

DAY 2 Preparing for Research			
Reading Strategy: Research Question and Recording with a Visual Format		Science Concept: Constructing Larva Growth Chambers (All organisms need resources for life.)	
Reading TEKS: 2.13A	Figure 19: Reading/Comprehension Skills F	ELPS: Speaking K-12, 19 TAC 74.4(c)(3) D	Science TEKS: 2.2 (A,D), 2.10, 9.A
Materials for Reading Mini-lesson: Chart paper, markers, butterfly inquiry chart, nonfiction butterfly text to model strategy			
Materials for Inquiry Circle Groups: Butterfly inquiry charts, pencils, variety of nonfiction texts for each group (Go to website), daily anchor chart			
Materials for Science Whole Group Lesson: See section for detailed lists.			
Content Vocabulary: Larva/larvae – Wingless, often worm-like form of a newly hatched insect (larva is singular, larvae is plural). Caterpillar – Larva of a butterfly. Butterfly Group of insects that have four broad wings, narrow body and fly mainly in the daytime. Habitat – Place where an organism usually lives and grows.			
Science and Literacy Connection: An important first step in research is preparation, which may be determining your research question or preparing for your experiment.			

For an expanded version of the Standards listed above, see page 8.

Reading Mini-lesson — 15 minutes

OVERVIEW

Scientists always identify a question to research and record their data in an organized matter. While a true inquiry project would allow students to develop their own research questions, for this guided inquiry, we will provide questions that can be answered for each organism to be researched. Students will record their findings in an inquiry chart. The teacher will model mini lessons each day using butterflies and will complete a class inquiry chart during the modeling.

Each group will need an inquiry chart to be created (by the teacher) on a large piece of chart or butcher paper. Be sure the size is manageable for storage when groups are not working together and will be easy for students to record on (big enough for recording space, but not so large that it cannot be laid out in the classroom for the group to work). A model for an inquiry chart is provided in the Day 2 folder for you.



PROCEDURE

1. Say something like, “Today, we will record information about our organism on an Inquiry Chart.”

- Say something like, “Scientists record data in an organized fashion. Each day you will work with your research in inquiry circles to complete your Inquiry Chart.”
- While you model the strategy, say something like, “First, let’s look at the research questions along the top row of the Inquiry Chart. We need to be sure we know what the question is asking.” Refer to the unit vocabulary list if needed.
- Say something like, “Now let's look at the first column of the chart. I see that the first section asks me to record what I already know about my topic (butterflies). I will write the information I already know in the correct section.”

Butterflies	What is the life cycle of a butterfly?	What are the physical traits of the adult?	What are the physical traits of the offspring?	How do the physical traits of the offspring compare to the adult?	How do the physical traits help them survive?	Other Interesting facts
What We Know						
Resource 1 Record the title, author, website, here.						
Resource 2 Record the title, author, website, here.						
Resource 3 Record the title, author, website, here.						
Resource 4 Record the title, author, website, here.						

- Say something like, “I see that I will need to record my resources as I gather information. That means I will write the title and author of books I use and the address of the websites.” Remind students of this when they start researching on Day 3.

Note: For this first day of using the Inquiry Chart while in inquiry circles, students will work together to only complete the “what we know” section. After this day, students will use the inquiry chart to record their research data while in inquiry circles.

Inquiry Circle Groups — 30 minutes

OVERVIEW

Scientists work in teams when conducting research and experiments. Each day of this unit, students will work in inquiry circle groups while embodying the role of a scientist. They will do so by taking on roles of scientists in research by speaking like a scientist, reading like a scientist, and writing like a scientist.

PROCEDURE

Before Inquiry Circle Groups — 2–5 minutes

1. Say something like, “It is time to get into our inquiry circle groups. You will be with the same research team as yesterday.”
2. Say something like, “When we research organisms, we will practice our roles as scientists. We will do this because scientists use different ways to observe the world, read scientific texts, and write about what they have studied. There is no better way to learn about science than to become a scientist!”

During Inquiry Circle Groups — 30 minutes

1. Say something like, “We have anchor charts to help guide your thinking. Do not forget to use them while in groups.” Refer to the “Language of a Scientist” anchor chart and the daily anchor chart discussed today. Remind students that they can use all the reading strategies taught, not just the one for that day.
2. Say something like, “My role is to help guide the inquiry circle groups, but I expect you to work as a scientific team to accomplish your work together.”
3. Say something like, “Do not forget to answer your research questions and record your ideas on the inquiry chart. It is important to record your sources on the inquiry chart as you complete it.”
4. While groups are working together, walk around the room to facilitate as needed.

After Inquiry Circle Groups — 5 minutes

1. Say something like, “As we are concluding our inquiry circle groups for today, each group will have a chance to share what they accomplished and learned.”
2. Say something like, “The Lab Director should lead the discussion with their inquiry circle group about today’s results. For example, what did you learn about your organism? Which reading strategies did you use? What problems did you encounter? How did you resolve those problems?”
3. Say something like, “The Data Scientist will now share with the entire class either something the group learned about their organism, which reading strategy(ies) were used, or how the group solved a problem. “

Science Whole Group Lesson — 30 minutes

OVERVIEW

This activity provides the materials and instructions for constructing growth habitat chambers for the butterfly larvae.

GUIDING QUESTIONS

How do scientists study organisms? What resources need to be provided for live animals to be safe and well cared for while they are being studied?

BACKGROUND INFORMATION

When we think of scientists, our minds are often drawn to clean white laboratories filled with all kinds of glassware and machines. We usually don't think of the other places in which scientists work. The other laboratory is nature itself. Scientists observe nature's many phenomena and collect data and form questions for further research. Outdoor observation and data collecting go hand-in-hand with research in the classic laboratory. Our study of painted lady butterflies demonstrates just how this partnership works.

When painted lady butterflies lay their eggs, they do so on the underside of leaves of plants that are good for larvae to eat after hatching. By careful observation, scientists can find where the eggs are laid and wait for a couple of days for hatching. However, after a few days, when they come back to see the larvae, they are gone. Were they eaten by predators? Did they just move to someplace else where the food is better? The scientist can't tell. Eventually, the scientist will find larvae again but where did they come from? Different parents? How old are they? The scientist can't tell.

Here is where it's important to have an indoor laboratory or enclosed space. To study the life cycle of the butterfly, the scientist collects some eggs and places them inside some sort of chamber that simulates the natural environment and provides food and moisture. In this way, the scientist can study the complete life cycle of the butterfly and compare those observations with those made in the natural world.

In this preparation activity, up to six larvae growth chambers will be needed for student teams when the butterfly larvae are delivered by the suppliers (see "Animal Care of Larvae and Butterflies" for ordering information and complete instructions). The larvae will come in small cylindrical containers along with larva food, and they may remain there if you choose. However, the benefits of larvae growth habitats are that they permit the larvae to move about a larger area than the shipped containers, and they provide and facilitate easier observation and data collection by student teams.

The larvae growth habitat described here consists of a clear plastic, clamshell style, take-home salad box, two clean and empty plastic coffee creamer cups, a sponge square, and a plastic micropipette.

Prepare the habitat stand before making the habitat. Clean coffee creamer cups have to be glued to the inside of the habitat. Placing the closed habitat in the stand facilitates the gluing process. Students can perform most steps in building the growth habitats. However, one step involves melting a small hole in the side "wall" of the habitat. For safety, this step should be done by the teacher.

SAFETY

Download and read "Animal Care of Larvae and Butterflies" (Animal Care.pdf) for specific information about ordering larva, etc., prior to conducting this activity. Remind student teams daily to be gentle with the growth habitats during handling to prevent disturbing the larvae.

Please follow all district and school science laboratory safety procedures. It is good laboratory practice to have students wash hands before and after any laboratory activity. Clean work areas with disinfectant.

MATERIALS

The materials below are for making one habitat stand and one habitat. It is recommended to make at least one habitat stand/habitat per student group. Please read “Setup” for specific instructions.

Per Group of Students: Habitat Stand

- 12-ounce Styrofoam™ coffee cup
- Download and print the “Make a Habitat Stand” page (02-Habitat Stand.pdf). Check the application print settings to ensure the file will print at the actual size of 100% on 8.5-in. x 11-in. standard copy machine paper *Do not fit, shrink or scale the page*. The illustration is accurately scaled to use with a 12-ounce Styrofoam™ cup.
- Print one pattern page for each student team on standard copy machine paper, ensuring the application print option for scaling is set to print at the actual size of 100%. Make one extra copy for you to use as a model for demonstrating to the students how to prepare the cup.
- Scissors
- Tape

Teacher: Habitat (see “Setup”)

- Butane lighter
- Ice pick, or pliers with a small iron nail or a knitting needle

Per Team of Students: Habitat

- 2 plastic coffee creamer portion cups or other small portion cups (empty and washed)
- Clear plastic take-home salad box (clamshell style, cleaned)
- Plastic micropipette
- Sponge square, about 4 cm x 4 cm in size
- White school glue

SETUP

Before class time, you will need to prepare the hole in each plastic habitat for the pipette containing water to be inserted. (See diagram below for correct placement of the hole.) Using a butane lighter, heat the tip of the ice pick. If using the nail or knitting needle, use the pliers to grasp and hold the end opposite the tip of the needle or nail. After a few moments, push the ice pick tip through the plastic where indicated in the diagram. The hole should be just large enough for the micropipette to fit through to add water.

DAILY OBSERVATIONS

Give students time to observe their organisms (whether they are in the larvae, pupa, or adult stage), take measurements of the larvae (if applicable), and record their observations in their science notebooks. Facilitate group discussions by asking questions like, “What did you notice?” “What has changed since the last time you observed your organisms?”

PROCEDURE

Engage

1. Ask the students where they think butterflies come from. Accept all responses and discuss their ideas.
2. Remind them that they are now going to become scientists working in teams. Tell them that their special investigation will focus on the life cycle of butterflies. In other words, they will observe to see how the butterflies grow and change over time. Discuss why it might be difficult for scientists to

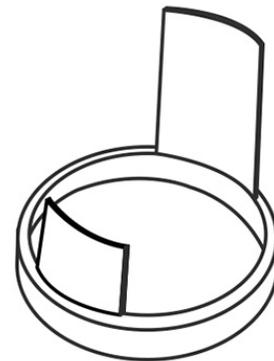
study butterflies over time in nature (outside).

3. Ask students to share their ideas about how it might be easier to study butterflies. If no one else brings it up, talk about setting up an indoor habitat where the class could study the life cycle of butterflies.
4. Tell the students that the class will soon be receiving butterfly larvae (very young forms of butterflies) to observe and study for their investigation, and that they will help build the habitats for them. Ask them to think about what the larvae, which are animals, might need in the habitat.
5. Remind them that all living things have basic needs. Ask the class to think about we (humans) need to stay alive (source of energy -food? air? water? a place to live?) Do animals have the same needs? Ask for their ideas about what that might look like in the butterfly habitat (how will we make sure they have what they need?)
6. Explain that there are several steps for making the habitats and members of each team will have a job. Depending on the age group, the teacher may assign or allow students to pick their first job designated on badges (rotating jobs as the unit progresses).

Explore

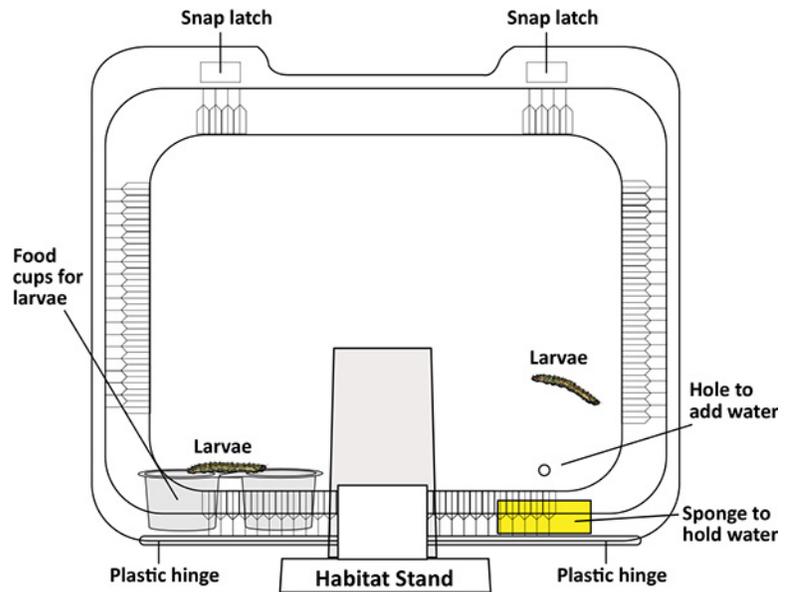
Make a Habitat Stand

7. Tell the students that the first step will be to make a stand for the habitat to stand on.
8. Show the students the “Make a Habitat Stand” page. Explain that they will cut out the part of the pattern that has square boxes in it surrounded by the bold (or highlighted) line.
9. Teacher will cut out the large pattern from the copy and model how to place it around and just below the rim of the outside of the Styrofoam™ cup. Tape it in place.
10. Explain that they will cut out the cup under the square boxes. Caution them NOT to cut out the cup under the white flaps.
11. Model how to do the cutting. Using the pattern as a guide, trim away most of the coffee cup beneath the pattern, leaving just the thick cup rim, and two rectangular-shaped “teeth” attached to the rim.
12. Turn the modified cup upside down to use as the stand (see illustration, above). Show them that it is now a completed habitat stand.
13. Explain that the gap between the “teeth” will support the plastic habitat and the cup rim will provide a stable base.



Make a Habitat

14. After all stands are complete, tell the class that they will now build the habitats for the larvae. Explain that each team will build one habitat (If you have a very small class, teams may need to build more than one each).
15. Give each team the illustrated handout of the habitat. Show them the salad container and discuss correct orientation and placement of the cups and sponge.
16. Have each team place their habitat in their stand to see what it should look like.



17. Explain that the creamer cups will hold the food for the larvae. Have students put a large drop of glue on the bottom of each creamer cup and set the cups inside the clear box where indicated on the illustration. Use the stand to hold the closed box upright while the glue dries.
18. Next, ask them what they think the sponge is for. Have them consider the placement of the sponge right under the hole in the box. After discussing their ideas, tell them that they will occasionally use the micropipette to add a few drops of water to the sponge, to maintain a slightly humid environment inside the box. Discuss why that is important for the developing larvae.
19. After the glue on the cups has dried enough, direct the students to place a sponge square inside the habitat box right under the hole that was heat-bored.
20. The boxes and stands are complete and ready for the larva!

Explain

21. Ask students to compare the chambers to the natural world where painted lady butterflies live. Discuss and list the things the butterflies need for survival.

Elaborate

22. Tell the class that when the larvae arrive they will learn how to take care of them in the habitats they have constructed. How will the habitats provide basic needs of the larvae and butterflies?

Evaluate (examples)

23. If students are using journals or science notebooks, were they able to communicate what they did or learned today? If they used drawings, were they a reasonable representation?
24. Did students communicate verbally what they had learned? Did students use new science vocabulary in their responses? Did students work as a team to construct the habitats?

Expanded Standards

Reading TEKS: 2.13A Inquiry and research: listening, speaking, reading, writing, and thinking using multiple texts. The student engages in both short-term and sustained recursive inquiry processes for a variety of purposes. The student is expected to: (A) generate questions for formal and informal inquiry with adult assistance.

Figure 19: Reading/Comprehension Skills. Students use a flexible range of metacognitive reading skills in both assigned and independent reading to understand an author’s message. Students will continue to apply earlier standards with greater depth in increasingly more complex texts as they become self-directed, critical readers. (F) make connections to own experiences, to ideas in other texts, and to the larger community and discuss textual evidence.

ELPS: Student Expectations for Speaking K-12, 19 TAC 74.4(c)(3) The student is expected to: (D) speak using grade level content vocabulary in context to internalize new English words and build academic language proficiency (E)share information in cooperative learning interactions.

Science TEKS:

2.2 Scientific investigation and reasoning. The student develops abilities necessary to do scientific inquiry in classroom and outdoor investigations. The student is expected to:

- (A) ask questions about organisms, objects, and events during observations and investigations;
- (D) record and organize data using pictures, numbers, and words.

2.9 Organisms and environments. The student knows that living organisms have basic needs that must be met for them to survive within their environment. The student is expected to:

- (A) identify the basic needs of plants and animals;

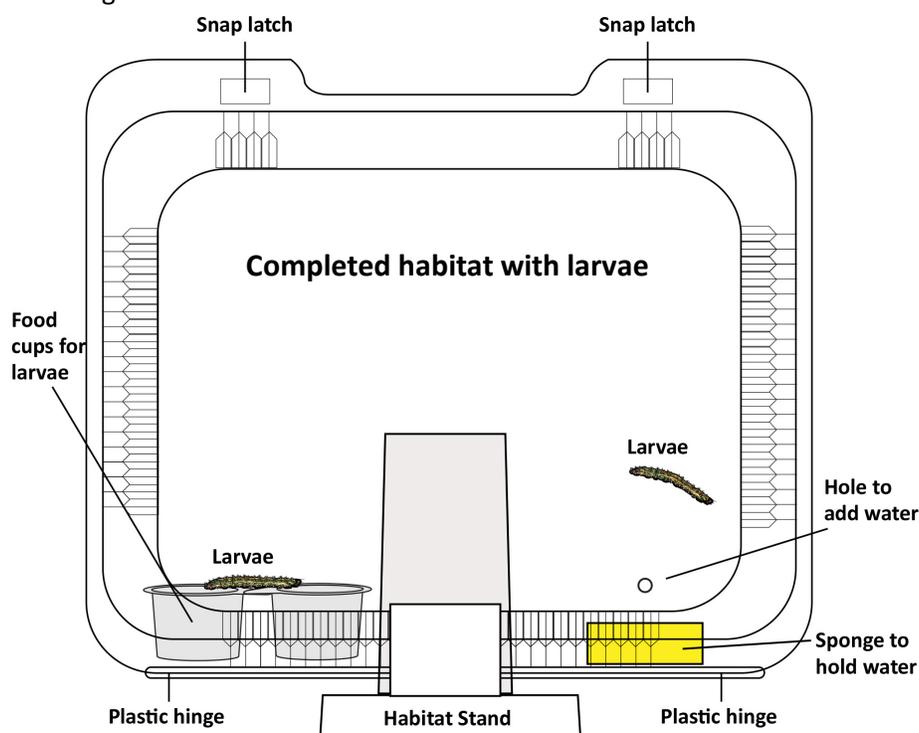
2.10 The student knows that organisms resemble their parents and have structures and processes that help them survive in their environments.

ANIMAL CARE OF LARVA AND BUTTERFLIES

PROCEDURE

- Follow the instructions on the provided prepaid coupon from Carolina Biological Supply Company to order the butterfly larvae and food. **It is best if the delivery date is mid-week** to make sure you and your students are able to get the larva and their food moved into the chamber upon arrival.
- Create the larva growth habitat and habitat stand **prior** to the arrival of the larva (**see Activity 2 for complete instructions**). Prepare the stand first. The habitat will need to have two washed, disposable coffee creamer cups, and a 4-cm x 4-cm sized sponge placed inside. Cups will be glued as shown but the sponge will not need to be glued to the habitat.

Avoid using plastic glue because fumes could damage the larva. Use the stand to hold the closed box upright while the glue dries.



Teacher only: To make a clean hole in the habitat wall, use a butane lighter to heat the tip of an ice pick. If you use a candle or match, soot will accumulate and blacken the hole rim on the habitat. If an ice pick is not available, use a small iron nail or a knitting needle. (**see Activity 2 for complete instructions**)

When the larvae arrive, use the soft paintbrush to gently move the larva to the chamber. Transfer lumps of food from the shipping container to the cups with the craft stick. Touch only one end of the craft stick; use the other end for food transfer.

SAFETY

- Neither the food nor the larvae are harmful but careless handling of the larva can injure them. Direct contact of skin with the food can lead to mold growth on the food.

DAILY CARE: LARVA

- Use the craft sticks to move food from the shipped food container(s) to the small food cups. Fill the small food cups about half full. Refrigerating the food container, ~~which~~ will keep it the food fresh longer. Check the food cups in the habitat periodically and add more food if necessary. If refrigerated, let the food return to room temperature before feeding.
- Every day or two, have the students insert a water-filled pipette into the hole and drip some water on to the sponge to increase the humidity of the chamber.
- When larva climb to the top of their chambers and remain there, chrysalis formation will take place shortly thereafter.
- After the larvae are safely inside their chrysalises, remove them and relocate them to the mesh Butterfly Sanctuary from Carolina Biological Supply Company. **Be sure to orient the chrysalises in the same way they are oriented in the larva growth chambers.**
- A tape loop can be used to hold the chrysalises to the “ceiling” of the butterfly sanctuary. The chrysalises must hang downward for metamorphosis to properly occur.
- **Tip:** If possible, cut the plastic box around the place where the chrysalises are attached and tape the plastic with the chrysalises to the ceiling of the mesh butterfly sanctuary.



DAILY CARE: ADULT BUTTERFLIES

- When the butterflies emerge, a reddish liquid will be released. This a waste product and not blood. The butterflies are fine but the liquid, called meconium, is messy. To control the mess, place some paper on the bottom of the sanctuary and remove it when all butterflies have finished emerging.
- Put a small disposable Styrofoam™ or paper plate holding a slice of orange citrus fruit on the butterfly sanctuary floor. The butterflies will feed on the orange juice. Change out the orange slice every two days.
- Branches or plants such as mallow or milkweed (butterfly-garden plants from garden shops) can be placed inside the sanctuary. Besides looking nice, they will provide the emerging adult butterflies a place to land and possibly to lay eggs for the next generation.
- The butterflies will need some time to pump out their wrinkled wings before flying.
- If the air in your classroom is dry, use a spray bottle to spray water on the mesh sanctuary to increase the humidity inside of it.

- If any butterflies escape from the sanctuary, they can easily be captured and returned. Wait until they land and gently surround them with the fingers of your hand. If the butterflies flutter around the ceiling lights, turn the lights off and wait for the butterflies to descend to where they can be reached.
- Save the empty chrysalises for examination by the students with their magnifiers. If available, place several chrysalises inside plastic Petri dishes to protect them during examination.
- The adult butterflies will last for about 10 days to two weeks. Dead butterflies can be saved and mounted for examination of their wings. Detailed instructions for mounting butterflies can be found on the Texas Agricultural Extension Service website.

<http://www.butterflywebsite.com/articles/tamu/mountbutter.html>

Image Resource

Illustration by G.L. Vogt © Baylor College of Medicine.

Photo of Butterfly Sanctuary © Carolina Biological Supply Company. Used with permission.

https://www.carolina.com/butterfly-kits/painted-lady-life-cycle-biokit/143990.pr?intid=jl_pdp&jl_ctx=on_site#