

Lessons at a Glance

Science Content: Big Ideas

The Matter Unit concentrates on the following Big Ideas. Along with the scientific Habits of Mind discussed on pages 6–7, these concepts are reinforced throughout the unit. The lessons in which each Big Idea is introduced or is a major focus are indicated in parentheses.

Lessons

- Matter commonly exists in one of three states: solid, liquid, or gas. (Lessons 1, 5)
- Some properties help us classify matter as solid, liquid, or gas. (Lesson 2)
- All matter takes up space (has a volume) and has mass (which we usually measure by weight). (Lessons 3–6)
- Materials can be described in terms of their properties. (Lessons 3–4, 6, 14)
- Matter can change between states. (Lessons 7–9)
- Temperature affects the change of matter from one state to another. (Lessons 7, 9)
- Even if matter is not visible, it still exists. (Lessons 8–9)
- One way to answer a question is to design a simple experiment. (Lessons 10–11)
- When you mix materials together, the result weighs the same as the sum of the parts. (Lessons 12–13)
- A mixture can often be separated by the properties of the different materials in it. (Lessons 12–13)
- Sometimes when you mix materials together, you get a new material with different properties. (Lessons 14–15)

Skill Building Activities

- Paying attention to a book’s organization can assist reading comprehension. (Skill Building Activity: Reading Science Books)
- Observation is a powerful tool for learning about something. Detailed and accurate descriptions of your observations help you communicate them to others. (Skill Building Activity: Observing and Describing)
- Measurements are not exact, but trying to be accurate is one way scientists can make better comparisons of objects. (Skill Building Activity: Accurately Measuring Weight and Volume)
- Scientists write clear procedures so that others can understand what they did and accurately repeat their investigations. (Skill Building Activity: Writing Procedures)
- Scientists plan and design fair tests so they can determine how the one variable being changed affects the results of an experiment. (Skill Building Activity: Designing a Fair Test)
- Scientists form conclusions about the world based on evidence from their investigations and what they already know about the world. (Skill Building Activity: Forming Conclusions)

Lesson Overviews

The following overviews briefly summarize each lesson in the Matter Unit. Suggestions for scheduling and flexible implementation are shown in gray. An asterisk indicates a core lesson.

Lesson 0: Doing Science

Students sharpen their awareness of scientific thinking and become familiar with the “I Wonder” circle as they conduct a self-directed exploration and then reflect on the processes they engaged in. In the context of these experiences, they are introduced to the work of scientists and to the Science Companion “I Wonder” circle, which provides a visual representation of many of the facets of scientific inquiry, exploration, and discovery.

You can find Lesson 0 in the *Teacher Reference Materials*.

Lesson 1: What Is Matter?*

In this introductory lesson, students examine landscape scenes and brainstorm all of the materials they might find there. They sort and identify the materials as solid, liquid, or gas, and they think about how to define matter.

Consider teaching the Skill Building Activity “Reading Science Books” on pages 292–301 after this lesson to orient your students to the *Matter Student Reference Book*.

Lesson 2: Discovering the Properties of Matter*

Students compare an assortment of solids, liquids, and gases. They examine balloons filled with different materials, and write down descriptive words or phrases. Next, they open the balloons, explore the substances with a variety of tools, and record further observations and comparisons between the substances. Finally, they list the properties of solids, liquids, and gases.

This lesson is conducted over two sessions.

Consider teaching the Skill Building Activity “Observing and Describing” on pages 302–311 prior to this lesson.

Lesson 3: Exploring the Weight of Solids and Liquids*

Students explore weight, which is often used to measure the amount of matter in an object. They view a demonstration of weighing folded laundry, and predict whether it will weigh more, less, or the same after being unfolded and rumped. Students then carry out their own hands-on explorations by weighing and re-weighing modeling clay and connectable or stackable solids formed into different shapes, and by weighing and re-weighing water held in different shapes of containers. To synthesize the lesson, students discuss their predictions about whether changing the shape of a material changes its weight, and conclude that it does not when no new matter has been added.

The Explore section of this lesson can be taught during mathematics.

Teach the weight portions of the Skill Building Activity “Accurately Measuring Weight and Volume” on pages 312–327 prior to this lesson.

Lesson 4: Exploring the Volume of Solids and Liquids*

This lesson explores volume. Students begin by reviewing concepts from previous lessons in which materials changed shape, but did not change weight. Next, they see a demonstration of volume with base-10 blocks. In Session 2, students conduct an exploration for observing that a single solid maintains its volume, no matter how its shape is changed. They also see a demonstration of measuring the volume of a collection of solids.

This lesson is conducted over two sessions. The first session can be taught during mathematics.

Teach the volume portions of the Skill Building Activity “Accurately Measuring Weight and Volume” on pages 312–327 prior to this lesson.

Lesson 5: Investigating Air*

This lesson is devoted to exploring the properties of gases, using air as the most readily available gas. Students begin with a sensory exploration of breathing, noticing what happens to their bodies when they inhale and exhale air. They are challenged to design and complete a simple investigation that shows that air takes up space. In the optional final session they use syringes to compress and expand air.

This lesson can be conducted over two or three sessions.

Consider teaching the Skill Building Activity “Writing Procedures” on pages 328–335 prior to this lesson.

Lesson 6: Sensing Density

Students explore another property of matter: density. Through various experiences with objects made of different materials, they are introduced to the concept that density is how heavy or light an object is for its size. In Session 1, they compare two solid objects of the same size that have different weights, and then compare two solid objects with the same weight but different sizes. The students then rank objects of different sizes and materials according to how heavy or light the objects feel for their size. In Session 2, they weigh and compare equal volumes of liquids with different densities, and then reach some conclusions about this property of matter.

This lesson is conducted over two sessions.

Lesson 7: Heating and Cooling Solids and Liquids*

Students focus on the idea that heating and cooling can change the state of solids and liquids. They melt materials which are liquid at room temperature, then melt substances which are solid at room temperature. They notice that some substances return to a solid state when cooled again to room temperature. This lesson supplies the first example of how matter always keeps the same weight even when it changes state.

Lesson 8: Evaporation: Changing from Liquid to Gas*

Students investigate how water can become an invisible gas called water vapor. They observe and measure water as it evaporates in the classroom, and begin to think about variables that affect evaporation.

This lesson requires two sessions. Schedule the second session three days after the first session.

Lesson 9: Condensation: Changing from Gas to Liquid*

Students review the process of evaporation, and compare examples of evaporation and condensation. They conduct explorations focused on water changing states from gas to liquid. Students observe that water droplets form on the outside of a chilled container, and investigate where the water came from. They also observe condensation on chilled marbles, which clearly have no water inside them. By the end of the lesson, students can brainstorm additional examples of when water condenses out of the air.

Lesson 10: Evaporation Investigations: Setting Up*

Applying their knowledge of evaporation, students conduct investigations that explore the phenomenon in detail. They consider a number of variables that affect evaporation and then conduct a fair test to investigate their ideas. Students increase their scientific inquiry skills by collecting data in this lesson and using the data to draw conclusions in the next lesson.

Consider teaching this lesson in two sessions. Use the first session to discuss which variables to test and how to test them. Then have the students gather the supplies they need and use the second session to write the procedures and set up the experiment.

Lesson 11: Evaporation Investigations: Drawing Conclusions*

Students collect and record the final data for the evaporation investigations they designed. They analyze the results of their fair test experiment to draw conclusions and present their results to the class.

Schedule this lesson two or three days after the previous lesson.

Consider teaching the Skill Building Activity “Forming Conclusions” on pages 346–359 prior to this lesson.

Lesson 12: Mixing and Separating Solids*

In this lesson, students begin by describing the properties they observe of three different kinds of solids. They weigh the samples separately, then combine the samples in a mixture, and weigh them again. Students then use the properties of the different solids, including whether or not the solid is magnetic and whether the solid floats or sinks in water, to separate the mixture.

Lesson 13: Mixing and Separating Solutions*

Mixing and separating solids and liquids are the main methods for learning about matter in this lesson. Students compare a mixture in which the materials (sand and water) remain distinct to a mixture in which the materials (salt and water) form a solution. Two activities follow: an exploration in which students create a solution, and another where they evaporate the water from the solution and examine the solid salt crystals left behind.

Since it takes 20–40 minutes for the water to evaporate water out of a teaspoon of salt/water solution on a cup warmer, plan to move on to another activity and return to finish the lesson, or conduct the lesson in two sessions.

Lesson 14: Whatzit?!

Students investigate a mixture called “Whatzit” and find that it has properties unlike any other materials explored in the unit. They perform some investigations to determine whether Whatzit is a solid or a liquid. Depending on how they manipulate the Whatzit, they find that it is sometimes more like a solid and sometimes more like a liquid. Their experiences with this unusual material challenges students’ understanding of solids, liquids, and mixtures. It also offers a brief exposure to the many different types of matter in the world that don’t conform to people’s expectations.

Lesson 15: Chemical Changes

While observing examples of chemical changes, students learn how a chemical change is different from the physical changes they explored in previous lessons. They see an apple get brown when exposed to air, form a precipitate from mixing tea and pineapple juice, and create a gas by mixing vinegar and baking soda.

Skill Building Activity: Reading Science Books

Students familiarize themselves with the organization and layout of the *Matter Student Reference Book*. They are encouraged to look through each section before they begin reading so they can use visual and text cues—such as headings, margin notes, and illustrations—to help understand the material and its relationship to what they already know.

Ongoing reading strategies to help children absorb new information and vocabulary are included at the end of the lesson.

Skill Building Activity: Observing and Describing

Observation is a powerful tool for learning about something. Detailed and accurate descriptions of your observations help you communicate them to others.

Skill Building Activity: Accurately Measuring Weight and Volume*

Taking accurate measurements of volume and weight and using graduated cylinders, beakers, calibrated cups, and scales are the skills students practice in this lesson. They compare their observations with observations made by others, and evaluate the accuracy of their measurements to learn that measurements are not exact.

This Skill Building Activity teaches prerequisite skills for Lessons 3 and 4.

Skill Building Activity: Writing Procedures

Many investigations require students to follow written procedures or to write their own. In this lesson, students write procedures for making a peanut butter and jelly sandwich, and then watch a “robot” follow them. By seeing unexpected outcomes, the lesson helps them understand what makes an accurate written procedure.

Skill Building Activity: Designing a Fair Test*

An important aspect of any scientific experiment is designing a fair test. In this lesson, students analyze elements of an unfair test and discuss ways to make the test fair. They identify variables that could affect how high a ball bounces and strategize about how to change only one variable while keeping all other parts of the experiment the same.

Unless your students have prior experiences in designing a fair test, this Skill Building Activity is recommended before Lesson 10.

Skill Building Activity: Forming Conclusions

Students, using data provided to them, form and write conclusions. They evaluate their conclusions to check whether they are clear, supported by the data and logical reasons, and seem plausible based on previous knowledge. Finally, they consider what kind of new data they would need to verify their conclusions or to answer new questions.