ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine
CENTER FOR EDUCATIONAL OUTREACH

DAY 12: WHAT HAPPENS INSIDE A CHRYSALIS?

MINI-LESSON

Teacher reviews the steps taken to develop a synthesis statement about butterflies.

SCIENCE INQUIRY CIRCLES

Teams work to develop a synthesis statement about the animal they have been researching.

GUIDED SCIENCE INVESTIGATIONS

Learners observe the formation of a chrysalis and the transformation of a caterpillar into a butterfly.

ABBREVIATED STANDARDS

- **Reading TEKS: 2(b)(6)(H)**
- **CCSS: W.2.2**
- **NGSS: 2-LS4-1**
- **Science TEKS: 2.1(A), 2.3(B)(C)**

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Day 12: What Happens Inside a Chrysalis?

Literacy Strategy: Teams will synthesize information about the animal they have investigated.

Science Concept: Caterpillars undergo a transformation, or metamorphosis, inside of a chrysalis.

Science and Literacy Connection: As strategic readers, we synthesize information from many sources in order to create our own, new information. During an investigation, we must analyze information from multiple sources to produce evidence that supports our claims and explains our work.

Mini-Lesson (15 minutes)

OVERVIEW

Today learners will work in their teams to develop a synthesis statement on the research they have done on their chosen animal. Use today's mini-lesson to review the steps taken to develop the synthesis statement about butterflies.

MATERIALS

Teacher needs:

- chart paper
- marker(s)
- class Inquiry Chart
- "Synthesizing" anchor chart

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may choose to use for the lesson; additional teacher actions and considerations are in parentheses.

Tell what the strategy is (declarative knowledge)

1. *Today we will use the strategy of synthesizing information to create a synthesis statement about the organism you have researched. Remember that synthesizing is combining information from all of the sources we've used to create our own, new information.* (Refer to the "Synthesizing" anchor chart and the synthesis statement written yesterday about butterflies.)

Tell when and why to use the strategy (conditional knowledge)

1. *As a strategic reader, I synthesize when I combine information from different books, online resources, experts, and videos. Synthesizing helps me to organize and see things in a new way.*

Tell how to employ the strategy (procedural knowledge)

1. *Yesterday we organized information from our class Inquiry Chart to make a synthesis statement about butterflies.* (Point to the class Inquiry Chart and the synthesis statement). *Today you will use the strategy to make a synthesis statement about your animal.*
2. (Review the strategy and point out the steps on the anchor chart.) *When writing a synthesis statement, the first thing we do is look at each of the questions on the team Inquiry Chart and think about what was important from each source.*
3. *Then we compare and contrast the important information from each of the sources. Ask yourself, how are they the same or how are they different?*
4. *Using this information, think about what can be added from your own schema that the authors did not mention.*
5. *Finally, combine all the information together to write a synthesis statement.* (Reread the butterfly synthesis statement from yesterday to the class.)
6. *As you write your own synthesis statement, remember the concepts this unit has focused on:*
    - *Organisms have physical characteristics that help them survive. (What are the physical characteristics of your organism that helps it survive?)*
    - *Organisms go through life cycle stages.*
    - *Some organisms go through unique life cycle stages (What stages or changes does your organism go through as it grows?)*
7. *The synthesis statement you write about your organism in your inquiry circles should incorporate these concepts.*
8. *When you have finished your synthesis statement, copy it onto a large sheet of chart paper. We will display them tomorrow.*

Science Inquiry Circles (30 minutes)

OVERVIEW

Today learners will work within their own inquiry circles to write a synthesis statement about their organism.

MATERIALS

Each team needs:

- team Inquiry Chart
- pencils
- chart paper
- access to informational texts/media

Teacher needs:

- "Animal Resources" spreadsheet for ideas

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may choose to use for the lesson; additional teacher actions and considerations are in parentheses.

Before Inquiry Circles

1. *It is time to get into our inquiry circles.* (Have the Equipment Directors gather their team's Inquiry chart.)
2. *Today you will work with your team to develop a synthesis statement about your organism.*
3. *Your synthesis statement should include information about the concepts we have focused on:*
    - *Organisms have physical characteristics that help them survive. (What are the physical characteristics of your organism that helps it survive?)*
    - *Organisms go through life cycle stages.*
    - *Some organisms go through unique life cycle stages. (What stages or changes does your organism go through as it grows?)*
4. *Remember to work as a team, help each other, and use the strategies we have learned as you do your research.*

During Inquiry Circles (20 minutes)

1. *While working in your teams, you may refer to all the anchor charts posted to help guide your thinking, as well as the questions I have written on the whiteboard.* (Point to the posted anchor charts and questions. Remind learners that they can use all the reading strategies taught, not just the one for that day.)
2. *The Lead Scientists will begin the discussion, and the Data Scientists will record your ideas and synthesis statement on chart paper. The Lab Directors and Equipment Directors must help find useful information on the inquiry chart*
3. *I expect you to work together as a scientific team to develop your statement. If you cannot come up with a statement or have any questions, I will be happy to help you.* (While teams are working together, walk around the room to facilitate as needed.)
4. *When you are finished, the Data Scientists will copy your synthesis statement on a large sheet of chart paper.*

After Inquiry Circles (10 minutes)

1. *As we conclude our inquiry circles for today, each team will have a chance to share what they accomplished and learned.*
2. *The Lab Directors should lead the discussion with their inquiry circles about today's results. For example, Did your team answer all the questions on the white board? Is the team's synthesis statement ready? If not, why not?* (Give learners a few moments to discuss.)
3. *The Data Scientists will now share their team's synthesis statement with the entire class.* (Have the Data Scientists hold up the chart paper with the team's statement as it is read.)
4. (After all teams have shared, thank them for their hard work, and point out any excellent behaviors that you observed. If you noticed any problems in the teams, take a moment to point them out and explain your expectations for all future inquiry circles. Collect all Inquiry Charts and synthesis statements or have the Equipment Directors put them in their normal classroom place for ongoing work so learners can easily access them.)

Guided Science Investigation (30–45 minutes)

OVERVIEW

Through time-lapsed videos, children observe the transformation of a caterpillar into a butterfly.

GUIDING QUESTIONS

What is a chrysalis? What happens to the caterpillar inside? How does it become a butterfly?

BACKGROUND INFORMATION FOR THE TEACHER

By today, children may or may not have observed the formation of chrysalises in their habitats. It may be that this transformation and the eventual emergence of a butterfly occur after this unit of study is over. We encourage you to continue the observations so that the children can witness this wonderous event.

In this lesson children will watch two short, time-lapsed videos that will allow them to observe the formation of a chrysalis and the transformation of a caterpillar into a butterfly. If children have already seen this in their habitats, it will enhance their understanding. If the chrysalis has not yet formed, it will give them cues about what to look for in the coming days.

The videos included in this lesson are very short and will allow children to view them, respond to them during "turn and talks," and return to them as they explain their observations.

MATERIALS

Each team member needs:

- 1 copy of the "See, Think, Wonder" page
- pencil
- Butterfly Investigation Journal

Each team needs:

- access to the videos

Teacher needs:

- "See, Think, Wonder" page
- "Inside a Chrysalis" image
- video links (see lesson)
- ability to project videos

SETUP

- Make copies of the "See, Think, Wonder" page (1 per team member).
- Preview the suggested videos ahead of time to decide when you will pause them to allow for "turn and talk" with partners (see lesson).
- Prepare to project videos and the chrysalis image for the class. Videos may contain adds, so you may want to cue them ahead of time.
- You may also want to mute the videos to avoid distractions and allow children to focus on the images.
- Have team members sit together for "turn and talk" during the viewings.

SAFETY

- Remind teams daily to be gentle with the growth habitats during handling to prevent disturbing the larvae, especially once the chrysalis forms. **Ideally, the growth habitats should be placed where teams can do daily observations without moving them.**
- Please follow all district and school science laboratory safety procedures.
- It is good laboratory practice to have teams wash hands before and after any laboratory activity.

DAILY OBSERVATIONS

Give learners time to observe their organisms (whether they are in the larva, pupa, or adult stage), take measurements of the larvae (if applicable), and record their observations in their Butterfly Investigation Journals. Facilitate team discussions by asking questions, such as, *What did you notice? What has changed since the last time you observed your organisms?*

PROCEDURE

Engage

1. Regardless of whether a chrysalis has formed in the habitats, announce, *It's time to explore a very special stage in the life cycle of **Vanessa cardui**. Who is Vanessa cardui? That's the scientific name for the painted lady butterfly!*
2. *You may (or may not) have seen the formation of chrysalises in your habitats. Today we are going to learn more about what how a chrysalis forms.*
3. Ask the Equipment Directors to distribute the "See, Think, Wonder" pages (1 per team member).
4. Explain to learners that they will use the "See, Think, Wonder" page to write about what they are seeing in the videos, what they think is happening, and what they wonder—what questions do they have.
5. Add that you will be using videos and will pause several times to give them a longer look at what is happening. Then, within their teams, learners will turn and talk with a partner to consider what to write on their own "See, Think, Wonder" page.

Explore

1. Begin with this short video of a chrysalis forming. Pause it several times as changes occur to allow learners to get a good look at what's happening. With each pause, ask team members to turn and talk with a partner about what is happening and then write about it. Allow several minutes at each pause to do this. (An all-class discussion will follow after both viewings are complete.)
   https://www.youtube.com/watch?v=hYMGFsHca8A
2. Repeat this process with the second video showing a closer look at the emergence of the butterfly. We suggest you pause at
   - 1:29 when the butterfly begins to emerge at
   - 1:57 when the antennae and proboscis are seen
   - 2:03 when body emerges

   https://www.youtube.com/watch?v=5f9a-MCbzw4

Explain

1. Return to the first video, pausing again at intervals and randomly asking team members to share what they have written.

2. When sharing is complete, add your explanation about what the video depicts. Depending on where you paused the video, the following can be discussed:
    - At the beginning, the caterpillar is hanging upside down. It has attached itself to a twig or branch with a single silken string that comes out of its spinneret (If this has occurred in the habitats, where?)
    - (0:04–0:05 secs) The caterpillar appears to be shaking, and a change is occurring. Inside the body, underneath the skin, the chrysalis begins to form. The caterpillar no longer needs its skin, head, or legs, so it twists and shakes until the skin splits and falls off.
    - (0:05–0:07 secs) The caterpillar is no longer seen, and a clear, skinlike covering appears at the bottom. White or yellow spots on the right side are visible.
    - (0:08–0:10 secs) A clear shell-like covering has almost covered the caterpillar, which now seems shorter. This is the formation of the chrysalis, made of a strong, hard substance that will protect the pupa from predators. (In the habitats there are no predators.)
    - (0:14 secs) The dark-colored chrysalis has formed!
    - (0:15 secs) What appears to be a butterfly wing inside the chrysalis is visible.
    - (0:16 secs) The chrysalis begins to shake as the butterfly emerges. The butterfly is wet and crumpled. It pumps fluid into its wings and must dry its wings before it can fly.
3. The second video shows a better view of the emergent the butterfly. Use the following pauses again for discussion.
    - 1:29 (butterfly begins to emerge)
    - 1:57 (antennae and proboscis are visible)
    - 2:03 (butterfly emerges)

Elaborate

1. Inform the children that the videos have shown us how a chrysalis forms. But what exactly happens inside the chrysalis that changes a caterpillar into a butterfly?
2. Explain that it's a special process called *metamorphosis,* a time when the caterpillar is transformed as the parts of a butterfly begin to form.
3. How this happens is a very complicated process. The caterpillar's body dissolves into a soupy substance and then is rearranged into the shape of a butterfly.
4. Scientist have taken 3D pictures of a living chrysalis using a special imaging machine to show what the inside of a chrysalis looks like as the butterfly forms.
5. Project the "Inside a Chrysalis" image.

Evaluate

1. Did learners make and record good observations?
2. Did learners communicate a reasonable understanding of the process of a caterpillar changing into a butterfly?
3. Did learners use science language (written or oral) in their communications?

Science Language

- A **caterpillar** is the larval stage in the life cycle of a butterfly.
- A **chrysalis** is the hard outer covering that protects a pupa.
- When a caterpillar is transformed into a **butterfly,** it has reached the adult stage in its life cycle.

- When animals or insects go through a dramatic change in a life cycle, it is called **metamorphosis**.
- A **spinneret** is the tubelike structure on a caterpillar's mouth that produces liquid silk.

Expanded Standards

Reading TEKS

2(b)(6) Comprehension skills: listening, speaking, reading, writing, and thinking using multiple texts. The student uses metacognitive skills to both develop and deepen comprehension of increasingly complex texts. The student is expected to: **(H)** synthesize information to create new understanding.

CCSS

W.2.2 Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.

NGSS

2-LS4-1 Science & Engineering: Planning & Carrying Out Investigations -Make observations (firsthand or from media) to collect data that can be used to make comparisons.

Science TEKS

2.1 Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to: **(A)** ask questions and define problems based on observations or information from text, phenomena, models, or investigations; **2.3** Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to: **(B)** communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and **(C)** listen actively to others' explanations to identify important evidence and engage respectfully in scientific discussion.