INTRODUCTION

The Air and Weather Module provides experiences that heighten primary students’ awareness, curiosity, and understanding of Earth’s dynamic atmosphere and provides opportunities for young students to engage in scientific and engineering practices. Students explore the natural world by using simple instruments to observe and monitor change. In this module, students will

- Discover properties of air by observing interactions of air with objects.
- Demonstrate that compressed air can be used to make things move.
- Construct parachutes, pinwheels, and kites, and observe how they interact with air.
- Use weather instruments, including a thermometer, an anemometer, and a wind vane, to measure air conditions.
- Observe and describe daily weather on a calendar; record observations using pictures, words, and data.
- Graph weather observations to look for patterns in local weather conditions, precipitation, and temperature throughout the seasons.
- Monitor and record the changing appearance of the Moon over a month.
### AIR AND WEATHER — Overview

<table>
<thead>
<tr>
<th>Module Summary</th>
<th>Focus Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inv. 1: Exploring Air</strong></td>
<td>Students explore properties of a common gas mixture—air. Using vials, syringes, and tubing, students experience air as matter, discovering that it takes up space and can be compressed, and that compressed air builds up pressure that can push objects around. They construct and compare parachutes and balloon rockets that use air.</td>
</tr>
<tr>
<td><strong>Inv. 2: Observing Weather</strong></td>
<td>Students use instruments to observe and record weather over 4–8 weeks on a class calendar and in science notebooks. Students monitor temperature with a thermometer and rainfall with a rain gauge. They learn to identify three basic cloud types by matching their observations with a cloud chart.</td>
</tr>
<tr>
<td><strong>Inv. 3: Wind Explorations</strong></td>
<td>Students look for evidence of moving air. They observe and describe wind speed using pinwheels, an anemometer, and a wind scale. They observe bubbles and construct wind vanes to find the wind's direction. Students feel the strength of the wind and the direction it is moving by flying kites.</td>
</tr>
<tr>
<td><strong>Inv. 4: Looking for Change</strong></td>
<td>Students organize monthly weather data, using graphs to describe weather trends. They continue to monitor weather throughout the year, to compare the seasons and look for weather patterns. At home, they make observations of the night sky, looking for observable changes in weather conditions as well as in objects in the sky (the Sun, the Moon, and the stars). Students are introduced to the changing location of the Sun in the sky and the changing appearance of the Moon.</td>
</tr>
</tbody>
</table>
## Module Matrix

<table>
<thead>
<tr>
<th>Content</th>
<th>Reading</th>
<th>Assessment</th>
</tr>
</thead>
</table>
| • Air is a gas and is all around us.  
• Air is matter and takes up space.  
• Air makes objects move.  
• Air moves from place to place. Moving air is wind.  
• Air resistance affects how things move.  
• Air can be compressed.  
• The pressure from compressed air can move things, including water. | Science Resources Book  
"What Is All around Us?" | Embedded Assessment  
Teacher observation  
Scientific practices  
Benchmark Assessment  
Investigation 1 I-Check |
| • Weather describes conditions in the air outside.  
• Meteorologists study the weather.  
• Temperature is measured with a thermometer.  
• Clouds are made of liquid water drops that fall to Earth as rain. Wind moves clouds in the sky.  
• Rain gauges measure the amount of rain or snow.  
• Natural sources of water include streams, rivers, lakes (fresh water), and the ocean (salt water). | Science Resources Book  
"Clouds"  
"What Is the Weather Today?"  
"Water in the Air" | Embedded Assessment  
Teacher observation  
Scientific practices  
Benchmark Assessment  
Investigation 2 I-Check |
| • Wind is moving air.  
• Bubbles can show the changing direction and speed of the wind.  
• Meteorologists use a wind scale to describe wind strength, anemometers to measure wind speed, and a wind vane to indicate wind direction.  
• A wind vane points in the direction the wind is coming from.  
• Wind lifts kites up into the sky. | Science Resources Book  
"Understanding the Weather" | Embedded Assessment  
Teacher observation  
Scientific practices  
Benchmark Assessment  
Investigation 3 I-Check |
| • The Moon can be seen sometimes at night and sometimes during the day. It looks different every day, but looks the same again about every 4 weeks.  
• There are more stars in the sky than anyone can easily count.  
• The Sun and Moon can be observed moving across the sky; we see them at different locations in the sky, depending on the time of day or night.  
• Each season has a typical weather pattern that can be observed, compared, and predicted.  
• The Sun heats Earth during the day.  
• The weather affects animals and plants. | Science Resources Book  
"Changes in the Sky"  
"Seasons"  
"Resources"  
"Getting through the Winter" | Embedded Assessment  
Teacher observation  
Scientific practices  
Benchmark Assessment  
Investigation 4 I-Check |
FOSS CONCEPTUAL FRAMEWORK

FOSS has conceptual structure at the module level. The concepts are carefully selected and organized in a sequence that makes sense to students when presented as intended. In the last half decade, research has focused on learning progressions. The idea behind a learning progression is that core ideas in science are complex and wide-reaching—ideas such as the structure of matter or the relationship between the structure and function of organisms. From the age of awareness throughout life, matter and organisms are important to us. There are things we can and should understand about them in our primary school years, and progressively more complex and sophisticated things we should know about them as we gain experience and develop our cognitive abilities. When we can determine those logical progressions, we can develop meaningful and effective curriculum.

FOSS has elaborated learning progressions for core ideas in science for kindergarten through grade 6. Developing the learning progressions involves identifying successively more sophisticated ways of thinking about core ideas over multiple years. “If mastery of a core idea in a science discipline is the ultimate educational destination, then well-designed learning progressions provide a map of the routes that can be taken to reach that destination” (National Research Council, A Framework for K–12 Science Education, 2011). Most of this work is behind the scenes, never seen by the user of the FOSS Program. It does surface, however, in two places: (1) the conceptual framework represents the structure of scientific knowledge taught and assessed in a module, and (2) the conceptual flow is a graphic and narrative description of the sequence of ideas, presented in the Background for the Teacher section of each investigation.

The FOSS modules are organized into three domains: physical science, earth science, and life science. Each domain is divided into two strands, which represent a core scientific idea, as shown in the columns in the table: matter/energy and change, dynamic atmosphere/rocks and landforms, structure and function/complex systems. The sequence of modules in each strand relates to the core ideas described in the national framework. Modules at the bottom of the table form the foundation in the primary grades. The core ideas develop in complexity as you proceed up the columns.
In addition to the science content framework, every module provides opportunities for students to engage in and understand scientific practices, and many modules explore issues related to engineering practices and the use of natural resources.

**Asking questions and defining problems**
- Ask questions about objects, organisms, systems, and events in the natural and human-made world (science).
- Ask questions to define a problem, determine criteria for solutions, and identify constraints (engineering).

**Planning and carrying out investigations**
- Plan and conduct investigations in the laboratory and in the field to gather appropriate data (describe procedures, determine observations to record, decide which variables to control) or to gather data essential for specifying and testing engineering designs.

**Analyzing and interpreting data**
- Use a range of tools (numbers, words, tables, graphs, images, diagrams, equations) to organize observations (data) in order to identify significant features and patterns.

**Developing and using models**
- Use models to help develop explanations, make predictions, and analyze existing systems, and recognize strengths and limitations of the models.

**Using mathematics and computational thinking**
- Use mathematics and computation to represent physical variables and their relationships.

**Constructing explanations and designing solutions**
- Construct logical explanations of phenomena, or propose solutions that incorporate current understanding or a model that represents it and is consistent with the available evidence.

**Engaging in argument from evidence**
- Defend explanations, formulate evidence based on data, examine one’s own understanding in light of the evidence offered by others, and collaborate with peers in searching for explanations.

**Obtaining, evaluating, and communicating information**
- Communicate ideas and the results of inquiry—orally and in writing—with tables, diagrams, graphs, and equations and in discussions with peers.

_Air and Weather Module_
CONCEPTUAL FRAMEWORK in Air and Weather

Energy from the Sun

One significant energy source provides heat to Earth—the Sun. The amount of solar radiation transferred to Earth’s land, air, and water depends on a number of variables, including the time of day (no transfer to Earth at night), time of year, degree of cloud cover, nature of the surface on which the solar radiation falls, and efficiency of transfer from land and water to air.

Solar energy comes to Earth in the form of radiation waves. Different wavelengths have different amounts of energy. The bulk of the radiation streaming out from the Sun is in the range of wavelengths we recognize as visible light and the wavelengths just outside that range. Wavelengths just longer than we can see are infrared, and wavelengths just shorter than we can see are ultraviolet.

On a clear day, visible light passes through the atmosphere virtually unimpeded, to fall on the land and sea. Visible light is absorbed by land and water, warming Earth’s surface. Warm land and water release energy to the atmosphere in the form of infrared radiation. This process is called reradiation.

Infrared radiation is absorbed by water vapor in the atmosphere. The water molecules heat up. Warm water molecules “share” their heat with the other air molecules (primarily nitrogen and oxygen) when they collide with them. The atmosphere is heated indirectly by energy from the Sun.

For primary students, it is sufficient to point out that they are warm when they stand in the sunshine. Extend this warming experience to embrace all things on which the Sun shines, including the land, air, and water.

Air and Weather

Air and weather are inseparable. Air is a gas and, like all gases, is invisible and fills the space it’s in. Weather is the result of what is going on in the air around us. Is it hot or cold? Temperature is measured by using a thermometer to see how hot the air is. Is it calm, breezy, or blustery? Wind is an indicator of the force and direction of the movement of air. Is it foggy, rainy, or snowy? These words describe the
amount and condition of the water in the air. Without air, there is no weather. This is an understanding that should begin to develop with primary students.

Stated more precisely, weather is the condition of the atmosphere at a particular location at a specific time. Earth’s atmosphere is air, a complex gaseous layer that forms the outermost part of the planet. The atmosphere extends from the surface of Earth out to a distance of about 800 kilometers (km). If Earth were an apple, the skin would represent the thickness of the atmosphere. The atmosphere doesn’t end in an absolute way, however; it gets thinner and thinner as one moves away from Earth, until it becomes so thin that for all practical purposes it ends. The part of the atmosphere that meteorologists are most concerned is the first 15 km, known as the troposphere. It is here that just about all of what we know as weather takes place.

Earth’s atmosphere is an earth material. It has been here as long as Earth itself, but its composition has changed radically over time. The original atmosphere was composed of carbon dioxide, water vapor, and ammonia. As time passed, water vapor that originated within Earth was ejected into the atmosphere in great quantities as a result of volcanism at Earth’s surface. Earth was a violent, inhospitable place with high temperatures, poisonous gases for an atmosphere, and water only in the gaseous state.

Eventually Earth and its atmosphere cooled to the point where the water vapor could condense into liquid, and it started to rain. So great was the moisture concentration in the atmosphere that it rained hard and continuously for several million years! When the rain stopped, Earth had a different look—it was a water planet with a vast ocean covering much of the surface.

About 4 billion years ago, life emerged on Earth, changing the composition of the atmospheric gases again. Plants produced a by-product
of photosynthesis, oxygen, that became a prominent part of the atmospheric mix, and the ammonia was reduced to nitrogen and water. Today nitrogen is the predominant gas in air at about 78%, with oxygen making up the bulk of the remaining 22%. Dozens of other gases, including ammonia, methane, carbon dioxide, sulfur dioxide, helium, and hydrogen, are present in air in small quantities.

Primary students will be interested in exploring the air around them today. As they explore the phenomena on a macroscopic level, they can begin to build models. Air, like all gases, can be compressed. This means the particles can be pushed closer together, so that a quantity of gas takes up less space. The application of pressure can push a large quantity of air into a small space, as a bicycle pump compresses air and forces it into a tire or a balloon pump pushes air into a balloon.

**Energy and Weather**

An atmosphere of air is not going to produce weather without one additional critically important component: a source of energy to make things happen. On Earth, that energy source is the Sun. The Sun puts the air into motion (wind) and brings other materials into the air to contribute to the weather. So let’s make some weather.

Water vapor, a gas, is always being injected into the atmosphere. Solar energy evaporates water from lakes, rivers, the ocean, and wet surfaces. Plants transpire water vapor, and animals exhale it. This water in gaseous form joins the other gases in the air. It is a fact of nature that warm air can hold more water vapor than cold air can. The amount of water in air is called humidity. Humid air is less dense than dry air, and warm air is less dense than cool air, so warm, humid air will rise.

As air rises, it cools. Cool air holds less vapor, so the vapor begins to condense as tiny droplets of liquid water on dust particles in the air. When this happens, the invisible water vapor becomes visible as clouds. When conditions are right, perhaps in the mountains, you can watch clouds form as condensation occurs. If conditions change, you can watch clouds disappear as they return to vapor.

If the cloud is relatively warm, water will continue to condense, and tiny droplets will join together until they are big enough to fall. If the cloud cools until the condensing water freezes, the accumulation of ice will eventually yield to gravity and head for Earth. If the air is cold all the way down, we see snow. If the air warms and the snow melts, we see rain. If turbulence tosses the snow back up several times, ice crystals may stick together to form hail.
Observation and Forecasting

Primary students will be able to make meaningful observations of the weather in their neighborhoods and will learn some fundamental facts about the behavior of air, but they are unlikely at this stage in their cognitive development to put the two together to understand some of the fundamental principles that drive the weather. They will, however, be excited about extreme and catastrophic weather.

When young students see TV reports of tornadoes and hurricanes, they may recognize them as winds and know that they are the result of air in motion—serious high-speed motion. The causes of such dramatic winds—the clashes of warm and cold fronts or the juxtaposition of high- and low-pressure areas—will escape them. When they see reports of droughts, floods, or intense blizzards, they recognize them as extensions of sunny, rainy, and snowy weather, but at levels usually beyond their personal experience. They start to develop an understanding of the extremes of weather as a result of their studies of local weather.

Every subject of science that students are exposed to could develop into a lifelong interest. Meteorology has evolved into a highly technical field requiring extensive academic preparation in atmospheric science, earth science, physics, and computers. With each passing year, the importance of long-range weather forecasting increases, so a student bitten by the weather bug could go on to make a satisfying career out in the weather.

Weather is the result of well-understood physical principles. That’s why weather prediction has evolved into such a precise science. . . . Well, at least we are making progress.
Up in the Sky

The objects in the sky that we can observe directly include the Sun, the Moon, and the stars. The Sun is the most reliable and predictable of the bunch, and the easiest to find. Primary students might know that it “comes up” in the morning, is high overhead at midday, and “goes down” at night. They might know where to look for it during the day, and might be able to predict when and where it will rise the next day. They might not realize, however, that the height to which the Sun rises above the southern horizon changes with the season. Because of the tilt of Earth’s axis, North America shifts position until the Sun is more directly overhead as the summer solstice approaches. And the converse is true—the Sun dips lower and lower in the noon sky as the winter solstice approaches.

The Moon is a trickier companion. It is visible sometimes at night and sometimes during the day. In fact, the Moon splits each month evenly between day and night. The Moon’s shape also appears to change with the Moon’s time of arrival and departure in the sky. The changes in shape are known as phases, and one complete pass through the phases, the lunar cycle, takes about 4 weeks. Students can observe the Moon in three of its four key phases—first quarter, full Moon, and third quarter, each occurring 1 week apart. The new Moon, the fourth key phase, is invisible and is an important part of the lunar cycle. The cycle of phases is a product of the Moon’s 4-week orbit around Earth.

The Moon before the first quarter and after the third quarter is in the crescent phase, and the rounding Moon before and after the full Moon is in the gibbous phase. The Moon is said to be waxing as the visible portion increases from new to full, and waning from full to new. Understanding why we see phases of the Moon is hard because it involves the relative position and motions of the Sun, Earth, and the Moon. The mechanism of Moon phases is conceptually difficult for primary students, but they can successfully observe and record the changing shapes and observe the overall pattern of the changes in the Moon’s appearance.
On a dark night, a human can typically see 1,000–2,000 stars. This is a minute fraction of the several hundred billion stars in our galaxy. The intensity of light reaching Earth from most of them is so low that it simply cannot stimulate a photoreceptor. When a telescope, a powerful light-capturing instrument, is positioned between the view of the sky and the eye, stars in the deepest reaches of the galaxy snap into view, and details appear on closer objects, like the Moon, planets, and the Sun.

Earth Science, Earth’s Place in the Universe: Air and Weather

Structure

Concept A  Earth is part of a planetary system in the universe.
  • The Sun provides Earth with light and heat. The Sun can be observed from Earth only during the day.
  • The Moon can be seen sometimes at night and sometimes during the day. It looks different every day, but looks the same again about every 4 weeks.
  • There are more stars in the sky than anyone can easily see or count.

Interactions

Concept A  Patterns of change and apparent motion can be observed, described, and explained with models.
  • The Sun and Moon can be observed moving across the sky; we see them at different locations in the sky, depending on the time of day or night.
This table shows the five FOSS modules and courses that address the content sequence “dynamic atmosphere” for grades K–8. Running through the sequence are the two progressions—structure of Earth, and Earth interactions. The supporting elements in each module (somewhat abbreviated) are listed. The elements for the **Air and Weather Module** are expanded to show how they fit into the sequence.

<table>
<thead>
<tr>
<th>Module or course</th>
<th>Structure of Earth</th>
<th>Earth interactions</th>
</tr>
</thead>
</table>
| **Weather and Water** | - Weather is the condition of Earth's atmosphere at a given time in a local place; climate is the range of an area's weather conditions over years.  
- Weather happens in the troposphere.  
- Density is a ratio of a mass and its volume.  
- The angle at which light from the Sun strikes the surface of Earth is the solar angle. | - Complex patterns of interactions determine local weather patterns.  
- Energy transfers from one place to another by radiation and conduction.  
- Convection is the circulation of a fluid that results from energy transfer in a fluid.  
- When air masses of different densities meet, weather changes.  
- The Sun’s energy drives the water cycle and weather. |
| **Weather on Earth** | - Weather is described in terms of variables including temperature, humidity, wind, and air pressure.  
- Scientists observe, measure, and record patterns of weather to make predictions.  
- The Sun is the major source of energy that heats Earth; land, water, and air heat up at different rates.  
- Most of Earth’s water is in the ocean. | - The different energy-absorbing properties of earth materials lead to uneven heating of Earth’s surface and convection currents.  
- Evaporation and condensation contribute to the movement of water through the water cycle.  
- Climate—the range of an area's typical weather conditions—is changing globally; this change will impact all life. |
| **Water** | - Water is found almost everywhere on Earth, e.g., vapor, clouds, rain, snow, ice.  
- Water expands when heated, contracts when cooled, and expands when frozen.  
- Cold water is more dense than warmer water; liquid water is more dense than ice.  
- Soils retain more water than rock particles alone. | - Water moves downhill; the steeper the slope, the faster water moves.  
- Ice melts when heated; liquid water freezes when cooled.  
- Evaporation is the process by which liquid (water) changes into gas (water vapor).  
- Condensation is the process by which gas (water vapor) changes into liquid (water). |
| **Air and Weather** | - Weather is the condition of the air outside; weather changes.  
- Temperature is how hot or cold it is, and can be measured with a thermometer.  
- Wind is moving air; wind socks indicate direction and speed. | - Each season has typical weather conditions that can be observed, compared, and predicted.  
- Trees change through the seasons. |
| **Trees and Weather** | | |

**Note:**
- **Dynamic Atmosphere** is the sequence of learning about the atmosphere and climate.  
- **Structure of Earth** and **Earth interactions** are the two progressions running through the sequence.
The **Air and Weather Module** aligns with the **NRC Framework**. The module addresses these K–2 grade band endpoints described for core ideas from the national framework for **Earth’s systems** and **Earth and human activity**.

**Earth Science**

**Core idea ESS2: Earth’s systems—How and why is Earth constantly changing?**

- **ESS2.C:** *How do the properties and movements of water shape Earth’s surface and affect its systems?* [Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.]

- **ESS2.D:** *What regulates weather and climate?* [Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.]

**Core idea ESS3: Earth and human activity—How do Earth’s surface processes and human activities affect each other?**

- **ESS3.B:** *How do natural hazards affect individuals and societies?* [Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that communities can prepare for and respond to these events.]

---

<table>
<thead>
<tr>
<th>Structure of Earth</th>
<th>Earth interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air is a gas and is all around us.</td>
<td>The Sun heats Earth during the day.</td>
</tr>
<tr>
<td>Air is matter and takes up space.</td>
<td>Wind is moving air.</td>
</tr>
<tr>
<td>Weather describes conditions in the air outside; it occurs both during the day and night.</td>
<td>The pressure from compressed air can move things; air resistance affects how things move.</td>
</tr>
<tr>
<td>Weather conditions (temperature, wind, snow, rain) can be measured using tools such as thermometers, wind vanes, anemometers, and rain gauges.</td>
<td>Daily changes in temperature, precipitation, and weather type can be observed, compared, and predicted.</td>
</tr>
<tr>
<td>Clouds are made of liquid water drops.</td>
<td>Each season has typical weather conditions that can be observed, compared, and predicted.</td>
</tr>
<tr>
<td>Natural sources of water include streams, rivers, lakes, and the ocean.</td>
<td>Weather affects animals and plants.</td>
</tr>
</tbody>
</table>
This table shows the four FOSS modules and courses that address the content sequence “Earth’s place in the universe” for grades K–8. Running through the sequence are the two progressions—structure and interactions. The supporting elements in each module (somewhat abbreviated) are listed. The elements for the Air and Weather Module are expanded to show how they fit into the sequence.

<table>
<thead>
<tr>
<th>Module or course</th>
<th>Structure</th>
<th>Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planetary Science</td>
<td>• Earth and Sun are part of the Milky Way galaxy; many such systems exist in the universe. Gravity holds objects in orbit. Earth’s axis tilts at an angle of 23.5° and points toward the North Star. The Moon has surface features that can be identified in telescope images. Location or position can be described in terms of a frame of reference. Scale can be expressed as a ratio when an object and its representation are measured in related units. The temperature on planets in the solar system depends on two major variables—the distance from the Sun and the nature of the planet’s atmosphere.</td>
<td>• Patterns of apparent motion of the Sun, the Moon, and stars can be observed, described, predicted, and explained with models. Models of the solar system can explain tides, eclipses of the Sun and Moon, and motion of the planets relative to the stars. Earth’s spin axis is fixed in direction but tilted relative to its orbit around the Sun; seasons are a result of that tilt, as is differential intensity of light in different areas of Earth during the year. Earth and the Moon have been and continue to be bombarded by meteoroids at the same rate. The solar system formed during a sequence of events that started with a nebula.</td>
</tr>
<tr>
<td>Sun, Moon, and Planets</td>
<td>• The Moon can be observed both day and night, but the Sun only during the day. Moon phase is the portion of the illuminated half of the Moon that is visible from Earth. The solar system includes the Sun and other objects that orbit it (Earth and the Moon, other planets, moons, asteroids) Stars are at different distances from Earth. The position of stars relative to one another creates patterns (constellations).</td>
<td>• Shadows change (length and direction) during the day because the position of the Sun changes in the sky. The cyclical change between day and night is the result of a rotating Earth in association with a stationary Sun. The pulling force of gravity keeps the planets and other objects in orbit. Moon phases have a monthly cycle. Earth revolves around the Sun, so we see different stars during each season.</td>
</tr>
<tr>
<td>Air and Weather</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trees and Weather</td>
<td>• Objects can be seen in the sky.</td>
<td>• Trees change through the seasons.</td>
</tr>
</tbody>
</table>
The module addresses these K–2 grade band endpoints described for core ideas in the national framework for Earth’s place in the universe.

Earth and Space Sciences

Core idea ESS1: Earth’s place in the universe—What is the universe and what is Earth’s place in it?

• ESS1.A: What is the universe, and what goes on in stars? [Patterns of the motion of the Sun, Moon, and stars in the sky can be observed, described, and predicted. At night, one can see the light coming from many stars with the naked eye, but telescopes make it possible to see many more and to observe them and the Moon and planets in greater detail.]

• ESS1.B: What are the predictable patterns caused by Earth’s movement in the solar system? [Seasonal patterns of sunrise and sunset can be observed, described, and predicted.]

Engineering, Technology, and Application of Science

Core idea ETS2: Links among engineering, technology, science, and society—How are engineering, technology, science, and society interconnected?

• ETS2.A: What are the relationships among science, engineering, and technology? [People encounter questions about the natural world every day. There are many types of tools produced by engineering that can be used in science to answer these questions through observations or measurement.]

<table>
<thead>
<tr>
<th>Structure</th>
<th>Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Moon can be seen sometimes at night and sometimes during the day. It looks different every day, but looks the same again about every 4 weeks.</td>
<td>The Sun and Moon can be observed moving across the sky; we see them at different locations in the sky, depending on the time of day or night.</td>
</tr>
<tr>
<td>There are more stars in the sky than anyone can easily see or count.</td>
<td></td>
</tr>
<tr>
<td>The Sun can be seen only in the daytime.</td>
<td></td>
</tr>
</tbody>
</table>
FOSS COMPONENTS

Teacher Toolkit

The *Teacher Toolkit* is the most important part of the FOSS Program. It is here that all the wisdom and experience contributed by hundreds of educators has been assembled. Everything we know about the content of the module, how to teach the subject, and the resources that will assist the effort are presented here. Each toolkit has three parts.

*Investigations Guide.* This spiral-bound document contains these chapters.

- Overview
- Materials
- Investigations (four in this module)

*Teacher Resources.* This three-ring binder contains these chapters.

- FOSS Introduction
- Assessment
- Science Notebooks in Grades K–2
- Science-Centered Language Development
- Taking FOSS Outdoors
- FOSSweb and Technology
- Science Notebook Masters
- Teacher Masters
- Assessment Masters

The chapters contained in *Teacher Resources* and the Spanish duplication masters can also be found on FOSSweb (www.FOSSweb.com).

*Science Resources book.* One copy of the student book of readings is included in the *Teacher Toolkit.*

Equipment Kit

The FOSS Program provides the materials needed for the investigations, including metric measuring tools, in sturdy, front-opening drawer-and-sleeve cabinets. Inside, you will find high-quality materials packaged for a class of 32 students. Consumable materials are supplied for two uses before you need to restock. You might be asked to supply small quantities of common classroom items.
FOSS Science Resources Books

*FOSS Science Resources: Air and Weather* is a book of original readings developed to accompany this module. The readings are referred to as articles in the *Investigations Guide*. Students read the articles in the book as they progress through the module. The articles cover a specific concept, usually after that concept has been introduced in an active investigation.

The articles in *Science Resources* and the discussion questions provided in the *Investigations Guide* help students make connections to the science concepts introduced and explored during the active investigations. Concept development is most effective when students are allowed to experience organisms, objects, and phenomena firsthand before engaging the concepts in text. The text and illustrations help make connections between what students experience concretely and the ideas that explain their observations.

FOSSweb and Technology

The FOSS website opens new horizons for educators, students, and families, in the classroom or at home. Each module has an interactive site where students and families can find instructional activities, interactive simulations and virtual investigations, and other resources. FOSSweb provides resources for materials management, general teaching tools for FOSS, purchasing links, contact information for the FOSS Project, and technical support. You do not need an account to view this general FOSS Program information. In addition to the general information, FOSSweb provides digital access to PDF versions of the *Teacher Resources* component of the *Teacher Toolkit* and digital-only resources that supplement the print and kit materials.

Additional resources are available to support FOSS teachers. With an educator account, you can customize your homepage, set up easy access to the digital components of the modules you teach, and create class pages for your students with access to tutorials and online assessments.

Ongoing Professional Development

The Lawrence Hall of Science and Delta Education are committed to supporting science educators with unrivaled teacher support, high-quality implementation, and continuous staff-development opportunities and resources. FOSS has a strong network of consultants who have rich and experienced backgrounds in diverse educational settings using FOSS. Find out about professional-development opportunities on FOSSweb.

*Air and Weather Module*
FOSS INSTRUCTIONAL DESIGN

Each FOSS investigation follows a similar design to provide multiple exposures to science concepts. The design includes these pedagogies.

- Active investigation, including outdoor experiences
- Recording in science notebooks to answer the focus question
- Reading in FOSS Science Resources
- Assessment to monitor progress and motivate student reflection on learning

In practice, these components are seamlessly integrated into a continuum designed to maximize every student’s opportunity to learn. An instructional sequence may move from one pedagogy to another and back again to ensure adequate coverage of a concept.

FOSS Investigation Organization

Modules are subdivided into investigations (four in this module). Investigations are further subdivided into three to five parts. Each part of each investigation is driven by a focus question. The focus question, usually presented as the part begins, signals the challenge to be met, mystery to be solved, or principle to be uncovered. The focus question guides students’ actions and thinking and makes the learning goal of each part explicit for teachers. Each part concludes with students recording an answer to the focus question in their notebooks.

Investigation-specific scientific background information for the teacher is presented in each investigation chapter. The content discussion is divided into sections, each of which relates directly to one of the focus questions. This section ends with information about teaching and learning and a conceptual-flow diagram for the content.

The Getting Ready and Guiding the Investigation sections have several features that are flagged or presented in the sidebars. These include several icons to remind you when a particular pedagogical method is suggested, as well as concise bits of information in several categories.

Teaching notes appear in blue boxes in the sidebars. These notes comprise a second voice in the curriculum—an educative element. The first (traditional) voice is the message you deliver to students. It supports your work teaching students at all levels, from management to inquiry. The second educative voice, shared as a teaching note, is designed to help you understand the science content and pedagogical rationale at work behind the instructional scene.
The safety icon alerts you to a potential safety issue. It could relate to the use of a chemical substance, such as salt, requiring safety goggles, or the possibility of a student allergic reaction when students use latex, legumes, or wheat.

The small-group discussion icon asks you to pause while students discuss data or construct explanations in their groups. Often a Reporter shares the group’s conclusions with the class.

The new-word icon alerts you to a new vocabulary word or phrase that should be introduced thoughtfully. The new vocabulary should also be entered onto the word wall (or pocket chart). A complete list of the scientific vocabulary used in each investigation appears in the sidebar on the last page of the Background for the Teacher section.

The vocabulary icon indicates where students should review recently introduced vocabulary, often just before they will be answering the focus question or preparing for benchmark assessment.

The recording icon points out where students should make a science-notebook entry. Students record on prepared notebook sheets or, increasingly, on pages in their science notebooks.

The reading icon signals when the class should read a specific article in the FOSS Science Resources book, preferably during a reading period.

The assessment icon appears when there is an opportunity to assess student progress by using embedded or benchmark assessments. Some of the embedded-assessment methods for grades 1–2 include observation of students engaged in scientific practices, review of a notebook entry (drawing or text), or a teacher observation.

The outdoor icon signals when to move the science learning experience into the schoolyard. It also helps you plan for selecting and preparing an outdoor site for a student activity.

The engineering icon indicates opportunities for addressing engineering practices—applying and using scientific knowledge. These opportunities include developing a solution to a problem, constructing and evaluating models, and using systems thinking.

The EL note in the sidebar provides a specific strategy to use to assist English learners in developing science concepts. A discussion of strategies is in the Science-Centered Language Development chapter.

To help with pacing, you will see icons for breakpoints. Some breakpoints are essential, and others are optional.
Active Investigation

Active investigation is a master pedagogy. Embedded within active learning are a number of pedagogical elements and practices that keep active investigation vigorous and productive. The enterprise of active investigation includes

- context: questioning and planning;
- activity: doing and observing;
- data management: recording/organizing/processing;
- analysis: discussing and writing explanations.

**Context: questioning and planning.** Active investigation requires focus. The context of an inquiry can be established with a focus question or challenge from you or, in some cases, from students. (What can air do?) At other times, students are asked to plan a method for investigation. This might start with a teacher demonstration or presentation. Then you challenge students to plan an investigation, such as to find out how a parachute uses air. In either case, the field available for thought and interaction is limited. This clarification of context and purpose results in a more productive investigation.

**Activity: doing and observing.** In the practice of science, scientists put things together and take things apart, observe systems and interactions, and conduct experiments. This is the core of science—active, firsthand experience with objects, organisms, materials, and systems in the natural world. In FOSS, students engage in the same processes. Students often conduct investigations in collaborative groups of four, with each student taking a role to contribute to the effort.

The active investigations in FOSS are cohesive, and build on each other and the readings to lead students to a comprehensive understanding of concepts. Through the investigations, students gather meaningful data.

**Data management: recording/organizing/processing.** Data accrue from observation, both direct (through the senses) and indirect (mediated by instrumentation). Data are the raw material from which scientific knowledge and meaning are synthesized. During and after work with materials, students record data in their science notebooks. Data recording is the first of several kinds of student writing.

Students then organize data so they will be easier to think about. Tables allow efficient comparison. Organizing data in a sequence (time) or series (size) can reveal patterns. Students process some data into graphs, providing visual display of numerical data. They also organize data and process them in the science notebook.
**Analysis: discussing and writing explanations.** The most important part of an active investigation is extracting its meaning. This constructive process involves logic, discourse, and existing knowledge. Students share their explanations for phenomena, using evidence generated during the investigation to support their ideas. They conclude the active investigation by writing in their science notebooks a summary of their learning as well as questions raised during the activity.

**Science Notebooks**

Research and best practice have led FOSS to place more emphasis on the student science notebook. Keeping a notebook helps students organize their observations and data, process their data, and maintain a record of their learning for future reference. The process of writing about their science experiences and communicating their thinking is a powerful learning device for students. The science-notebook entries stand as credible and useful expressions of learning. The artifacts in the notebooks form one of the core elements of the assessment system.

You will find the duplication masters for grades 1–6 presented in notebook format. They are reduced in size (two copies to a standard sheet) for placement (glue or tape) into a bound composition book. Full-size duplication masters are also available on FOSSweb. Student work is entered partly in spaces provided on the notebook sheets and partly on adjacent blank sheets.
Reading in FOSS Science Resources

The FOSS Science Resources books emphasize expository articles and biographical sketches. FOSS suggests that the reading be completed during language-arts time. When language-arts skills and methods are embedded in content material that relates to the authentic experience students have had during the FOSS active learning sessions, students are interested, and they get more meaning from the text material.

Assessing Progress

The FOSS assessment system includes both formative and summative assessments. Formative assessment monitors learning during the process of instruction. It measures progress, provides information about learning, and is generally diagnostic. Summative assessment looks at the learning after instruction is completed, and it measures achievement.

Formative assessment in FOSS, called embedded assessment, occurs on a daily basis. You observe action during class or review notebooks after class. Embedded assessment provides continuous monitoring of students’ learning and helps you make decisions about whether to review, extend, or move on to the next idea to be covered.

Benchmark assessments are short summative assessments given after each investigation. These I-Checks are actually hybrid tools: they provide summative information about students’ achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. Reviewing a specific item on an I-Check with the class provides another opportunity for students to clarify their thinking.

The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and you look at their notebook entries. Within the instructional sequence, you will see the heading What to Look For in red letters. Under that, you will see bullet points telling you specifically what students should know and be able to communicate.
If student work is incorrect or incomplete, you know that there has been a breakdown in the learning/communicating process. The assessment system then provides a menu of next-step strategies to resolve the situation. Embedded assessment is assessment for learning, not assessment of learning.

Assessment of learning is the domain of the benchmark assessments. Benchmark assessments are delivered after each investigation. The assessment items do not simply identify whether a student knows a piece of science content. They identify the depth to which students understand science concepts and principles and the extent to which they can apply that understanding. Because the output from the benchmark assessments is descriptive and complex, it can be used for formative assessment as well as summative.

Completely incorporating the assessment system into your teaching practice involves realigning your perception of the interplay between good teaching and good learning, and usually leads to a considerably different social order in the classroom with redefined student-student and teacher-student relationships.

14. Assess progress: notebook entry
Observe students as they work on the notebook page. Check their work for form and substance.

What to Look For
- Students say that the parachute falls through the air. The air (or air resistance) pushing up from below slows the parachute’s fall.
- Students might say that more passengers made the parachute fall to the ground more quickly.
- Students might say that outdoors, wind (moving air) carried the parachute sideways or even upward.
Taking FOSS Outdoors

FOSS throws open the classroom door and proclaims the entire school campus to be the science classroom. The true value of science knowledge is its usefulness in the real world and not just in the classroom. Taking regular excursions into the immediate outdoor environment has many benefits. First of all, it provides opportunities for students to apply things they learned in the classroom to novel situations. When students are able to transfer knowledge of scientific principles to natural systems, they experience a sense of accomplishment.

In addition to transfer and application, students can learn things outdoors that they are not able to learn indoors. The most important object of inquiry outdoors is the outdoors itself. To today’s youth, the outdoors is something to pass through as quickly as possible to get to the next human-managed place. For many, engagement with the outdoors and natural systems must be intentional, at least at first. With repeated visits to familiar outdoor learning environments, students may first develop comfort in the outdoors, and then a desire to embrace and understand natural systems.

The last part of most investigations is an outdoor experience. Venturing out will require courage the first time or two you mount an outdoor expedition. It will confuse students as they struggle to find the right behavior that is a compromise between classroom rigor and diligence and the freedom of recreation. With persistence, you will reap rewards. You will be pleased to see students’ comportment develop into proper field-study habits, and you may be amazed by the transformation of students with behavior issues in the classroom who become your insightful observers and leaders in the schoolyard environment.

Teaching outdoors is the same as teaching indoors—except for the space. You need to manage the same four core elements of teaching: time, space, materials, and students. Because of the different space, new management procedures are required. Students can get farther away. Materials have to be transported. The space has to be defined and honored. Time has to be budgeted for getting to, moving around in, and returning from the outdoor study site. All these and more issues and solutions are discussed in the Taking FOSS Outdoors chapter in the Teacher Resources.

FOSS is very enthusiastic about this dimension of the program and looks forward to hearing about your experience using the schoolyard as a logical extension of your classroom.
Science-Centered Language Development

The FOSS active investigations, science notebooks, FOSS Science Resources articles, and formative assessments provide rich contexts in which students develop and exercise thinking and communication. These elements are essential for effective instruction in both science and language arts—students experience the natural world in real and authentic ways and use language to inquire, process information, and communicate their thinking about scientific phenomena. FOSS refers to this development of language process and skills within the context of science as science-centered language development.

In the Science-Centered Language Development chapter in Teacher Resources, we explore the intersection of science and language and the implications for effective science teaching and language development. We identify best practices in language-arts instruction that support science learning and examine how learning science content and engaging in scientific practices support language development.

Language plays two crucial roles in science learning: (1) it facilitates the communication of conceptual and procedural knowledge, questions, and propositions, and (2) it mediates thinking—a process necessary for understanding. For students, language development is intimately involved in their learning about the natural world. Science provides a real and engaging context for developing literacy, and language-arts skills and strategies support conceptual development and scientific practices. For example, the skills and strategies used for enhancing reading comprehension, writing expository text, and exercising oral discourse are applied when students are recording their observations, making sense of science content, and communicating their ideas. Students’ use of language improves when they discuss (speak and listen, as in the Wrap-Up/Warm-Up activities), write, and read about the concepts explored in each investigation.

There are many ways to integrate language into science investigations. The most effective integration depends on the type of investigation, the experience of students, the language skills and needs of students, and the language objectives that you deem important at the time. The Science-Centered Language Development chapter is a library of resources and strategies for you to use. The chapter describes how literacy strategies are integrated purposefully into the FOSS investigations, gives suggestions for additional literacy strategies that both enhance students’ learning in science and develop or exercise English-language literacy skills, and develops science vocabulary with scaffolding strategies for supporting all learners. The last section covers language-development strategies that are specifically for English learners.
FOSSWEB AND TECHNOLOGY

FOSS is committed to providing a rich, accessible technology experience for all FOSS users. FOSSweb is the Internet access to FOSS digital resources. It provides enrichment for students and support for teachers, administrators, and families who are actively involved in implementing and enjoying FOSS materials. Here are brief descriptions of selected resources to help you get started with FOSS technology.

Technology to Engage Students at School and at Home

Multimedia activities. The multimedia simulations and activities were designed to support students’ learning. They include virtual investigations and student tutorials that you can use to support students who have difficulties with the materials or who have been absent.

FOSS Science Resources. The student reading book is available as an audio book on FOSSweb, accessible at school or at home. In addition, as premium content, FOSS Science Resources is available as an eBook. The eBook supports a range of font sizes and can be projected for guided reading with the whole class as needed.

Home/school connection. Each module includes a letter to families, providing an overview of the goals and objectives of the module. Most investigations have a home/school activity providing science experiences to connect the classroom experiences with students’ lives outside of school. These connections are available in print in the Teacher Resources binder and on FOSSweb.

Student media library. A variety of media enhance students’ learning. Formats include photos, videos, an audio version of each student book, and frequently asked science questions. These resources are also available to students when they log in with a student account.

Recommended books and websites. FOSS has reviewed print books and digital resources that are appropriate for students and prepared a list of these media resources.

Class pages. Teachers with a FOSSweb account can easily set up class pages with notes and assignments for each class. Students and families can then access this class information online.
Technology to Support Teachers

Teacher-preparation video. The video presents information to help you prepare for a module, including detailed investigation information, equipment setup and use, safety, and what students do and learn through each part of the investigation.

Science-notebook masters and teacher masters. All notebook masters and teacher masters used in the modules are available digitally on FOSSweb for downloading and for projection during class. These sheets are available in English and Spanish.

Assessment masters. The benchmark assessment masters for grades 1–6 (I-Checks) are available in English and Spanish.

Focus questions. The focus questions for each investigation are formatted for classroom projection and for printing onto labels that students can glue into their science notebooks.

Equipment photo cards. The cards provide labeled photos of equipment supplied in each FOSS kit.

Materials Safety Data Sheets (MSDS). These sheets have information from materials manufacturers on handling and disposal of materials.

Teacher Resources chapters. FOSSweb provides PDF files of all chapters from the Teacher Resources binder.

• Assessment
• Science Notebooks
• Science-Centered Language Development
• Taking FOSS Outdoors
• FOSSweb and Technology

Streaming video. Some video clips are part of the instruction in the investigation, and others extend concepts presented in a module.

Resources by investigation. This digital listing provides online links to notebook sheets, assessment and teacher masters, and multimedia for each investigation of a module for projection in the classroom.

Interactive whiteboard resources. You can use these slide shows and other resources with an interactive whiteboard.

Investigations eGuide. The eGuide is the complete Investigations Guide component of the Teacher Toolkit in an electronic web-based format, allowing access from any Internet-enabled computer.
UNIVERSAL DESIGN FOR LEARNING

The roots of FOSS extend back to the mid-1970s and the Science Activities for the Visually Impaired and Science Enrichment for Learners with Physical Handicaps projects (SAVI/SELPH). As those special-education science programs expanded into fully integrated settings in the 1980s, hands-on science proved to be a powerful medium for bringing all students together. The subject matter is universally interesting, and the joy and satisfaction of discovery are shared by everyone. Active science by itself provides part of the solution to full inclusion.

Many years later, FOSS began a collaboration with educators and researchers at the Center for Applied Special Technology (CAST), where principles of Universal Design for Learning (UDL) had been developed and applied. FOSS continues to learn from our colleagues about ways to use new media and technologies to improve instruction. Here are the UDL principles.

**Principle 1.** Provide multiple means of representation. Give learners various ways to acquire information and knowledge.

**Principle 2.** Provide multiple means of action and expression. Offer students alternatives for demonstrating what they know.

**Principle 3.** Provide multiple means of engagement. Help learners get interested, be challenged, and stay motivated.

The FOSS Program has been designed to maximize the science-learning opportunities for students with special needs and students from culturally and linguistically diverse origins. FOSS is rooted in a 30-year tradition of multisensory science education and informed by recent research on UDL. Procedures found effective with students with special needs and students who are learning English are incorporated into the materials and strategies used with all students.

**English Learners**

The FOSS multisensory program provides a rich laboratory for language development for English learners. The program uses a variety of techniques to make science concepts clear and concrete, including modeling, visuals, and active investigations in small groups at centers. Key vocabulary is usually developed within an activity context with frequent opportunities for interaction and discussion between teacher and student and among students. This provides practice and application
of the new vocabulary. Instruction is guided and scaffolded through carefully designed lesson plans, and students are supported throughout. The learning is active and engaging for all students, including English learners.

Science vocabulary is introduced in authentic contexts while students engage in active learning. Strategies for helping all primary students read, write, speak, and listen are described in the Science-Centered Language Development chapter. There is a section on science-vocabulary development with scaffolding strategies for supporting English learners. These strategies are essential for English learners, and they are good teaching strategies for all learners.

**Differentiated Instruction**

FOSS instruction allows students to express their understanding through a variety of modalities. Each student has multiple opportunities to demonstrate his or her strengths and needs. The challenge is then to provide appropriate follow-up experiences for each student. For some students, appropriate experience might mean more time with the active investigations. For other students, it might mean more experience building explanations of the science concepts orally or in writing or drawing. For some students, it might mean making vocabulary more explicit through new concrete experiences or through reading to students. For some students, it may be scaffolding their thinking through graphic organizers. For other students, it might be designing individual projects or small-group investigations. For some students, it might be more opportunities for experiencing science outside the classroom in more natural, outdoor environments.

There are several possible strategies for providing differentiated instruction. The FOSS Program provides tools and strategies so that you know what students are thinking throughout the module. Based on that knowledge, read through the extension activities for experiences that might be appropriate for students who need additional practice with the basic concepts as well as those ready for more advanced projects. Interdisciplinary extensions are listed at the end of each investigation. Use these ideas to meet the individual needs and interests of your students.
ORGANIZING THE CLASSROOM

Students in primary grades are usually most comfortable working as individuals with materials. The abilities to share, take turns, and learn by contributing to a group goal are developing but are not reliable as learning strategies all the time. Because of this egocentrism and the need for many students to control materials or dominate actions, the FOSS kit includes a lot of materials. To effectively manage students and materials, FOSS offers some suggestions.

Small-Group Centers

Some of the observations and investigations with air and weather can be conducted with small groups at a learning center. For example, making pinwheels in Investigation 3, Part 3, could be conducted at a center. Limit the number of students at the center to six to ten at one time. When possible, each student will have his or her own equipment to work with. In some cases, students will have to share materials and equipment and make observations together. Primary students are good at working together independently.

As one group at a time is working at the center on a FOSS activity, other students will be doing something else. Over the course of an hour or more, plan to rotate all students through the center, or allow the center to be a free-choice station.

Whole-Class Activities

Introducing and wrapping up the center activities require you to work for brief periods with the whole class. FOSS suggests for these introductions and wrap-ups that you gather the class at the rug or other location in the classroom where students can sit comfortably in a large group.
When You Don’t Have Adult Helpers

Some parts of investigations work better when there is an aide or a student’s family member available to assist groups with the activity and to encourage discussion and vocabulary development. We realize that there are many primary classrooms in which the teacher is the only adult present. Here are some ways to manage in that situation.

• Invite upper-elementary students to visit your class to help with the activities. Remind older students to be guides and to let primary students do the activities themselves.

• Introduce each part of the activity with the whole class. Set up the center as described in the Investigations Guide, but let students work at the center by themselves. Discussion may not be as rich, but most of the centers can be done independently by students once they have been introduced to the process. Be a 1-minute manager, checking on the center from time to time, offering a few words of advice or direction.

When Students Are Absent

If a student is absent for an activity, give him or her a chance to spend some time with the materials at a center. Another student might act as a peer tutor. Allow the student to bring home a FOSS Science Resources book to read with a family member. Each article has a few review items that the student can respond to verbally and in writing.
SAFETY IN THE CLASSROOM AND OUTDOORS

Following the procedures described in each investigation will make for a very safe experience in the classroom. You should also review your district safety guidelines and make sure that everything you do is consistent with those guidelines. Two posters are included in the kit: Science Safety for classroom use and Outdoor Safety for outdoor activities.

Look for the safety icon in the Getting Ready and Guiding the Investigation sections that will alert you to safety considerations throughout the module.

Materials Safety Data Sheets (MSDS) for materials used in the FOSS Program can be found on FOSSweb. If you have questions regarding any MSDS, call Delta Education at 1-800-258-1302 (Monday–Friday, 8 a.m.–6 p.m. EST).

Science Safety in the Classroom

General classroom safety rules to share with students are listed here.

1. Listen carefully to your teacher’s instructions. Follow all directions. Ask questions if you don’t know what to do.
2. Tell your teacher if you have any allergies.
3. Never put any materials in your mouth. Do not taste anything unless your teacher tells you to do so.
4. Never smell any unknown material. If your teacher tells you to smell something, wave your hand over the material to bring the smell toward your nose.
5. Do not touch your face, mouth, ears, eyes, or nose while working with chemicals, plants, or animals.
6. Always protect your eyes. Wear safety goggles when necessary. Tell your teacher if you wear contact lenses.
7. Always wash your hands with soap and warm water after handling chemicals, plants, or animals.
8. Never mix any chemicals unless your teacher tells you to do so.
9. Report all spills, accidents, and injuries to your teacher.
10. Treat animals with respect, caution, and consideration.
11. Clean up your work space after each investigation.
12. Act responsibly during all science activities.

Science Safety

1. Listen carefully to your teacher’s instructions. Follow all directions. Ask questions if you don’t know what to do.
2. Tell your teacher if you have any allergies.
3. Never put any materials in your mouth. Do not taste anything unless your teacher tells you to do so.
4. Never smell any unknown material. If your teacher tells you to smell something, wave your hand over the material to bring the smell toward your nose.
5. Do not touch your face, mouth, ears, eyes, or nose while working with chemicals, plants, or animals.
6. Always protect your eyes. Wear safety goggles when necessary. Tell your teacher if you wear contact lenses.
7. Always wash your hands with soap and warm water after handling chemicals, plants, or animals.
8. Never mix any chemicals unless your teacher tells you to do so.
9. Report all spills, accidents, and injuries to your teacher.
10. Treat animals with respect, caution, and consideration.
11. Clean up your work space after each investigation.
12. Act responsibly during all science activities.

Outdoor Safety

1. Listen carefully to your teacher’s instructions. Follow all directions. Ask questions if you don’t know what to do.
2. Tell your teacher if you have any allergies. Let your teacher know if you have never been stung by a bee.
3. Never put any materials in your mouth.
4. Dress appropriately for the weather and the outdoor experience.
5. Stay within the designated study area and with your partner or group. When you hear the “freeze” signal, stop and listen to your teacher.
6. Never look directly at the Sun or at the sunlight being reflected off a shiny object.
7. Know if there are any skin-irritating plants in your schoolyard, and do not touch them. Most plants in the schoolyard are harmless.
8. Respect all living things. When looking under a stone or log, lift the side away from you so that any living thing can escape.
9. If a stinging insect is near you, stay calm and slowly walk away from it. Tell your teacher right away if you are stung or bitten.
10. Never release any living things into the environment unless you collected them there.
11. Always wash your hands with soap and warm water after handling chemicals, plants, or animals.
12. Return to the classroom with all of the materials you brought outside.
### SCHEDULING THE MODULE

The Getting Ready section for each part of an investigation helps you prepare. It provides information on scheduling the activities and introduces the tools and techniques used in the activity. Be prepared—read the Getting Ready section thoroughly.

Below is a suggested teaching schedule for the module. The investigations are numbered and should be taught in order, as the concepts build upon each other from investigation to investigation. We suggest that a minimum of 7 weeks be devoted to this module. Take your time, and explore the subject thoroughly. The last part, Comparing the Seasons, will take place during different seasons in the year.

**Active-investigation (A)** sessions include hands-on work with weather instruments, active thinking about experiences, small-group discussion, writing in science notebooks, and learning new vocabulary in context.

During **Wrap-Up/Warm-Up (W)** sessions, students share notebook entries.

**Reading (R)** sessions involve reading *FOSS Science Resources* articles. **I-Checks** are short summative assessments.

<table>
<thead>
<tr>
<th>Week</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>START Inv. 1 Part 1 A/W</td>
<td>START Inv. 1 Part 2 A</td>
<td>A</td>
<td>A</td>
<td>R/W</td>
</tr>
<tr>
<td>2</td>
<td>START Inv. 1 Part 3 A/W</td>
<td>START Inv. 1 Part 4 A</td>
<td>A</td>
<td>A/W</td>
<td>I-Check 1</td>
</tr>
<tr>
<td>3</td>
<td>START Inv. 2 Part 1 A/W</td>
<td>*</td>
<td>START Inv. 2 Part 2 A/W</td>
<td>A/W</td>
<td>A</td>
</tr>
<tr>
<td>4</td>
<td>START Inv. 2 Part 4 A</td>
<td>A</td>
<td>A</td>
<td>R</td>
<td>I-Check 2</td>
</tr>
<tr>
<td>5</td>
<td>START Inv. 3 Part 1 A</td>
<td>START Inv. 3 Part 2 A/W</td>
<td>START Inv. 3 Part 3 A</td>
<td>A/W</td>
<td>A</td>
</tr>
<tr>
<td>6</td>
<td>START Inv. 3 Part 4 A</td>
<td>R/W</td>
<td>START Inv. 3 Part 5 A</td>
<td>A</td>
<td>I-Check 3</td>
</tr>
<tr>
<td>7</td>
<td>START Inv. 4 Part 1 A</td>
<td>A</td>
<td>A/W</td>
<td>A</td>
<td>START Inv. 4 Part 3 A/R</td>
</tr>
<tr>
<td>seasonal</td>
<td>A/R</td>
<td>A/W</td>
<td>A</td>
<td></td>
<td>I-Check 4</td>
</tr>
</tbody>
</table>

**NOTE**

In Investigation 4, students are looking at change over time—change in the weather over a month, change of the Moon’s appearance over a month, and change in the weather over the seasons. This investigation will require flexibility in scheduling.

Review Investigation 4, Part 2, Observing the Moon, at the beginning of the module. Plan to start those observations during weeks 2–6 when there is a third-quarter Moon visible during the school day.

* Review Inv. 4 Part 2. Start this part when there is a third-quarter Moon visible during the school day.
## FOSS K–8 SCOPE AND SEQUENCE

<table>
<thead>
<tr>
<th>Grade</th>
<th>Physical Science</th>
<th>Earth Science</th>
<th>Life Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>6–8</td>
<td>Electronics</td>
<td>Planetary Science</td>
<td>Human Brain and Senses</td>
</tr>
<tr>
<td></td>
<td>Chemical Interactions</td>
<td>Earth History</td>
<td>Populations and Ecosystems</td>
</tr>
<tr>
<td></td>
<td>Force and Motion</td>
<td>Weather and Water</td>
<td>Diversity of Life</td>
</tr>
<tr>
<td>4–6</td>
<td>Mixtures and Solutions</td>
<td>Weather on Earth</td>
<td>Living Systems</td>
</tr>
<tr>
<td></td>
<td>Motion, Force, and Models</td>
<td>Sun, Moon, and Planets</td>
<td>Environments</td>
</tr>
<tr>
<td></td>
<td>Energy and Electromagnetism</td>
<td>Soils, Rocks, and Landforms</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Measuring Matter</td>
<td>Water</td>
<td>Structures of Life</td>
</tr>
<tr>
<td>1–2</td>
<td>Balance and Motion</td>
<td>Air and Weather</td>
<td>Insects and Plants</td>
</tr>
<tr>
<td></td>
<td>Solids and Liquids</td>
<td>Pebbles, Sand, and Silt</td>
<td>Plants and Animals</td>
</tr>
<tr>
<td>K</td>
<td>Materials in Our World</td>
<td>Trees and Weather</td>
<td>Animals Two by Two</td>
</tr>
</tbody>
</table>