

Grade 5: Life Science Module

Lesson Sequence 2: Defining Matter

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Overview

Total Time: 2 hours of instruction (divided into two sections)

In this lesson sequence, students collect evidence—by carrying out an investigation, reading an informational text, and participating in a Scientists Meeting—to support the claim that everything, including air, is made of matter. They learn the basics of the three states of matter: solid, liquid, gas. Students will use this learning to trace the flow of matter through ecosystems throughout the rest of the module.



Lesson Sequence Focusing Question and Big Ideas

What are the parts of an ecosystem made of?

- Many parts of an ecosystem are made up of matter. Sunlight and temperature are not matter, but living things are made up of matter, and material like water, air, soil, rocks, etc. are all matter. Matter is anything that has weight and takes up space.
- Air is matter because it takes up space and has weight.

Long-Term Learning Addressed (Based on NGSS)

Construct an argument with evidence that some parts of an ecosystem are made of matter. (Based on NGSS 5-PS1-1)

Note: This is the only lesson sequence aligned with 5-PS1-1 in this module. Depending on the needs of your students, they may need additional instruction to completely meet this standard.

This lesson sequence explicitly addresses:

Science and Engineering Practices:

- **Engaging in Argument:** Support an argument with evidence, data, or a model. *Students develop their own argument about which parts of an ecosystem are made of matter based on their own collected evidence. Note: This is not explicitly linked with 5-PS1-1.*
- **Obtaining, Evaluating, and Communicating Information:** Read and comprehend grade-appropriate complex texts to summarize and obtain scientific ideas and describe how they are supported by evidence. *Students read and summarize grade-appropriate text about states of matter to gather evidence to support their argument. Note: This is not explicitly linked with 5-PS1-1.*

Crosscutting Concepts:

- **Energy and Matter:** Matter is transported into, out of, and within systems. *Students do not yet learn how matter is transported within a system, but they do observe that matter has weight and takes up space. This will make it possible to understand how matter can be transported in subsequent lesson sequences. Note: This is not explicitly linked with 5-PS1-1.*

Disciplinary Core Ideas:

- **PS1.A: Structure and Properties of Matter:** Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. *Students observe a demonstration with balloons where they learn that matter cannot be seen but can still be measured.*

**Lesson Sequence Learning Target**

- I can collect evidence to support my own argument about what things in an ecosystem are made of.

Ongoing Assessment

- Student science notebook: Defining Matter entry
- Scientists Meeting: Building Understanding

Agenda**Total Time: 2 hours of instruction***Section 1***1. Opening**

A. Reviewing Learning Target and Focusing Question (20 minutes)

2. Carrying Out Investigations

A. Demonstrating Matter (40 minutes)

Optional Extension: Additional Experiments with Air

*Section 2***1. Obtaining Information**

A. Close Reading: “Three States of Matter” (30 minutes)

2. Engaging in Argument

A. Scientists Meeting: Building Understanding (30 minutes)

Teaching Notes**Purpose of lesson sequence and alignment to NGSS standards:**

- The purpose of this lesson is to give students basic background knowledge about what matter is (a Disciplinary Core Idea). It is aligned to **5-PS1-1**, which is not fully taught or addressed in this module but is essential for full understanding of **5-LS2-1**.
- In Section 1, students observe an investigation with balloons where they learn that air has matter because it takes up space and has weight.
- In Section 2, students obtain information through a text (a Science and Engineering Practice) that reiterates the properties of matter, describes the states of matter, and explains that matter is made of particles too small to see (a Crosscutting Concept). Students then synthesize their learning and create an oral argument (a Science and Engineering Practice) during a Scientists Meeting.

- In this lesson sequence, students begin two anchor charts that they will use throughout the Life Science module. The Concepts Scientists Think About anchor chart captures student learning about the Crosscutting Concepts or core ideas and patterns of thinking, that scientists use. The Scientists Do These Things anchor chart captures student learning about the Science and Engineering Practices explicitly taught within the Life Science Module.

How it builds on previous work in the Life Science Module:

- In the anchoring phenomenon, students observed parts of the ecosystem. In this lesson sequence, they discuss what those parts are made of—matter. This is necessary background knowledge for understanding the cycle of matter and energy and the food web—major components of the criteria for a healthy ecosystem.

How it connects to the CCSS Standards and EL Education’s Language Arts Grade 5 Module 2:

- The close read in Section 2 provides students the opportunity to practice reading informational texts and explaining the relationship between two or more ideas (CCSS ELA RI.5.3).
- The student science notebook is an opportunity for students to practice informative writing and gathering evidence (CCSS ELA W.5.2 and W.5.8).
- Students may be familiar with the Think-Pair-Share protocol from Language Arts Grade 5 Module 2. This protocol provides students the opportunity to practice speaking and listening skills (CCSS ELA SL.5.1).
- The Scientists Meeting in Section 2 provides students the opportunity to practice their speaking and listening skills while collaborating in whole group discussions (CCSS ELA SL.5.1).

Possible student misconceptions:

- Students may think that sound, light, and electricity are also examples of matter. This misconception is directly addressed in Section 2. Consider asking: “Does it take up space? Is there a way to measure its weight?”

Possible broader connections:

- Connect to students’ lives by providing examples of matter that students are invested in, such as their own bodies, air in a soccer ball, or a favorite solid snack and liquid drink.
- Connect to other sciences by discussing the importance of understanding matter in physical science (e.g., scientists who study how matter moves differently in various states).

Areas where students may need additional support:

- If your students have already developed models to show that matter is made up of particles too small to be seen, consider skipping this lesson or modifying it to better match what your students have already learned.
- For students who need additional support organizing their ideas in conversation, provide discussion questions from the Scientists Meeting in advance and provide ample processing time.

- Students will closely read a text in this lesson sequence. Some students may benefit from additional support. Consider these options:
 - For students who are overwhelmed by too much print on a page: Consider copying the text so that there is only one paragraph on each page, with an organized space for recording the gist and meanings of the unfamiliar words on that page.
 - For students who may need additional support with paraphrasing: Consider providing running notes on today's text.
 - Offer selected shorter passages to specific groups based on the readiness and needs of the group. This gives students an opportunity to read a complex text within the fifth-grade level span but differentiates the length of the text, not the complexity.
 - For students who may need additional support staying on pace during the close read: Consider gathering these students in one place in the room to support them quickly and quietly throughout the close-read portion of the lesson. Give prompts to help students stay on task, point out where the class is, or offer sentence frames as needed.
 - For ELLs and students who may need additional support with reading: Strategically pair students with a peer model.
 - For students who may need additional support determining the gist: Consider highlighting or underlining key phrases in their individual copy of the text in advance. This will lift the gist up for them.

Down the road:

- Students will return to the Concepts Scientists Think About anchor chart and the Scientists Do These Things anchor chart throughout the module.
- In this lesson sequence, students learn the basics of the three states of matter. In subsequent lessons, students will track the flow of matter in an ecosystem.
- In Lesson Sequence 3, students will design their own experiment to test what plants need to survive. Continue to care for enough seedlings for each group of three or four students to have a plant. Alternatively, seedlings can be purchased from a local nursery before Lesson Sequence 3.

In advance:

- Read each section and complete the Preparing to Teach: Self-Coaching Guide.
- Continue to establish expectations of behavior during group discussions and pair work.
- Construct a balance scale from a coat hanger by hanging a coat hanger from the ceiling of the classroom so that it can easily tip from side to side and then using binder clips or string to construct a way to attach objects to either side of the coat hanger balance (see supporting materials).
- Gather classroom objects with very different weights to demonstrate how the object with more weight tips the balance down during the balloon demonstration in Section 1.
- Prepare the Concepts Scientists Think About anchor chart and the Scientists Do These Things anchor chart (see supporting materials).
- Review the Think-Pair-Share protocol (see the Classroom Protocols pack on Curriculum. ELeEducation.org).

- Post: Lesson sequence focusing question and learning target, Life Science Module guiding question, Concepts Scientists Think About anchor chart, Scientists Do These Things anchor chart, and Criteria for Healthy Ecosystems anchor chart.

Optional extensions:

- *Additional Experiments with Air*. Watch and/or recreate this procedure: <http://www.pbslearningmedia.org/resource/phy03.sci.phys.matter.zlift/lifting-with-air/>

Vocabulary

matter: is made of particles, has weight, and takes up space

weight: how heavy something is

solid: has an unchanging shape

liquid: takes the shape of its container

gas: fills whatever space is available

state of matter: when particles are formed into a solid, liquid, or gas

relevant: relating to something; evidence that is relevant is on topic and makes sense

sufficient: enough; the evidence should provide enough information to be convincing

Materials

General Materials

- ✓ Student science notebook (from Lesson Sequence 1; one per student)
- ✓ Defining Matter entry (page 6 of student science notebook)
- ✓ Scientists Do These Things anchor chart (new; teacher-created; added to during Section 1; see supporting materials)
- ✓ “Three States of Matter” (one per student)
- ✓ Concepts Scientists Think About anchor chart (new; teacher-created; added to during Section 2; see supporting materials)
- ✓ Criteria for Healthy Ecosystems anchor chart (from Lesson Sequence 1; added to during Section 2; see supporting materials)

Science-Specific Materials (gathered by the teacher)

- ✓ Balloons (two; used in Section 1)
- ✓ Constructed balance from a coat hanger (used in Section 1; see supporting materials)
- ✓ Balance scale (optional; used in Section 1)
- ✓ Classroom objects with very different weights (two; used in Section 1)
- ✓ Tape (one 1/2-inch strip; used in Section 1)
- ✓ Teacher science notebook (from Lesson Sequence 1; for teacher reference)

Section 1: Opening

A. Reviewing Learning Target and Focusing Question (20 minutes)

- Direct students' attention to the posted lesson sequence focusing question and read it aloud as students following along, reading silently in their heads:
 - “What are the parts of an ecosystem made of?”
- Invite students to open their **student science notebook** to the **Defining Matter entry** and put their finger on the “Opening” section.
- Say:

“Our goal is to be able to assess and give suggestions to improve the health of an ecosystem. To do that, we need to better understand the parts of the ecosystem.”
- Ask:

“What are the parts of an ecosystem you observed in the Assessing the Health of an Ecosystem slideshow from the previous lesson sequence?”
- Invite students to record their thinking in the “Opening” section of their student science notebook.
- Cold call students to share out. As students share, capture their responses on a class list. Ensure the following are included in the list: water, soil, air, and light in addition to plants and animals (or examples of plants and animals).
- Ask:

“Now that we have a list of some of the parts of an ecosystem, let’s begin to think about what these things are made of. Who would like to share an idea of what something on this list is made of?”
- After students have discussed a few items on the list, ask ⁽¹⁾ ⁽²⁾:

“What does the word matter mean?” (Matter is anything that takes up space and has weight. This includes things we can see, like trees, and the things that are too small to be seen, like the particles that make up trees. So, a tree is both matter and made of matter.)
- Define *matter* as necessary ⁽³⁾.
- Redirect students' attention to the list the class generated and ask:

“What else is made of matter on this list?” (Responses will vary.)
- If students do not debate whether air and light are made of matter, consider asking ⁽⁴⁾:

“How do you know if air and light are made of matter? How can we prove that?”
- Assure students these questions will come up again later in the lesson.
- Invite students to return to the “Opening” section in their student science notebooks to record their final thoughts.
- Direct their attention to the posted lesson sequence learning target and read it aloud as students follow along, reading silently in their heads:
 - “I can collect evidence to support my own argument about what things in an ecosystem are made of.”
- Underline the word *argument* and tell students that creating arguments about their ideas is an important part of what scientists do ⁽⁵⁾.

- Direct students' attention to the posted **Scientists Do These Things anchor chart** and ask for a volunteer to read aloud the steps under "Engaging in Argument":
 - Preparing for the argument:
 1. Pose the question.
 2. Gather and identify evidence that answers the question.
 3. Evaluate whether that evidence is sufficient and relevant.
 - Making the argument:
 1. Make a claim (answer the question).
 2. Use the evidence and scientific reasoning to support the claim.
 3. Explain why the evidence is sufficient and relevant.
- Tell students that they have a question ("What are the parts of an ecosystem made of?") and now they need to identify what evidence will answer this question.
- Using a total participation technique, invite responses from the group:

"What do you think can be used as evidence?" (Responses will vary, but may include: observations, research about other scientists' ideas, experiments.)
- As students share out, capture their responses on the Scientists Do These Things anchor chart.
- Remind students that they should be thinking about this question as they work through this lesson sequence.

Preparing to Teach: Self-Coaching Guide

1. How do I want to get this idea of matter across? A tree might be a good thing to start with. Students may say that the tree is made of wood and leaves, at which point I can ask what those things are made of. As I get smaller, I'll be sure to end with: "... and this is made of matter too small to be seen."
2. How will I respond when students give correct or incorrect answers?
3. How can I transition to the definition without dismissing students' ideas or validating incorrect ideas?
4. What additional questions can I ask to focus student wondering on light and air?
5. How can I help my students see that a scientific argument is different from an argument they may have made socially?

Section 1: Carrying Out Investigation

A. Demonstrating Matter (40 minutes)

- Remind students that they are still considering whether air and light are made of matter. Tell them they will first try to figure out if air is made of matter.
- Remind students that matter has weight and takes up space.
- Invite students to brainstorm as a class:

“How might you prove that air does or does not take up space?”

- After 5 minutes, demonstrate that air can take up space by showing students a deflated **balloon** and then filling the balloon with air ⁽¹⁾.
- Invite students to record their observations about the balloon in the Defining Matter entry under the “Carrying Out Investigation” section.
- Tell students that you are now going to think of ways to prove that air has weight.
- First, ask probing questions about students’ understanding of weight. Consider asking:

“What do you know about weight?” (It’s how heavy something is.)***“How can you test if something has more weight than another thing?” (Put it on a balance; hold something in two hands and feel which thing pushes down on it more; weigh both objects using a scale and compare weights.)***

- Demonstrate how a balance works by showing students a **constructed balance from a coat hanger** or, if available, a real **balance scale**. Use **classroom objects with very different weights** (such as a piece of paper versus a book) to show students that the object with more weight tips the balance downward.
- Ask students to Think-Pair-Share with an elbow partner. Remind them that they used this protocol in the Language Arts modules. Review as necessary. Refer to the Classroom Protocols pack on Curriculum.ELeducation.org for the full version of the protocol.

Ask: “How might you prove that air has weight or does not have weight?”

- Demonstrate for students that two empty balloons weigh the same amount by using **tape** to affix one balloon on each side of the balance scale.
- Then fill one balloon with air and re-tape it to the balance scale.
- Invite students to record their observations in the Defining Matter entry under the “Carrying Out Investigation” section.
- Encourage student thinking by asking:

“What do you think would happen if the second balloon was blown up to be bigger than the one that is already inflated?” (It would have more air and weigh more.)***“If the balloon has weight, the air inside it must be made of something, even if we cannot see the air. What might that be?” (matter)***

- If students need further demonstration, consider filling both balloons with the same amount of air and attaching them to either side of the balance scale and then pricking one with a pin to slowly release the air.
- Invite students to record their observations from each trial in the Defining Matter entry under the “Carrying Out Investigation” section.
- To debrief, consider asking:

“Do you now have sufficient evidence to make an argument in response to the question of what everything in an ecosystem, including air, is made of? Matter? Why or why not?” (We have some evidence, but more evidence would make an argument stronger.)***“What additional evidence would make your argument stronger?” (Responses will vary.)***

- Remind students that they have not discussed sunlight, which is one of the parts of an ecosystem they identified on the class chart.

The Cycle of Matter and Energy in Healthy Ecosystems

- Lead students to understand that light is not matter. Consider asking students to turn and talk with an elbow partner:
 - “Is sunlight made of matter? Why or why not?” (Responses will vary.)*
 - “How would we weigh sunlight? What observation or data could we collect?” (There is no way to weigh light.)*
 - “Does it take up space? How would you prove that?” (There is no way to prove that light takes up space because it doesn’t.)*
 - “Could we fill the balloon with sunlight? Why or why not?” (No, you cannot because it has no matter.)*
- Clarify for students that things like light, sound, and electricity are not matter. Light is energy, and they will learn more about what energy has to do with healthy ecosystems in later lesson sequences ⁽²⁾.

Preparing to Teach: Self-Coaching Guide

1. After I try these demonstrations ahead of time, what potential problems may I have? How can I avoid those problems?
2. My students will revisit the difference between energy and matter several times. What lingering questions do my students seem to have? What will I ask when I revisit energy and matter in Lesson Sequence 4?

Section 2: Obtaining Information

A. Close Reading: “Three States of Matter” (30 minutes)

- Distribute the “**Three States of Matter**” text.
- Tell students that they will work hard as readers today to learn more about the types of matter and their characteristics. Their new learning may supply good evidence to support their argument that many parts of the ecosystem are made of matter.
- Remind students that when they read complex texts, they often need to read the text multiple times. Tell them that it’s okay if they do not understand everything the text says the first time ⁽¹⁾.
- Remind students of some of the close reading practices they follow in their Language Arts lessons:
 - Read small chunks of the text slowly and think about the gist.
 - Talk with my partner or group about the text.
 - Circle or underline words I don’t know.
 - Write notes or answer questions about the text.
- Refer students to the “Obtaining Information” section in the Defining Matter entry of their student science notebook. Let students know they are going to have the opportunity to independently read the text. Tell them to stop after each paragraph during this first read and jot the gist of that paragraph and any unfamiliar vocabulary in their notebook. Review and model finding the gist as necessary.

- Ask students to begin reading. Circulate and support them as they read and determine the gist.
- After 10 minutes, ask students to turn to and talk to an elbow partner ⁽²⁾:
“What gist notes or vocabulary words did you write down? What similarities and differences are there between our notes?”
- After 5 minutes, refocus whole class. Point out to students that their job is to learn everything they can about matter. Explain that they should gather as many *facts*, *definitions*, and *details* as they can as they read. Clarify these terms as needed ⁽³⁾.
- Tell students they are going to read the text again. This time, they should read closely for details, facts, and definitions to add to the Reading Closely about Three States of Matter graphic organizer in the Defining Matter entry of their science notebook.
- Consider doing a brief guided practice, as necessary ⁽⁴⁾.
- Ask students to begin reading. Circulate and support students as they read.
- After 10 minutes, invite students to Think-Pair-Share:
“What is one definition about matter you noticed in the first paragraph?” (Matter is anything that takes up space and has weight.)
- Continue this pattern for the following paragraphs as time allows.

Preparing to Teach: Self-Coaching Guide

1. How can I help my readers who need additional support?
2. What norms are in place for elbow partners? What would support my students to keep those norms?
3. What do my students understand about *facts*, *definitions*, and *details*?
4. What paragraph will I use for the guided practice?

Section 2: Engaging in Argument

A. Scientists Meeting: Building Understanding (30 minutes)

- Ask students to bring their science notebooks and gather for a Scientists Meeting.
- Using a total participation technique, invite responses from the group:
“What are the norms of a Scientists Meeting?” (take turns talking, build on one another’s ideas, disagree respectfully, ask questions to clarify information)
- Remind students that a Scientists Meeting is a conversation where they speak to one another as scientists and not just to the teacher ⁽¹⁾.
- Share with students that the goal of today’s meeting is to make meaning from the information they have learned from the demonstration and the informational text. Students also want to build understanding of the answer to their initial question of what the things, including the air and light, of an ecosystem are made of.
- Using a total participation technique, invite responses from the group:
“What is the lesson sequence focusing question we have been investigating?” (What are the parts of an ecosystem made of?)

- Direct students' attention to the Scientists Do These Things anchor chart and have a student read aloud the steps under "Making the argument."
 - Making the argument:
 1. Make a claim (answer the question).
 2. Use the evidence and scientific reasoning to support the claim.
 3. Explain why the evidence is relevant and sufficient.
- Using a total participation technique, invite responses from the group:

"Where will you find evidence to support your claim?" (my notes from the balloon demonstration and the close reading of "Three States of Matter")

"What does it mean to be relevant?" (relating to something; the evidence is on topic and makes sense)

"What does it mean to be sufficient?" (enough; the evidence we found should provide enough information to be convincing)
- Point out that part of thinking about whether or not evidence is sufficient is thinking about what additional evidence would make your argument more convincing.
- Tell students that they are ready to make their claim and use their evidence and scientific reasoning to support their claim.
- Invite them to turn to the "Engaging in Argument" section of the Defining Matter entry in their science notebook and take a few minutes to prepare an argument. They should write a claim, at least one piece of evidence with scientific reasoning, and explain whether or not it is sufficient.
- After 5–10 minutes, ask for volunteers to share out their arguments about matter. Remind students to cite evidence from their notebook to support their reasoning ⁽²⁾.
- As students share out, capture their thinking in the **teacher science notebook** and prompt them to see connections between one another's argument:

"Does anyone have something similar?"

"How are these ideas the same? How are they different?"

"Can someone paraphrase what Student A said?"

"Who thinks something similar or different?"

"Can you add to what Student A said?"
- After a few minutes of noticing and naming similarities, lead the class to consensus. Consider saying something like: "I'm seeing some patterns emerge. I think we're all agreeing that most things in an ecosystem are made of matter."
- Ask students to Think-Pair-Share with an elbow partner ⁽³⁾:

"Can someone put into words what things are classified as matter?" (Matter is what makes up everything that takes up space and has weight. Just about everything that we interact with is matter besides light, sound, and electricity.)
- Introduce the **Concepts Scientists Think About anchor chart** by telling students that there are certain concepts, or big ideas, that come up over and over again in science that scientists spend a lot of time thinking about.
- Tell students that matter and energy are among these topics.
- Record class understanding about matter on the Concepts Scientists Think About anchor chart: "Matter has weight and takes up space—almost everything is made of matter."

- Remind students of the module guiding question:
 - “How do we assess and improve the health of an ecosystem?”
- Direct students’ attention to the **Criteria for Healthy Ecosystems anchor chart**.
- Tell students that looking at the matter in an ecosystem is an important part of assessing the health of an ecosystem ⁽⁴⁾.
- Using a total participation technique, invite responses from the group:
 - “What is some of solid matter in an ecosystem?” (plants, animals, rocks, soil)*
 - “What is some of the liquid matter in an ecosystem?” (water, sweat)*
 - “What is some of the gas matter in an ecosystem?” (air)*
- Tell students that in the coming lesson sequences, they will see how these types of matter cycle through a healthy ecosystem.
- Add “The matter (solid, liquids, and gases) cycles in an ecosystem” to the Criteria for Healthy Ecosystems anchor chart.
- Invite students to return to their seats.

Preparing to Teach: Self-Coaching Guide

1. A Scientists Meeting is different from a regular group discussion. What group norms will I emphasize?
2. How familiar are my students with the steps of making an argument? Would they benefit from more scaffolding, like sentence stems?
 - Consider using these:
 - Claim: Many of the parts of the ecosystem are made of ____.
 - Evidence and Reasoning:
 - Reasoning: Matter is anything that _____.
 - Evidence: Solids, like _____, are matter because _____.
Liquids, like _____, are _____. Gases, like _____, are _____. Light is _____.
 - Therefore, (restate claim) _____.
 - Relevance and sufficiency: This evidence is sufficient because _____. **OR** Further evidence is needed because _____.
3. This conversation will set the stage for student learning about the way matter cycles in an ecosystem. What understanding of matter do I want my students to walk away with?
4. Note: How matter relates to the health of an ecosystem is an idea that students will return to multiple times throughout the module. Notice initial understanding, questions, or misconceptions, but do not correct students at this time.

Notes

Lesson Sequence 2

Lined area for taking notes.