<table>
<tr><th colspan="4">Day 04
How Do Mold and Cast Fossils Form?</th></tr>
<tr><td colspan="2">Literacy Strategy: evaluating claims, determining authenticity of content.</td><td colspan="2">Science Concept: Fossilization of organisms occurs in many different ways. Molds and casts are two ways that fossils are formed.</td></tr>
<tr><td>Reading TEKS:
3.9(E)(i & ii)</td><td>CCSS:
RI.3.6, W.3.7, W.3.8</td><td>NGSS: 3-LS3-1</td><td>Science TEKS:
3(b)(1)(A), 3(b)(4)</td></tr>
<tr><td colspan="4">Materials for Mini-lesson on Science-Based Disciplinary Literacies (referred to as Mini-lesson): chart paper, markers, sample inquiry chart, Evaluating Evidence-Based Claims anchor chart.</td></tr>
<tr><td colspan="4">Materials for Science Inquiry Circles: team inquiry charts, pencils, variety of nonfiction texts for each group, access to websites and online books.</td></tr>
<tr><td colspan="4">Materials for Guided Science Investigation: see instructions beginning on page 4.</td></tr>
<tr><td colspan="4">Content Vocabulary:
Observation—the action or process of looking at something or someone carefully to gather information.
Organisms—living things that are able to carry on the functions (actions) needed to live, grow, and survive.
Fossil—the preserved remains or traces of organisms found in the layers of the Earth.
Mold fossil—a mineralized impression of the remains of an organism left in sediment.
Cast fossil—a re-creation of the shape of an organism’s remains formed by mineralized sediment that fills a mold.</td></tr>
<tr><td colspan="4">Science and Literacy Connection: scientists conduct authentic investigations to find information and evidence that supports their claims.</td></tr>
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Mini-lesson—15 minutes

OVERVIEW

Did you know that anyone can publish a website? If you can write and you have access to the internet, you can create a webpage. So, how do scientists know that the information they are reading on a website is authentic? That is, how do they know the information is true and reliable? They use a reading strategy called “evaluating claims.” A claim is a statement that can be supported by evidence. This strategy is used to evaluate the claims written by other scientists, book authors, and authors who write online to determine if the claim is true and reliable.

PROCEDURE

Each statement in quotation marks below contains suggested wording the teacher may choose to use for the lesson.

EXPLAIN THE STRATEGY

Tell what the strategy is (declarative knowledge)

- “Today we’re going to learn a strategy that will help us determine if the claims an author is making are true and reliable. This strategy is called ‘evaluating claims.’”

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

- "This is a strategy I use when I read informational text, including text in reports other scientists write, but also when I'm reading on social media and someone is making a claim about something happening in the world. I know to use this strategy because it's important to me that I can believe things I read and that I know what I'm reading is real and proven by science."

Tell how to employ the strategy (procedural knowledge)

While you model the strategy, you might want to say something like this to the readers:

- "The first thing I do as I evaluate the claim of an author is to think about what I know to be true about a topic."
- "The next thing I think about is where the information is coming from. I ask myself questions, such as
    - Is the source a reliable one? Is it one I've used before, and do I generally trust this source and the information I get from it? If so, I can probably believe the claims made by the source.
    - Is the site one that is hosted by a research center or university (e.g., is the domain address .net, .org, .edu)? If so, I can probably believe the claims made by the source.
    - Is the site one that is hosted by the government (e.g., is the domain address .gov?) If so, it's probably trustworthy, but it may be a controversial source. I might need to see if the claims in the source agree with claims made by other authors.
    - Is the site one that is hosted by a for-profit (e.g., is the domain .com)? If so, I want to read the claims made by the authors very carefully. I want to be sure that the claims are grounded in evidence and facts and that the claims are in agreement with claims I've read in other sources.
    - What is the credibility of the author? Is the author a scientist or an expert on the subject? Is the author making claims that are grounded in evidence or just presenting opinions? If opinions, I might consider not including the statements in my inquiry, as they may not be evidence-based claims.
- I will then note those claims that I take to be authentic and true on my inquiry chart, along with the name of the author and/or source where I found them."

Science Inquiry Circles—30 minutes

OVERVIEW

Scientists often work in teams when conducting inquiry and investigations. Today, we will work in inquiry circles to investigate different questions about plant groups.

Prior to starting the inquiry circle work, be sure to have texts and technology available for your learners. You have been provided with a list of suggested books and websites titled Plant Resources in the Day 4 folder. These are suggestions, and you may use other resources. You may need to provide learners with specific instructions on how to access websites within your school district, or you may want to create a click sheet of approved websites for learners to be distributed in your learning management system (Google Classroom, Schoology, etc.). As teams begin working, you may have some groups working online while others are working with traditional texts. This will depend on your access to technology and texts.

PROCEDURE

Each statement in quotation marks below contains suggested wording the teacher may choose to use for the lesson; teacher actions in parentheses.

Before Inquiry Circles

1. "It is time to get into our inquiry circles. You will be with the same team as yesterday, but we will rotate the scientific roles." (Assign roles at your discretion and have the Equipment Directors gather the inquiry chart for their team).
2. "You are already familiar with the inquiry chart and the inquiry questions. Today we will continue to look for answers to all of your questions."
3. "As you look for answers to your questions, you will practice your roles as scientists. You will do this because scientists have a special way in which they look for answers. One way to look for answers is to do investigations. This means that they look at text (in books and on the computer) that might help them find information they can use."

During Inquiry Circles—20 minutes

4. "Today you will continue to investigate your plant group by using preselected websites on the computer (or tablet) and preselected texts." (The websites and texts are available in the Plant Resources document.)
5. "We have anchor charts to help guide your thinking. Do not forget to use them while working." (Refer to the Evaluating Evidence-Based Claims anchor chart and the other anchor charts already introduced. Remind learners that each day they will practice the literacy mini-lesson during this inquiry circle time. Once you have taught several mini-lessons, they can use any of the reading strategies taught, not just the one for that day.)
6. "The Lead Scientist will guide all inquiries for the day by picking which question(s) will be answered. The Data Scientist will record all source information and the answers to your inquiry questions on the inquiry chart. Remember, it is important to record on your inquiry chart where you found the information (source) so that you do not plagiarize." (Point out to learners where sources are located on the inquiry chart and how one source may answer various questions. Remind your learners to record the title and author for texts and the URL for websites.) "The Lab Director and the Equipment Director must help find the answers to the questions online and in texts." (Be sure to model for learners where to record their source and where to record answers to specific questions. Explicitly show them how the inquiry chart will organize their progress.)
7. "My role is to help guide the inquiry circles, but I expect you to work as a scientific team to solve your problems together." (While teams are working together, walk around the room to facilitate as needed.)

After Inquiry Circles—10 minutes

8. "As we conclude our inquiry circles for today, each team will have a chance to share the questions they answered, what they accomplished, and what literacy strategies they used. The Lab Director will lead the discussion about today's results, and the Data Scientist will share your responses with the class. Discuss with your team, considering what you learned about your plant group. What problems did you encounter? How did you resolve those problems? Did you use a reading strategy? Which one, and how did it help you? What new questions do you have?" (After you have allowed the teams to gather their thoughts, have the Data Scientist share with the class.)
9. (After all learners have shared, thank them for their hard work, and point out any excellent behaviors that you observed. If you saw an outstanding example of using a reading strategy or collaborative work, explicitly point it out. If you notice any problems in the teams during the lessons, take a moment to point them out, and explain your expectations for all future inquiry circles. Collect all inquiry charts or have learners put them in their normal classroom place for ongoing work so they can easily access them.)

Guided Science Investigation—30 to 45 minutes

OVERVIEW

Learners create their own mold and cast fossils to gain a deeper understanding of how these types of fossils form.

GUIDING QUESTIONS

What's the difference between mold and cast fossils? How are they formed?

BACKGROUND INFORMATION

Mold fossils are the detailed holes or cavities left in Earth materials (like mud or sandstone) by an organism after it decays or rots away. A process called authigenic preservation leaves a negative indentation, or cavity, in the Earth materials. Over time, that cavity becomes rock. Partial, entire, or even traces of organisms can leave mold fossils.

If that mold (cavity) is filled with another material, such as sand or groundwater, it becomes a cast of the original hard parts of the organism. When water seeps into the rock surrounding the mold, it deposits minerals that fill the mold and eventually harden, taking the shape of the mold fossil. Whether a mold will form into a cast fossil depends on the strength of the mold fossil and the availability of water and minerals.

SAFETY

Children should wear safety goggles as they work with the plaster of paris.

MATERIALS

Each team member will need:

- science notebook
- goggles

Each team will need:

- Making Fossils Student Guide (in the Day 4 folder)
- 3-oz. cup of plaster of paris (2/3 full)
- 3-oz. cup of water (1/2 full)
- 1 small packet of air-dry clay
- 1 rolling pin or any object suitable for rolling out clay
- 5-oz. paper ice cream cup
- 1 large paper clip
- newspapers and paper towels (to keep work area clean)
- sticky note to label tray with team identifier (teams or teacher may decide on team identifiers, such as a name or number)

Teacher will need:

- Making Fossils Student Guide to project and/or read aloud to class
- How to Make Mold and Cast Fossils PPT
- assortment of plant leaves (small-sized to fit into cups), preferably with a stem or strong veins (to be collected by the teacher. **NOTE: the teacher will need to collect enough leaves for use on days 4 and 5!**

SETUP

- Print one copy of the Making Fossils Student Guide for each team.
- Organize the following materials into tubs or trays, one tray per team:
    - goggles
    - 3-oz. cup of plaster of paris (2/3 full)
    - 3-oz. cup of water (1/2 full)
    - 1 small packet of air-dry clay
    - 1 rolling pin or any object suitable for rolling out clay
    - 5-oz. paper ice cream cup
    - 1 large paper clip
    - newspapers and paper towels (to keep work area clean)
    - sticky note to label tray with team identifier (teams or teacher may decide on team identifiers, such as a name or number)
- Provide ample room to work in and designate an area to set fossils to dry at the end of the activity.

DAILY OBSERVATIONS

There are no observations at this time.

PROCEDURE

Engage

1. Ask, *Have you ever left a footprint in the sand or on wet soil? What did it look like?* Accept responses. Explain that the footprint, whether made by a shoe or foot, likely left a dent or impression in the sand or soil.
2. Say, *Today we're going to explore how organisms make dents in Earth materials that can become fossils*!

Explore

3. Ask the Equipment Directors to collect one tub or tray of supplies for their team.
4. Ask the teams to cover their workspace with newspapers or towels because this could get messy!
5. **Explain that you will first show a short slideshow all the way through to give them an idea of what they need to do. You may then choose to run the slideshow again, stopping at each step of the process**. **You can also make the PPT electronically available to students. Stress that it is important that they follow directions.**
6. Direct the class to the printed instructions in their supplies. Remind them that they are working in teams and that each team member should have a role in making the fossils. **Instruct them to identify which step each team member will do before they begin.**
7. Inform them that they will complete all these steps today but that the actual fossil may not be ready until tomorrow (It will need time to dry).
8. Ask for any questions or clarification needed, then begin making fossils!
9. Move between the teams to ensure they are following directions for making the fossils and that each team member has a role.
10. When the process is complete, remind the Lab Directors to clean the work areas and return the trays with supplies back to the designated area.
11. Ask the Data Scientist to write their team identifier on the sticky note and place it with their fossils in the designated area. Remind the teams that they will have time in the next class to see their fossil casts.

Explain

12. Ask for volunteers from each team to describe their experiences making the molds first. *What did you notice? What did it look like? What features of the live leaf are visible in the mold?* Repeat with volunteers describing how they made the casts. Accept responses.
13. Ask, *How would you describe the difference between a mold and a cast?* Accept responses.
14. Describe how the imprint of the leaf on the clay created the mold. When they lifted out the plant and poured the plaster over the imprint, it filled in the mold.
15. Say, *After the plaster dries on your fossil, it will take the shape of the mold to make a cast of the plant. You will be able to see that tomorrow!*
16. Say, *So, how are molds and casts of organisms formed in nature?* Accept responses.

Elaborate

17. Remind the learners of the sedimentary layering they learned about in the previous class. Explain that when an organism is buried in sediments, groundwater seeps in and dissolves the soft parts of the organism over time, leaving only a detailed mold of the organism.
18. When mineralized sediment fills the mold, it recreates the shape of the organism and creates a cast. However, it is only a cast of the outside of the organism. Over millions of years, the sediments become rock and a fossil is created.
19. Write this statement on the whiteboard (or project it) and ask learners to respond to it in their science journals: “Explain something new you learned today about how fossils are formed.”

Evaluate

20. Did the learners communicate understanding about how fossils can form (written or verbal)?
21. Did learners demonstrate teamwork in making the molds and casts?
22. Did learners include new science vocabulary in their responses or explanations?

Extended Standards
Reading TEKS: 3.9E Multiple genres: listening, speaking, reading, writing, and thinking using multiple texts—genres. The learner recognizes and analyzes genre-specific characteristics, structures, and purposes within and across increasingly complex traditional, contemporary, classical, and diverse texts. The learner is expected to (E) recognize characteristics and structures of argumentative text, (E)(i) identify the claim, and (E)(ii) distinguish facts from opinion.
CCSS: RI.3.6 Distinguish their own point of view from that of the author of a text. W.3.7: Conduct short research projects that build knowledge about a topic. W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
NGSS: 3-LS3-1 Crosscutting Concepts: Similarities and differences in patterns can be used to sort and classify natural phenomena. Connections to the Nature of Science: Science investigations use a variety of methods, tools, and techniques.
Science TEKS: 3(b)(1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following home and school safety procedures and environmentally appropriate practices. The student is expected to (A) demonstrate safe practices as described in Texas Education Agency–approved safety standards during classroom and outdoor investigations using safety equipment as appropriate, including safety goggles or chemical splash goggles, as appropriate, and gloves. 3(b)(4) Scientific investigation and reasoning. The learner knows how to use a variety of tools and methods to conduct science inquiry. The learner is expected to collect, record, and analyze information using tools, including cameras, computers, hand lenses, metric rulers, Celsius thermometers, wind vanes, rain gauges, pan balances, graduated cylinders, beakers, spring scales, hot plates, meter sticks, magnets, collecting nets, notebooks, and Sun, Earth, and Moon system models; timing devices; and materials to support observation of habitats of organisms such as terrariums and aquariums.