genotype of the F1 generation? How do you think that eye colour is inherited (autosomal, sex linked or something else)?
3. Prove your prediction using a Chi Square Analysis. Use the numbers from Cross 2. Include a null and an alternate hypothesis, show all of your work in a table format, and include a final statement whether you should reject or accept your null hypothesis.

Part D. Cross 3

Wild Type Female x Vestigial Winged Aristapedia Male: <https://www.biologycorner.com/fruitflygenetics/flash3.html>

1. Note what the parent flies look like (difference in wings and antennae). Mate the 2 parent flies. Notice that the F1 generation all look alike, showing only the dominant trait. Then mate the F1 generation and record the observed F2 results in a table you create below.
2. What is the genotype of the F1 generation parents and how is aristapedia and vestigial wings inherited (autosomal or sex linked or….)?
3. Prove your prediction using a Chi Square Analysis. Use the numbers from Cross 3. Include a null and an alternate hypothesis, show all of your work in a table format, and include a final statement whether you should reject or accept your null hypothesis.

Part E: Complete the Lab Bench Activity: Genetics of Organisms.

<http://www.phschool.com/science/biology_place/labbench/lab7/intro.html>

The multiple choice questions on the online lab are included below. Please record your answers here as well. Don’t forget the three final discussion questions.

1. Is fly “A” male or female?
2. Is fly “B” male or female?
3. Is fly “C” male or female?
4. Is fly “D” male or female?
5. Is fly “E” male or female?

Case 1

1. Base on the data obtained, is this cross a monohybrid or a diyhrid?
2. Is the cross sex-linked or autosomal?

Case 2

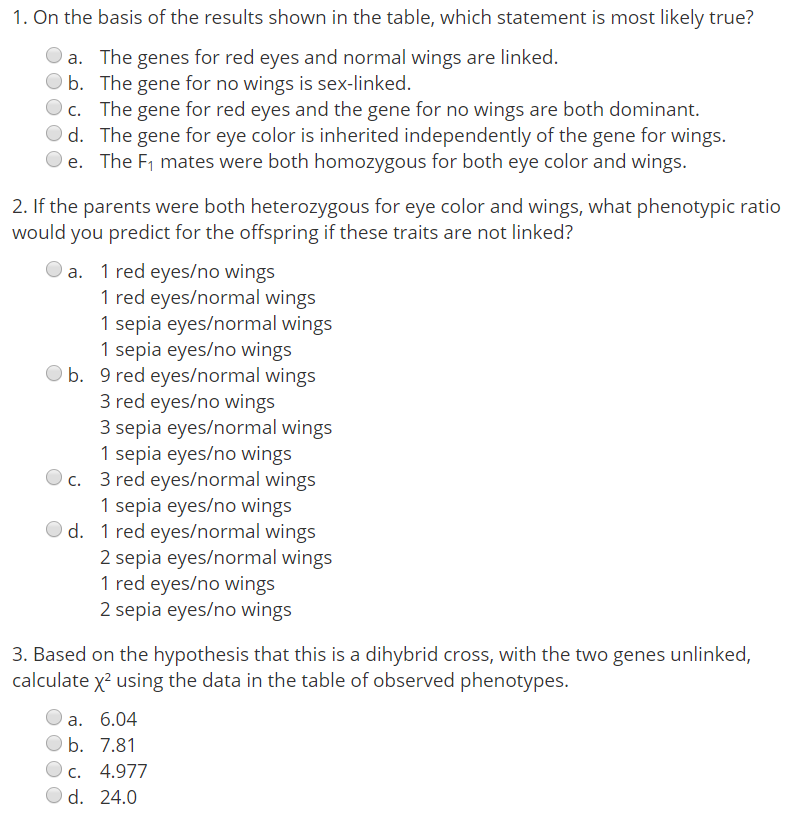
1. Based on the data obtained, which is the most likely mode of inheritance in Case 2? Autosomal or Sex-linked?
2. From the data presented, determine the genotype of the parental generation

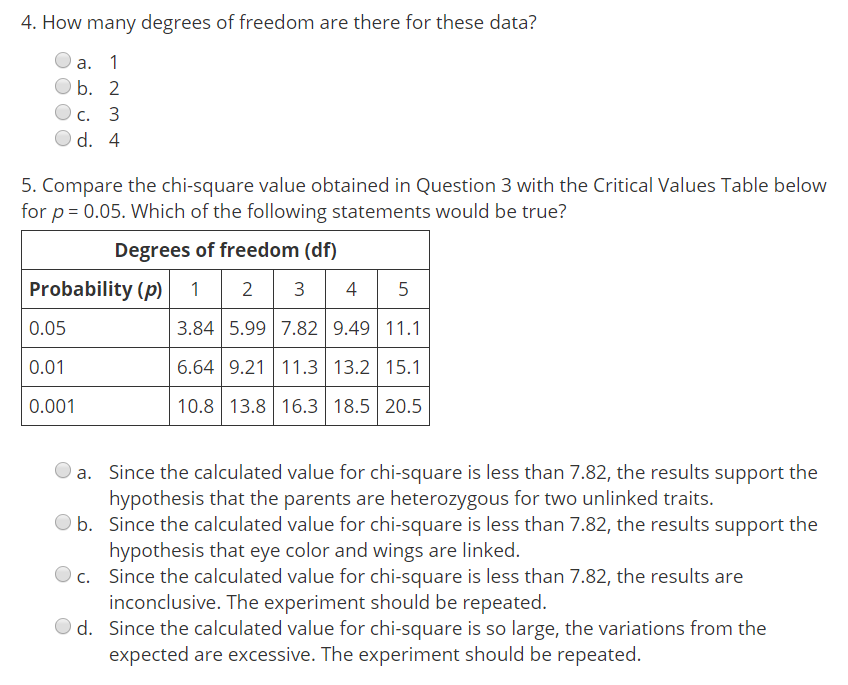
+ = wild type (red eyes)

W = white eyes

1. X+X+ × X+Y
2. X+Xw × X+Y
3. X+X+ × XwY
4. XwXw × XwY

Lab Quiz





**Discussion Questions:**

1. Why are fruit flies a good subject for genetic studies? Why did we not use them here then?
2. Why is Mendel’s law of Independent Assortment not always valid for two or more phenotypical traits?
3. Describe how crossing over results in genetic recombination and infers in the relative position of a set of linked alleles based on recombination frequency.