<table>
<tr><th colspan="4">Day 08
What Are Gymnosperms?</th></tr>
<tr><td colspan="2">Literacy Strategy: synthesizing information.</td><td colspan="2">Science Concept: Environmental changes over time created or destroyed habitats, requiring organisms to develop structures that improved their chances for survival. Gymnosperms produced pollen and seeds that allowed them to colonize new environments.</td></tr>
<tr><td>Reading TEKS:
3.6(H)</td><td>CCSS:
RI.3.9</td><td>NGSS: 3-LS2-1, 3-LS4-1, 3-LS4-3</td><td>Science TEKS:
3(b)(2)(B)
(3)(b)(3)(A)
(3)(b)(10)(A)</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.</td></tr>
<tr><td colspan="4">Materials for Inquiry Circles: team inquiry charts, pencils, variety of nonfiction texts for each group, access to websites and online books, access to anchor charts already introduced.</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:
Gymnosperms—a group of vascular seed plants that have uncovered seeds; gymnosperms have roots, stems, and leaves.
Specimen—an organism, or part of an organism, used in scientific research or scientific investigations.
Evidence—data, observations, or other information collected from an investigation that can be used to support explanations and answers.
Data—facts or information collected during an investigation (e.g., images, measurements, or words).
Extinction—the dying out or disappearance of a particular species of plants or animals on Earth.
Species—a classification of organisms that share characteristics and are alike in some manner.</td></tr>
<tr><td colspan="4">Science and Literacy Connection: scientists synthesize what they already know about a topic with new information that comes from observations and investigations.</td></tr>
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Mini-lesson—15 minutes

OVERVIEW

Scientists put together new information about the world every day! Before they conduct their own investigations, scientists read a lot of texts written by other scientists about their work. Scientists "synthesize" what they have read with what they already know and put that information together in a new way. "Synthesis" means making something new by putting things together.

PROCEDURE

Each statement in quotation marks below contains suggested wording for the lesson; teacher actions are in parentheses.

EXPLAIN THE STRATEGY

(You might want to start with a whole-group synthesis statement about all plants, followed by inquiry circle groups creating their own synthesis statements. Learner groups can create a synthesis statement for each inquiry question by combining (synthesizing) the findings in each column on the inquiry chart. Then, you might have groups create one synthesis statement that combines all of their findings about their plant.)

Tell what the strategy is (declarative knowledge)

- "Today we will practice synthesizing our evidence from multiple sources. We will combine information from all of our sources and create our own, new information. This is different from re-stating what other scientists have written. When I write a synthesis statement, I combine my evidence from multiple sources with my own knowledge, and state the information in a new way."

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

- "I write synthesis statements because other scientists expect me to show that I have read scientific writing about my topic, but they also expect me to write in my own words. I also synthesize because it helps me construct a deeper and broader meaning about my topic across all of my resources. As a strategic reader and writer, I synthesize to make sense of lots of information. I write a synthesis statement when I find information from different books, online resources, experts, and videos."

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 will do is look at my inquiry chart and think about what was important from each source. I'll do that as I consider each of my inquiry questions."
- "Then I will compare and contrast the important information from each of the sources."
- "Next, I check that all of my information fits together in a way that makes sense. If the information across sources is similar, I often do not need to do anything. If my sources contradict (or disagree with each other, I need to stop and try to evaluate the claims or statements the authors are making."
- "Now, I need to think about what I know about this important information and if I can add something from my own knowledge that the authors did not mention directly. I will be careful to include only my knowledge that is factual and that matches what I have read in the writing of other scientists. I will not include opinions or information that I have heard someone in my life say. If what I know is in agreement with what other scientists are saying, I can include it in my synthesis statement."
- "Finally, I write a synthesis statement that combines evidence from my sources and my own factual knowledge."

You might present the following as a model synthesis statement as part of this mini lesson:

- "Plants have structures that help them survive in their specific environments. Plant life on Earth has changed over millions of years because the environments of plants have changed. Fossils can show us when and where different types of plants have lived. "

- (Explain that their synthesis statements will focus on the plant or type of plants that they have been learning about and should include information related to the concepts the unit has focused on:
    - Plant populations have changed over long periods of time in response to changing environments.
    - Plant populations have developed structures (adaptations) that allow them to survive in different environments.
    - The fossil record provides evidence of when and where populations of plants have lived
    - On Earth.

Science Inquiry Circles—30 minutes

OVERVIEW

Scientists often work in teams when conducting inquiry and investigations. Today, we will work in inquiry circle teams 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 websites titled Plant Resources in the Day 8 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 are in parentheses.

Before Inquiry Circles

1. "It is time to get into our inquiry circle groups. 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. "Yesterday we became familiar with the inquiry chart and the inquiry questions. We also recorded what we already know about the plant group (mosses, ferns, conifers, or flowering plants). Today we will begin 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 of looking 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 and for the next few days, you will 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 Inquiry Toolbox anchor chart and the Skimming and Scanning for Specific Information anchor chart. 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 the 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.)

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 continue plant observations as they are introduced to representative gymnosperm plants (conifers) and images of other plants in this group.

GUIDING QUESTIONS

What are gymnosperms? How are they different from vascular plants? Overall, how are plants changing?

BACKGROUND INFORMATION

Documenting the early forms of seed plants is difficult. The fossil record shows that gymnosperms with "naked " or unenclosed seeds were the earliest true seed plants, appearing about 390 million years ago in the fossil record. Seeds were produced within cones and typically were spread by wind. Seeds and the production of pollen allowed gymnosperms to spread and colonize new environments. Sturdy wooden stems (trunks) and roots allowed these plants to grow taller into shrubs or trees and to live for many years.

Gymnosperms do not produce flowers or fruit. Examples of gymnosperms include cycads, conifers, gingkos, and gnetophytes. Conifers make up the largest group of gymnosperms. Conifers produce cones to produce pollen and grow their seeds. Many conifers have long, thin, needlelike or scalelike leaves. Conifers include the magnificent giant Sequoias, which hold the world's record for the tallest, oldest, widest, and larget trees! Conifers are present in all continents except Antarctica.

It is worth noting that the fossil record covered in this lesson spans a time period of about 208 millions of years and marks significant changes in environments and organisms. The climate during this time period was warm and wet. There are many different types of animal organisms on the land, in the seas, and in the air. In spite of a mass extinction in the middle of this time period, life continued, and early mammals and dinosaurs appeared! In discussions, it is important to reiterate that we know these changes occurred because we have evidence in the form of the fossil records.

SAFETY

- Instruct children not to tear off or cut any part of the plants! They may gently lift leaves for inspection if needed.
- Children should avoid touching their faces while handling the plants and should wash their hands after their work.

MATERIALS

Each team member will need:

- science notebook
- goggles

Each team will need:

- Day 8 Images PPT (paper copies or electronic access)
- Plant Observations chart
- Leaf Morphology chart (paper copies or electronic access)
- assortment of pine cones and pine needles
- hand lenses
- rulers or measuring tapes

Teacher will need:

- Day 8 Images PPT
- gallon zip-top bags (10)

SETUP

- **Before the class**, the teacher will collect an assortment of pine cones and pine needles and prepare a bag containing samples of both for each team.
- **Before class**, make color copies of the Day 8 images PPT (or allow electronic access). If using paper copies, cut out 1 set of images for each team and place in a zip-top bag labeled *Day 8*.
- **NOTE: it is important not to identify the specimens as representatives of "gymnosperms" until after the children have completed their observations.**
- Place sample bags and material bags (containing hand lenses, ruler or measuring tape, and the Leaf Morphology chart) in a designated area for distribution.

DAILY OBSERVATIONS

Children conduct daily observations of different live plants/images.

PROCEDURE

Engage

1. Direct the attention of the class to a bag of pine cones you hold up for them to see. Ask, *Where did these come from ? (*Accept responses, which should include "a tree" or "a pine tree"). *Why didn't I bring the tree?* (Too big!)
2. Explain that they will conduct their investigation on these samples in the same way they did in the previous class with the live fern and other plant images. Because of the size of these plants, they will use these parts of the plant (tree) to investigate.
3. Instruct the children to always record in their science notebooks any additional information that does not fit into the Plant Observations chart but that is important to remember (e.g., information they learn from discussions with the teacher or each other, or additional questions to investigate during inquiry circles).
4. When ready, each Equipment Director should collect one bag of samples and one bag of materials for their team.

Explore

5. Once again, instruct the class to take a close look at the specimen, using only their eyes to begin with.
6. As a team, they should come up with a question they want to answer; if they come up with more than one questions, ask them to choose one to investigate.
7. After they formulate their question, they should write it on their Plant Observation chart, along with today's date.
8. As before, they should record all of the information from their observations on the chart. Remind them to identify the evidence that supports the answer to their question.
9. Inform them that if they can't find answers to their questions, they need to use science inquiry circle time to look for the answers!
10. Let them know that they have 20 minutes for their investigation. Remind them to work as a team, with each one of them doing a part of the work. They can decide as a team who does what.
11. As teams work, navigate between them to ask open-ended questions, such as, *What question are you trying to answer? Are you finding the information you need? What do you notice about these plant parts compared to the plants you have already investigated?*

Explain

12. When time is up, ask the Data Scientist from each team to give a brief report on the question their team question was investigating, an explanation of what they discovered, and whether or not they found the answer to their question. Ask, "*What evidence supports your answer?"* Accept their responses.
13. Remind the class they are working with limited information. If they did not find the answer to their question, that is perfectly OK. Scientists don't always find the answers they need right away either! This is why they need to record all the questions and continue their search for answers during science inquiry circle time.
14. After each team has shared, ask, *How were these specimens different from plants in the images? How were they the same?* Accept and discuss responses.
15. Share that the group of plants they explored today are called gymnosperms. Ask, *What did you notice about all the plants in this group? Can you describe describe the differences between them?* Accept all responses and discuss.
16. Explain that the fossil record shows that gymnosperms were the earliest true seed plants. They produced seeds within cones, which were typically spread by the wind. The pine cones and pine needles represent the largest group of gymnosperms, the conifers. Conifers can have long, needlelike leaves like the ones in the sample bags, or scalelike leaves.
17. Add that gymnosperms appear in the fossil record about 300 million years ago at a time when Earth's environment was very warm and wet; it rained a lot. There were no ice caps and sea levels were high. Many plants appear in the fossil record, and there is evidence that different species of animals lived on land, the oceans, and in the air. It was also during this time period that dinosaurs appeared!

Elaborate

18. Ask the "experts" on conifers to share any other information they have found in their inquiry circles.
19. Ask if there are any other new questions that came up during the investigation that they could not answer. Encourage them to always write new questions on their observation chart as they work and explain that they may find the answers during inquiry circle time or in the next investigations.
20. Instruct the Lab Directors to collect and store all of the materials used today.
21. **OPTIONAL:** The teacher may choose to show the following 5-minute video about gymnosperms. https://vimeo.com/421075272

Evaluate

22. In their communications (verbal or written) is there evidence learners are making sense of how plants are changing over time?
23. Did teams develop a reasonable question to begin the investigation with?
24. Are learners using evidence to back up their answers?
25. Were any new questions raised?
26. Was any information from the science inquiry circle work included?

Expanded Standards
Are learners using science language in their communications, either written or verbal? **Reading TEKS:** 3.6 Comprehension skills: listening, speaking, reading, writing, and thinking using multiple texts. The learner uses metacognitive skills to both develop and deepen comprehension of increasingly complex texts. The learner is expected to (H) synthesize information to create new understanding.
CCSS: RI.3.9 Compare and contrast the most important points and key details presented in two texts on the same topic.
NGSS: 3-LS2-1 Science and Engineering Practices: Construct an argument with evidence, data, and/or a model. 3-LS4-1 Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. 3-LS4-3 Disciplinary Core Ideas: For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.
Science TEKS: 3(b)(2) Scientific investigation and reasoning. The learner uses scientific practices during laboratory and outdoor investigations. The learner is expected to (B) collect and record data by observing and measuring using the metric system and recognize differences between observed and measured data. (3)(b)(3) Scientific investigation and reasoning. The learner knows that information, critical thinking, scientific problem solving, and the contributions of scientists are used in making decisions. The learner is expected to (A) analyze, evaluate, and critique scientific explanations by using evidence, logical reasoning, and experimental and observational testing. (3)(b)(10) Organisms and environments. The learner knows that organisms undergo similar life processes and have structures that help them survive within their environments. The learner is expected to (A) explore how structures and functions of plants and animals allow them to survive in a particular environment.