

## Anchoring Phenomenon

Tiny seedlings grow and transform into trees with a great quantity of matter.



## Lesson Concept

Develop a model to explain where all the matter in a tree comes from when it begins as a small seedling. Develop a model to describe the observable and unobservable variables that explain how trees rearrange matter to support growth.



## Investigative Phenomenon

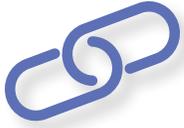
Introduce anchoring phenomenon: Tiny seedlings grow and transform into trees with a great quantity of matter.



## Standards

Refer to Appendix 7.1 for NGSS, CCSS (ELA), and California ELD Standards.

# 7.1 Tree Matter



## Storyline Link

In this lesson, students will observe a time-lapse video of a seed growing into a large tree to develop an initial model to explain how plants transform matter from the surrounding environment to create new plant material. Students will make observations from the video, ask questions, and develop an initial model. Student questions and models will be revised in later lessons as they gather additional evidence regarding the transfer of matter and energy within the system.

Throughout the lesson, a flag (▶) denotes formative assessment opportunities where you may change instruction in response to students' level of understanding and making sense of phenomena.



## Time

60 minutes

One 60-minute session



## Materials

### Whole Class

- The [growing tree](https://www.youtube.com/watch?v=RjnKAWxCK3k) video <https://www.youtube.com/watch?v=RjnKAWxCK3k>
- 7.1.R1: Display Idea for Giant Sequoia Tree Probe (optional)
- A small seedling (optional)
- A large piece of wood (optional)

### Group

(Groups of 4)

- Chart paper, markers
- Sticky notes

### Individual

- Science notebook
- 7.1.H1: Giant Sequoia Tree Probe
- 7.1.H2: Make a Model

## Advance Preparation

1. Preview the [growing tree](https://www.youtube.com/watch?v=RjnKAWxCK3k) video <https://www.youtube.com/watch?v=RjnKAWxCK3k>
2. Make copies of **7.1.H1: Giant Sequoia Tree Probe** and **7.1.H2: Make a Model**

## 7.1 Tree Matter



### Procedure

#### Engage

*Develop a model to explain where all the matter in a tree comes from when it begins as a small seedling. Develop a model to describe the observable and unobservable variables that explain how trees rearrange matter to support growth.*

#### Eliciting Prior Knowledge: Individual

1. Distribute **7.1.H1: Giant Sequoia Tree Probe** and ask students to respond individually to the prompts. Explain to students that they will have an opportunity to return to their answers later so it is not necessary to provide a “correct” answer. Tell students it is important to fully record their ideas. Provide 5-10 minutes for students to complete the probe.

#### TEACHER NOTE

Students who are learning English or who are below grade level may communicate their ideas more clearly using pictures or symbols. The intent here is not to make a model, but rather to give students another option for how to express their ideas. At this point, it is not necessary for students to communicate in complete sentences or with accurate grammar and spelling.

2. Ask students to put their response sheets into their science notebook or some other place where they can find it later.

#### TEACHER NOTE

This can also be presented on a display so that students can record their thinking in their science notebook. See an example of this modification in **7.1.R1: Display Idea for Giant Sequoia Tree Probe**.

#### Making Prior Knowledge Public

3. Explain to students that you will now show them [the growing tree](#) video. Direct students to take notes on the events that occur and any information that they think might explain the events. Show the video twice to provide sufficient time for students to make observations.

## 7.1 Tree Matter

### TEACHER NOTE

The [growing tree](#) video shows a seedling growing into a large tree. ► This is an opportunity to assess students' prior knowledge about the phenomenon and determine what knowledge they are bringing to the unit. Students should notice the addition of a significant amount of matter to the tree, the development of new branches, and green leaves. If the majority of your students bring up ideas such as photosynthesis or chemical reactions, this could be an indication that the students have advanced knowledge of the phenomenon. However, it may also be an indication that students have heard of these terms but do not have a deep understanding of the underlying concepts. Monitoring their conversations and science notebook entries will help to determine students' level of understanding.

4. Ask students to think about the questions they have about what they saw in the growing tree video. Direct students to record those questions in their science notebook.
5. Ask students to consider where they have seen or heard of similar phenomena. Record their ideas on a chart in the classroom. Students might suggest growing vegetables, shrubs, or trees in their neighborhood or other plants they encounter in their daily lives. Students who share experiences growing plants should be asked to describe those experiences, including what they did to help the plants grow.
6. Consider taking students on a short walk around campus to observe plants in the schoolyard or presenting photos of plants in a nearby park. Students can record observations of plants they see during their walk, possibly taking photos.

### TEACHER NOTE

These experiences do not need to be scientific. Encourage students to share experiences related to growing plants that reflect their home and family experiences. It is also appropriate for students to share experiences that they cannot fully explain such as why a family member planted something in a particular area or repotted plants. The intent is to gather personal and community connections to the phenomenon.

To help students engage with the phenomenon, consider bringing in a small seed and a large piece of wood. Let students hold both the seed and the piece of wood and compare the mass of each. Ask students their ideas and questions about how something so tiny can grow into a very massive tree.

7. Ask students to share their questions with a partner. When pairs have had a chance to discuss, ask students to share some of the questions they developed with their table. As students share, walk around and monitor their conversations.

## 7.1 Tree Matter

### TEACHER NOTE

Students learning English can be encouraged to use their drawings in their science notebook to communicate with their partners. As students share their ideas with the class, revoice student ideas so that students who are learning English or may have limited academic vocabulary can have the opportunity to hear their ideas again and in a variety of contexts. For example, you might say, “So you noticed that the tree grew taller faster than it grew wider.”

8. Facilitate a class discussion around which particular question or questions to investigate further. Direct students to write their questions on individual sticky notes. Individual student questions can be gathered, or you can ask table groups to share their questions to select one or two questions for the table. Ask students to share their questions by reading one question aloud at a time. After the first question is read, ask the class if anyone has a similar question. If so, ask the student who had a similar question to read aloud their question and then place it next to the first question, clumping both questions together in a clump. If there are no other similar student questions, ask students for a different question. Once all the questions have been read and “clumped,” facilitate a class conversation about possible categories or titles of each clump. As clumps are assigned a “title,” circle the clump and record the title above the clump. You should now have a series of possible question clumps to investigate.
9. At this point, groups of students could select different questions to investigate, the class could decide to investigate one particular question, or the class could be directed to investigate the clump related to “tree growth” with a question such as: How the tree grew from a small seedling to a larger tree. Where did the matter come from? If you are going to move forward in the lesson sequence as written, explain that the class will continue investigating how the tree gets the matter to grow by focusing on the question: Where does the matter come from for the tree to grow from a small seedling to a larger tree? If this exact question was not suggested by students in the previous discussion, adjust the prompt to connect to students’ questions. If students generate questions related to the notion of “tree growth” such as what makes the tree grow so tall? or would all trees grow at the same rate?, the guiding question can be replaced with one that was generated from the students.

### Making a Model

10. Distribute **7.1.H2: Make a Model**. Tell students to create a model that includes both drawings and words. Their model should represent their initial ideas about the focus question related to the increase in tree mass.

## 7.1 Tree Matter

### TEACHER NOTE

► This is an opportunity to assess students' prior knowledge about developing and using models to determine what knowledge they are bringing to the unit. Record if students are using observations from the video or the list of related phenomena in their models (evidence), if the models contain visible and invisible components, and if the models show relationships. If this is the first time students have made a model, they may need some encouragement to record their ideas. Remind students that this model will represent their initial thinking, and there will be opportunities to add or revise their models later.

This is also an opportunity to assess students' prior knowledge related to the CCC Energy and Matter. For example, are students including both energy and matter elements in the model? Is matter represented as particles in any part of the model? Are there indications that matter is changing form or transported through the system?

11. Direct students to share their ideas with their team (2–4 students) in order to create a group model. Distribute chart paper or large whiteboards for students to create their group model. As student groups work, ask the groups to consider.
  - a. What are the parts (components) that are part of this process? Are any of these parts invisible? If so, how did you/could you represent the “invisible” parts on your model?
  - b. What are the relationships between these parts?
  - c. How does your model show what is happening at the beginning, middle, and end of the process?
  - d. How is the matter transported into, out of, and within the tree or system?
  - e. How much matter is there before, during, and after the process? Does it change?
12. Explain to the students that this is their first opportunity to explain this phenomenon with their model, and as they learn more, they will have additional opportunities to add and revise this model.
13. Once the groups have had sufficient time to record their ideas, you may choose to have a few groups share their models, depending on how much time you can provide.
14. Five minutes before the end of the class, direct students to add to or revise their initial model and record it in their science notebook based on discussions in their group.
15. End class by asking students to record any new questions they might have about the phenomenon.

## 7.1 Tree Matter

16. ► Collect **7.1.H1: Giant Sequoia Tree Probe** and **7.1.H2: Make a Model** and assess student prior knowledge. Prior knowledge should be evaluated in all three dimensions. For example, consider student models. Were they able to describe the phenomenon accurately using words and pictures? Do their models show visible and invisible components? Relationships? Student understanding of concepts related to Organization for Matter and Energy Flow in Organisms (DCI) and Energy in Chemical Processes and Everyday Life (DCI) may include inaccurate ideas such as the mass comes from soil or lack an awareness that invisible gases have mass and enter the plant. Do students include some description of the conservation of mass or the role of energy in moving matter? If they use terms like photosynthesis, is there evidence that these terms are applied accurately to explain the phenomenon? These student work pieces can be used to make instructional decisions as you move through the series of lessons; indicating areas where you may need to slow down to allow more processing time or areas where students may have more understanding than the lesson anticipates. Return **7.1.H1: Giant Sequoia Tree Probe** and **7.1.H2: Make a Model** to students after you have reviewed them. These should be placed in their science notebook.

### References

Keeley, P., Eberle, F., & Tugel, J. B. (2007). *Uncovering Student Ideas in Science, 2:25 More Formative Assessment Probes*. Arlington: National Science Teachers Association.

Muviag. (2011, March 2). The growing tree / Timelapse Animation. Retrieved from <https://www.youtube.com/watch?v=RjnKAWxCK3k>.

## Toolbox Table of Contents

7.1.H1	<u>Giant Sequoia Tree Probe</u>	7.1.9
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## Giant Sequoia Tree Probe

### Giant Sequoia Tree

The giant sequoia tree is one of the largest trees on earth. It starts as a small seedling and grows into an enormous tree. Five children can stretch their arms across the width of the trunk of one of the large sequoia trees!

Where did most of the matter that makes up the wood and leaves of this huge tree originally come from? Use words and pictures to explain your ideas.



Explain your thinking. How did you decide where most of the matter that make up this tree came from?

Modified from P. Keeley Uncovering Student Ideas in Science, Vol 2

## Make a Model

Make a model of how a seedling becomes a large tree. Remember to show the parts you can and can't see. Show where the matter comes from and how it gets into the tree.

**Seedling**



Image via iStock.com/[ermingut](#)

**Large Tree**



Image via iStock.com/[vandervelden](#)

Draw your model here.

## Display Idea for Giant Sequoia Tree Probe

### Phenomenon

The giant sequoia tree is one of the largest trees on Earth.

It starts as a small seeding and grows to an enormous tree.



Image by iStock.com/[Andrei Stanescu](#)

### Essential Question

Where did most of the matter that makes the wood and leaves of this huge tree come from?

Use words and pictures to explain your ideas. Also, record any wonderings you have in your science notebook.



Image by iStock.com/[Meinzahn](#)

## Explain Your Thinking

How did you decide where most of the matter that makes up this tree came from?



Image by iStock.com/[RiverNorthPhotography](#)

# Appendix 7.1

## Tree Matter

### Next Generation Science Standards (NGSS)

This lesson is building toward:

#### PERFORMANCE EXPECTATIONS (PE)

- |                 |   |
|-----------------|---|
| <b>MS-LS1-6</b> | Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. <i>[Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]</i> |
|-----------------|---|

NGSS Lead States. 2013. Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press.

#### SCIENCE AND ENGINEERING PRACTICES (SEP)

##### Developing and Using Models

- Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.
- Develop a model to describe unobservable mechanisms.

#### DISCIPLINARY CORE IDEAS (DCI)

##### LS1.C Organization for Matter and Energy Flow in Organisms

- Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.

##### PS3.D Energy in Chemical Processes and Everyday Life

- The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen.

#### CROSCUTTING CONCEPTS (CCC)

##### Energy and Matter

- Energy can be transferred in various ways and between objects. (From Grades 3–5)
- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

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## Appendix 7.1

### Common Core State Standards (CCSS)

#### CCSS ELA SPEAKING & LISTENING

##### CCSS.ELA-LITERACY.SL.7.1.B

Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.

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### California English Language Development (ELD) Standards

#### CA ELD

**Part 7.1.3** Offering and justifying opinions, negotiating with and persuading others in communicative exchanges

EMERGING	EXPANDING	BRIDGING
<p><b>P1.7.3</b> Negotiate with or persuade others in conversations (e.g., to gain and hold the floor or ask for clarification) using learned phrases (e.g., <i>I think . . .</i>, <i>Would you please repeat that?</i>) and open responses.</p>	<p><b>Part 1.7.3</b> Negotiate with or persuade others in conversations (e.g., to provide counterarguments) using learned phrases (<i>I agree with X, but . . .</i>), and open responses,</p>	<p><b>Part 1.7.3</b> Negotiate with or persuade others in conversations using appropriate register (e.g., to acknowledge new information) using a variety of learned phrases, indirect reported speech (e.g., <i>I heard you say X, and I haven't thought about that before</i>), and open responses.</p>

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