

Lesson 6: Measuring Larval Growth and Development

Key Concepts:

- Recording and keeping organized data is an important part of scientific questioning and research.

Skills:

- Record keeping
- Data entry
- Organization
- Observation
- Critical thinking

Materials:

- *Monarch Daily Observations* sheets (student handout pages, 1 per student or student group; data for each larva are kept on a separate sheet)
- Rulers with mm marks clearly visible; clear plastic ones work best
- Balance accurate to the nearest mg is highly desirable; you may be able to borrow one from a high school or other source
- All of the materials required to rear larvae (see lesson 2, *Rearing Monarch Larvae*)
- *Monarch Class Data Sheet* (student handout page, you can keep a single copy for the entire class, and when it is complete, copy it for individual students or groups of students)

Objective

Expose students to data entry and logging information into organized data tables and creating questions based upon their findings.

Background

Two important scientific skills are making detailed measurements and keeping careful, organized records of these measurements. As your students rear their larvae, they will learn a great deal more if they practice these skills. We have developed data sheets and measurement techniques that will help them to do this.

This lesson should be done in conjunction with lesson 2, *Rearing Monarch Larvae*. If you would like your students to keep detailed word descriptions during this process, please see lesson 7, *Keeping a Monarch Journal*.

Procedure

1. Tell students they will keep detailed records of the growth and development of their larva. Hand out *Monarch Daily Observations* charts and monarch eggs or larvae. Do the first observations together. If you do not have an accurate balance for weighing larvae, just record their lengths.
2. Have students fill in their *Monarch Daily Observations* chart daily or every other day during the larval stage, and every 4-5 days during the pupa stage. At the end of each stage, fill in the summary section for that stage.
3. If desired, have students try to determine the sex of their monarchs during the pupa stage. See *Monarch Butterfly Rearing and Observing Techniques* in the How-To's section for directions on how to do this.
4. When butterflies emerge, summarize all data on the *Class Data Sheet*. Adult mass can be measured using a triple beam balance (nearest 0.1g) or an electronic balance (nearest 0.01 g or 0.001 g). In both cases the butterfly should be placed in an envelope while it is being weighed. Be sure to subtract the mass of the envelope. The length of the forewings can also be measured; measure to the nearest millimeter from where the wing attaches to the thorax to its tip, or apex. It is interesting to measure both the right and left forewings and to note the degree of asymmetry (how different the two wings are on each butterfly).
5. Make copies of the completed Class Data Sheet and give one to each student (or pair of students). Have each student choose one of

— 9 mm —

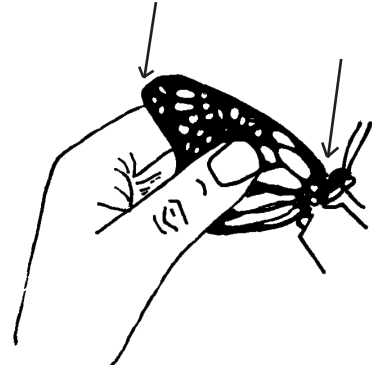


the questions listed below or think of another question that interests them. For some of the questions they will need to use their own and other students' individual data sheets.

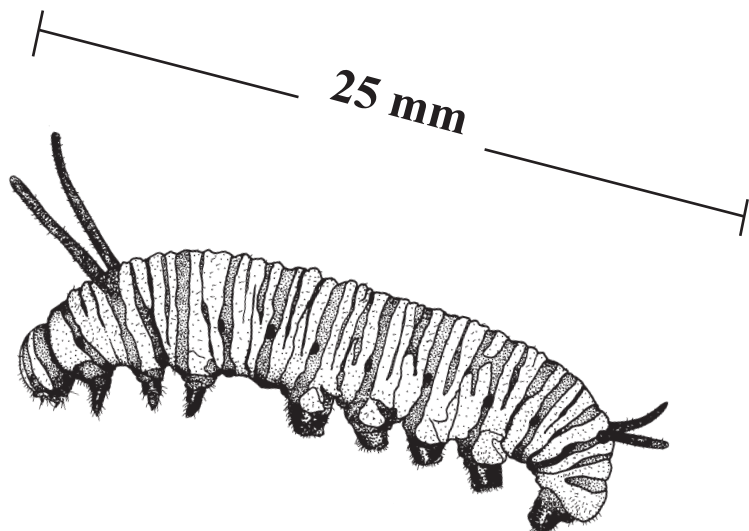
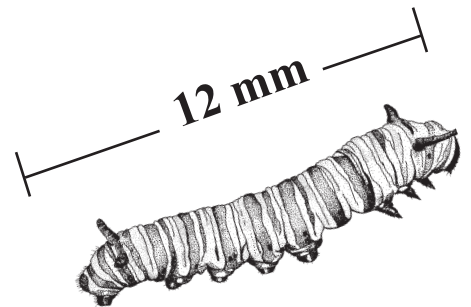
- *Do large caterpillars produce large butterflies?*
- *Which are larger, females or males?*
- *Do males or females emerge sooner from the chrysalis?*
- *Do larger caterpillars take longer to pupate?*
- *What is the average length of time spent as a larva (or pupa)?*
- *How much growth (either mass or length) occurs in a single day in the larval period?*

6. Have students write reports to answer the questions they choose. Each report should include the following components:

- *Data table*
- *Graph*
- *Conclusion that summarizes your findings*
- *Discussion of how the data do and/or do not answer your question*



Measuring the forewings from one arrow to the other



Daily Observations

(page 2)

Individual Monarch Summary

Larva (Caterpillar)

Maximum Length	Maximum Weight	Date larva formed "J"

Chrysalis

Length	Weight	Date of Chrysalis formation	Date Butterfly emerged	# of days in Chrysalis

Adult Butterfly

Number	Male or female?	Weight	Left Forewing length	Right Forewing length

