# Assignment Summary

For this assignment, you will examine an experiment related to the survival of monarch butterflies and predict the results of the experiment.

Background Information

Monarch butterflies, *Danaus plexippus*, consume milkweed as one of their primary food sources. Many of the milkweed plants that they consume are near agricultural areas, and pesticides have been found on the milkweed plants and in the monarch butterfly larva. Scientists are worried that these pesticides are having detrimental effects on the butterflies and could be aiding in the decrease in monarch butterfly populations. If populations continue to decline, the monarch butterflies may face extinction.

Materials

* Computer with internet access
* Writing utensils

# Assignment Instructions

For this project, you are expected to submit a completed version of this guide, including graphic organizers and answers to written analysis questions.

**Step 1: Prepare for the project.**

1. Read through the guide before you begin so you know the expectations for this project.
2. If anything is unclear to you, be sure to ask your teacher.

**Step 2: Familiarize yourself with the experiment.**

1. Read the experimental procedure.
2. Fill in the graphic organizer about the experiment.

**Step 3: Analyze the data.**

1. Review the two data tables carefully.
2. Complete the graphic organizer below.

**Step 4: Answer the analysis questions.**

1. Use your graphic organizers to answer the analysis questions in the **Written Analysis** section for this document.

**Step 5: Evaluate your project using this checklist.**

If you can check each box below, you are ready to submit your project.

* Did you complete a graphic organizer for the experimental procedures?
* Did you complete the data analysis graphic organizer?
* Did you complete the Written Analysis section?

**Step 6: Revise and submit your project.**

1. If you were unable to check off all of the requirements on the checklist, go back and make sure that your project is complete. Save your project before submitting it.
2. Submit this handout to your teacher.
3. Congratulations! You have completed your project.

# Project

* Read the experimental procedure.
* Complete the graphic organizer about the procedure.
* Read the results.
* Complete the data analysis graphic organizer about the results.
* Complete the written analysis questions about the experiment and results.

# Experimental Procedure

Monarch butterflies were raised for the experiment. Monarch larva were randomly assigned to different control and test groups. A control group was given milkweed without clothianidin, a pesticide, and experimental groups were given different concentrations of clothianidin. Clothianidin treatments were given to the monarchs on 1 cm leaf discs of milkweed. Monarch larvae were given leaf discs for 36 hours. If the disc was completely consumed, a new, treated leaf disc would be given to the larvae within the 36-hour window. Larval body length, mass, and head capsule width were measured prior to the experimental treatment and after the 36 hours. Measurements continued for the first three molts of the larvae.

Experimental Procedure Graphic Organizer

|  |  |
| --- | --- |
| Experimental question |  |
| Independent variable |  |
| Dependent variable |  |
| Control group |  |
| Prediction about the results of the experiment |  |

Experimental Data (after First Molt)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concentration of Clothianidin (ppb) | Head Capsule Width (mm) | Body Length (mm) | Weight (mg) | Duration (Days to 1st Molt) |
| 0 | 1.41 | 8.7 | 23.23 | 3.77 |
| 0.5 | 1.72 | 7.74 | 17.39 | 4.28 |
| 1 | 1.4 | 7.87 | 19.61 | 4.06 |
| 5 | 1.4 | 7.65 | 18.72 | 4.33 |
| 10 | 1.42 | 7.17 | 21.62 | 4.27 |
| 25 | 1.4 | 11.55 | 32.40 | 4.66 |

Experimental Data (after Second Molt)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concentration of Clothianidin (ppb) | Head Capsule Width (mm) | Body Length (mm) | Weight (mg) | Duration (Days to 2nd Molt) |
| 0 | 1.68 | 12.78 | 73.68 | 1.28 |
| 0.5 | 1.65 | 13.08 | 60.57 | 1.16 |
| 1 | 1.62 | 12.47 | 77.28 | 1.19 |
| 5 | 1.59 | 11.95 | 59.25 | 1.20 |
| 10 | 1.55 | 11.85 | 55.35 | 1.20 |
| 25 | 1.64 | 11.29 | 53.77 | 1.04 |

Data Analysis Graphic Organizer

|  |  |
| --- | --- |
| Trends and patterns |  |
| Prediction |  |

Written Analysis

Answer the questions below.

1. Based on the data, what do you notice about how the different concentrations of clothianidin have affected the monarch butterflies? What do you predict about the survivability of monarch butterflies that have been exposed to clothianidin?
2. A field test is done on the milkweed in the wild, and the clothianidin content per plant was about 1 ppb. Larvae spend days in the wild eating the milkweed. How is this different from the experimental conditions? How could you design an experiment to test these conditions?
3. Another study was conducted and found that milkweed with clothianidin in concentrations above 1 ppb resulted in less successful hatching of monarch butterfly eggs. Using this information and the information presented in the experiment for this project, predict what will happen to the monarch population if clothianidin continues to be used in the agricultural fields around the monarchs’ habitat.