ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine
CENTER FOR EDUCATIONAL OUTREACH

# DAY 9: WHAT ARE ANGIOSPERMS?

## MINI-LESSON

Teams create a synthesis statement for each remaining column of information on the team Inquiry Chart.

## SCIENCE INQUIRY CIRCLES

Teams work together to create synthesis statements for the remaining columns on their Inquiry Chart.

## GUIDED SCIENCE INVESTIGATIONS

Teams examine a flowering plant specimen and record observations in their "Plant Observation" booklet.

**ABBREVIATED STANDARDS**

- Reading TEKS: 4.6.C, 4.6.F, 4.6.G, 4.6.H, 4.9.D(i)
- CCSS: RI 4.2, RI.4.9, SL.4.2
- NGSS: 4-ESS2-1, 4-LS1-1
- Science TEKS: 2018–19: 4.2B, 4.10A; 2024–25: 4.1E, 4.13A

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# Day 9: What Are Angiosperms?

**Literacy Strategy:** Practice identifying the main idea by drawing conclusions and synthesizing information.

**Science Concept:** Whether the environment changes suddenly or over long periods of time, some organisms adapt and survive, and some die. The development of flowers in plants was a key factor in successful reproduction that made angiosperms the dominant form of land plant.

**Science and Literacy Connection:** Scientists synthesize what they already know about a topic with new information that comes from observations and investigations.

## Mini-Lesson (15 minutes)

### OVERVIEW

In the previous class, the teacher modeled how to write a synthesis statement and supported inquiry circle teams as they created a synthesis statement for one of their inquiry questions. Today teams create a synthesis statement for each remaining inquiry question by combining (synthesizing) the findings in each column of the Inquiry Chart.

Some teams may have finished their Inquiry Chart yesterday and will be writing their first synthesis statement today. Other teams may have written their first synthesis statement yesterday and are ready to continue writing synthesis statements for their remaining inquiry questions. Use this time to support teams as needed. You may need to model writing a synthesis statement again (using the same materials from yesterday) for teams who are just starting to synthesize.

This time might also be used to review and practice the reading strategy on extrapolate the main idea by drawing conclusions. Teachers are encouraged to use this time to best meet the needs of their learners.

Teachers can determine if the mini-lesson will be facilitated with the whole class or a particular inquiry circle team that needs additional support. If you are working with a specific team, we suggest your other learners spend additional time working in inquiry circles. You may want to return to the information in the mini-lessons from Days 7 and 8 with some or all of your teams.

## Science Inquiry Circles (30 minutes)

### OVERVIEW

Today inquiry teams will continue writing synthesis statements for each of their remaining inquiry questions.

## MATERIALS

**Each team member needs:**

- science notebook
- pencil

**Each team needs:**

- team Inquiry Chart

**Teacher needs:**

"Plant 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. You will be with the same team as yesterday, but we will rotate the science roles.* (Assign roles at your discretion and have the Equipment Directors gather the Inquiry Chart for their team).
2. *We have answered all (or most) of our Inquiry Chart questions. Today we will write our synthesis statements so we need to be sure we have completed the Inquiry Chart.* (Make adjustments for teams that have not yet completed their inquiry charts.)
3. *Now, inquiry teams will work together on their synthesis statements.*

**During Inquiry Circles (20 minutes)**

1. *When all questions are answered on your Inquiry Chart, your team will work together to write a synthesis statement for each one of your inquiry questions.*
2. *Today you will follow the same process as we did yesterday when writing one synthesis statement for one inquiry question.*
3. *As you work to write your synthesis statements, remember the statement we wrote yesterday using one of the questions from the inquiry chart.* (Refer to the written statement.)
4. *Choose one inquiry question at a time and write a synthesis statement as a team.* (You might also give teams the option to divide up the inquiry questions and have each team member write one synthesis statement. Facilitate in a way that works best for your learners.)
5. ***Write your synthesis statements in your science notebooks**.*
6. *Do not forget to use the anchor charts to help guide your thinking.* (Refer to the posted anchor charts.)
7. *I will help guide the inquiry circles, but I expect you to work as a team to solve your problems together.* (While teams are working, walk around the room to facilitate as needed.)

**After Inquiry Circles (10 minutes)**

1. *As we conclude our inquiry circles for today, the Data Scientist from each team will have a chance to share what they accomplished. The Lab Director will lead the discussion about today's results. Was the team able to synthesize the questions on their inquiry chart? What problems did the team encounter? How did the team resolve those problems?* (After you have allowed the teams to gather their thoughts, have the Data Scientist share with the class.)

2. *The Data Scientists will now share with the entire class one of their team's synthesis statements.* (**Encourage teams to share how they developed their synthesis statements.** If you saw a great example in action, encourage that team to share with the entire class.)

## Guided Science Investigation (30–45 minutes)

### OVERVIEW

Today learners are introduced to angiosperms, the final group of plants to investigate. They will make observations on a live representative plant and use images of other plants from this group to compare.

### GUIDING QUESTIONS

What are angiosperms? How do their plant structures compare to the other plant groups?

### BACKGROUND INFORMATION FOR THE TEACHER

Angiosperm pollen first appears in the fossil record about 135 million years ago. Scientists believe that angiosperms (flowering plants) became widespread during this time period, although exactly when they actually appeared on Earth is still a mystery. Over time, they have diversified into 300,000 species of flowering plants that can live in just about every habitat on Earth, and there are species of flowering plants in tropical forests and other remote locations that have yet to be identified or named.

The word "angiosperm" comes from a Greek word meaning "hidden seeds." This means the seeds are covered or enclosed. Angiosperms are divided into two major groups: monocots and dicots. All monocots and dicots are flowering plants, but not all of them have noticeable flowers. The development of flowers in plants was a key factor in reproduction that allowed animals to aid in the dispersal of pollen and seeds produced in fruit. Successful reproduction has made angiosperms the dominant form of land plant.

Examples of monocots include orchids, lilies, palms, banana trees, and grasses. Examples of dicots include most trees that are not conifers and many food crops, such as cabbage, beans, and peaches. Angiosperms produce the majority of the crops needed for sustaining life and can be found in many commercial products.

The fossil record from approximately 146 million years ago to the present also gives evidence of Earth's ever-changing climate. It became very hot and humid, then it cooled down, warmed up again, and went through several more ice ages. During this time period we also have evidence of many different species of plants and animals on Earth. New habitats appear. However, a mass extinction occurred 65 million years ago, and dinosaurs and other organisms died off from the land and in the sea.

Over the last 10,000 years the climate has been warmer and more stable. Today, temperatures on Earth appear to be going up, potentially changing Earth's global climate again. The extinction of some species continues.

### MATERIALS

**Each team member needs:**

- science notebook
- pencil
- goggles

- gloves

**Each team needs:**
- 1 live specimen
- 1 bag containing paper copies of the Day 9 Plant Images, or electronic access to them
- 1 bag containing hand lenses, goggles, gloves, rulers or measuring tapes, and a copy of the "Leaf Morphology" chart
- team "Plant Observations" booklet

**Teacher needs:**
- Day 9 Plant Images PPT
- live specimen(s) of any angiosperm (flowering plant)
- gallon ziplock bags

## SETUP
- **Before class,** make color copies of the Day 9 Plant Images (or allow electronic access). If using paper copies, cut out **one set of images for each team** and place in a zip-top bag labeled "Day 9 Plant Images."
- Prepare cuttings from a live flowering plant, one cutting per team. Make sure that each cutting has all plant structures (roots, stems, leaves, flowers). You may also provide each team a whole small flowering plant with visible roots.
- Place the team "Plant Observations" booklets, plant image bags and material bags (containing hand lenses, ruler or measuring tape, and "Leaf Morphology" chart) in a designated area for distribution.
- **NOTE: it is important not to identify the specimens as representatives of "angiosperms" until after the children have completed their observations.**

## 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 wear safety goggles and gloves during plant observations.
- Children should avoid touching their faces while handling the plants and should wash their hands after their work.

## DAILY OBSERVATIONS
Learners conduct their last observations of a live plant specimen and the corresponding plant images.

## PROCEDURE
**Engage**
1. Direct the attention of the class to the live plant specimen you are holding up for them to see. Ask, *What do you see?* (Accept responses.)
2. Explain that they will make their observations on this specimen in the same way they did in the previous classes.
3. Remind them that they are looking for an answer to their question about plant structures, and the information they record in their "Plant Observations" booklets is important.
4. Instruct them to record any additional information in their science notebooks.

**Explore**

1. When ready, each Equipment Director should collect the team "Plant Observations" booklet, one live specimen, one bag of plant images, and one bag of materials for their team.
2. As before, the Data Scientist should record all of the information from their observations in the plant booklet.
3. Let them know they have 20 minutes for their investigation. Remind them to work as a team, with each one doing a part of the work, and to check with the "expert" on flowering plants for any additional information.
4. As teams work, navigate between them checking their progress, offering guidance as needed and asking open-ended questions, such as, *Are you finding the information you need? What do you notice about these plant structures compared to the plants you observed yesterday?*
5. Remind the teams to prepare a 6-word summary of the most important information they discovered today.

**Explain**

1. When time is up, ask the Data Scientist from each team to share the 6-word summary about what was discovered during their exploration.
2. If not discussed, ask, *How was this live plant different from plants in the images? How were they the same?* **Accept all responses, but do not correct them nor give them any additional information. (**On Day 10, a review and descriptions of all the plant structures by groups will be discussed.)
3. Share that the live specimen they examined today was a _____ (**name of plant used**), and it is part of a group of plants called **angiosperms**.
4. Explain that the **oldest known fossil record** of angiosperm pollen dates back approximately **135–134 million years ago**. But scientists are still not exactly sure when angiosperms appeared on Earth.
5. Add that the fossil record for that time period gives evidence of Earth being much warmer and more humid than it is today. Then, millions of years later, **there were many shifts in climate that caused Earth to cool down, warm up again, and then experience several more ice ages.** Some organisms had adaptations that allowed them to survive these changes.
6. Over the last 10,000 years the climate has been warmer and more stable. Many species of plants and animals continue to survive, while others become extinct.

**Elaborate**

1. Ask the "experts" on angiosperms to share with the class any other information they have discovered in their inquiry circles.
2. Tell the teams that in the next class period they will look over all of the information from their observations to synthesize what they have learned about the different plant groups.
3. Instruct the Lab Directors to collect and store all of the materials used today.

**Evaluate**

1. In their responses (verbal or written) is there evidence learners are digging deeper to make sense of how changes in the environment and changes in organisms are related? Were any questions raised about this relationship?
2. Are learners using evidence to back up their answers?
3. Was any information from the science inquiry circle work included?

## Science Language

- **Plant adaptations** made some species of plants better suited to living in a particular habitat or environment.
- **Angiosperms** are flowering plants**.**
- A **specimen** is an organism or part of an organism used in scientific research or investigations.
- **Evidence** is data collected during an investigation to support (backs up) explanations and answers.
- **Data** are facts and information (such as images, words, and measurements) collected during an investigation.
- An **extinct** species has no living members of its group in existence.
- **Species** refers to a group of organisms that share similar characteristics.

## Expanded Standards

**Reading TEKS**

**4.6C:** Make and correct or confirm predictions using text features, characteristics of genre, and structures. **4.6F:** Make inferences and use evidence to support understanding. **4.6G:** Evaluate details read to determine key ideas. **4.6H:** Synthesize information to create new understanding. **4.9D(i):** [Recognize] the central idea with supporting evidence.

**CCSS**

**RI.4.2:** Determine the main idea of a text and explain how it is supported by key details; summarize the text. **RI.4.9**: Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. **SL.4.2:** Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

**NGSS**

**4-ESS2-1:** Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. **4-LS1-1:** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

**Science TEKS**

**2018–19: 4.2B:** Collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps. **4.10A:** Explore how structures and functions enable organisms to survive in their environment.

**2024–25: 4.1E:** Collect observations and measurements as evidence. **4.13A:** Explore and explain how structures and functions of plants such as waxy leaves and deep roots enable them to survive in their environment.