INTRODUCTION

We live in a dynamic world where everything is in motion, or so it seems. But not everything is moving the same way. Some things move from one place to another. Other things rotate around and around. Still other things are stationary, stable for a time, balanced on a thin line between stop and go. Other objects move back and forth or vibrate. These are the global phenomena that students experience in the Balance and Motion Module. In this module, students will

• Create and use representational models to demonstrate stable balanced systems.
• Plan and execute examples of stable balanced systems.
• Discover different ways to produce rotational motion.
• Construct and evaluate toys that demonstrate spinning, and explain how they operate.
• Design runways to control or change the motion of marbles.
• Communicate observations and compare stability and motion, using precise vocabulary.
• Plan and carry out investigations with sound and with magnetic force.
• Analyze and interpret observational data.
## Module Summary

<table>
<thead>
<tr>
<th>Inv. 1: Balance</th>
<th>Inv. 2: Spinners</th>
<th>Inv. 3: Rollers</th>
<th>Inv. 4: Back and Forth</th>
<th>Inv. 5: Magnets and Tools</th>
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<tbody>
<tr>
<td>Students explore numerous ways to balance two-dimensional shapes made out of tagboard, by positioning counterweights (clothespins) in strategic locations. They make mobiles to apply their understanding of a stable position.</td>
<td>Students explore the variables that influence the spinning of a top, a zoomer, and a twirler (a flying spinner). They explore the forces (pushes and pulls) that make tops and zoomers move. They observe the force of gravity causing objects to fall (twirlers).</td>
<td>Students investigate rolling objects—wheels, cups, and spheres—and describe change in position over time. They gain more experience with gravity causing objects to fall to the ground. Students use flexible marble runways to observe an object’s change of position.</td>
<td>Students explore the production of sound with a door fiddle, tuning forks, xylophones, kalimbas, and spoon-gongs. Students look for vibrations at the sound source and explore how to change pitch and volume of sound.</td>
<td>Students work with magnets and find that two magnets either attract or repel one another, depending on their orientation (force at a distance). They read about and view a video on how tools and machines make things move.</td>
</tr>
</tbody>
</table>

## Focus Questions

<table>
<thead>
<tr>
<th>Inv. 1: Balance</th>
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<tbody>
<tr>
<td>What do you have to know to get a crayfish to balance on its nose?</td>
<td>How can spinning motion be changed?</td>
<td>How can a wheel-and-axle system be changed?</td>
<td>What causes sound?</td>
<td>What happens when magnets come close together?</td>
</tr>
<tr>
<td>How can counterweights help balance shapes in stable positions?</td>
<td>How can a string keep a disk in motion?</td>
<td>Can we predict where a rolling cup will end up?</td>
<td>How do sounds differ?</td>
<td>How can people make hard work easier?</td>
</tr>
<tr>
<td>How can a pencil balance on its point?</td>
<td>What causes twirlers to rotate?</td>
<td>How can we make a runway system that will let a marble roll its entire length?</td>
<td>What can we observe outdoors that is vibrating?</td>
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<tr>
<td>Content</td>
<td>Reading and Media</td>
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<td>------------------------------------------------------------------------</td>
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</table>
| • Objects can be balanced in many ways. Balance can be changed by counterweighting. | **Science Resources Book**
  "Make It Balance!"                                                      | **Embedded Assessment**
  **Benchmark Assessment**
  Investigation 1 I-Check                                                 |
| • A stable position is one that is steady: the object is not falling over. The place on which an object balances is called the balance point. | **Science Resources Book**
  "Push or Pull?"
  "Things That Spin"                                                       | **Embedded Assessment**
  **Benchmark Assessment**
  Investigation 2 I-Check                                                 |
| • The position of an object can be described by relating its location to another object. | **Science Resources Book**
  "Rolling, Rolling, Rolling!"                                             | **Embedded Assessment**
  **Benchmark Assessment**
  Investigation 3 I-Check                                                 |
| • A mobile is a hanging system of balanced beams and objects.            | **Science Resources Book**
  "Strings in Motion"                                                       | **Embedded Assessment**
  **Benchmark Assessment**
  Investigation 4 I-Check                                                 |
| • Tops exhibit rotational motion (spinning) when torque is applied to the axial shaft; performance is affected by speed, disk mass, and diameter. | **Science Resources Book**
  "Move It, but Don’t Touch It"
  "Tools and Machines"                                                     | **Embedded Assessment**
  **Benchmark Assessment**
  Investigation 5 I-Check                                                 |
| • A zoomer is a disk that rotates when torque is applied by a twisting string. | **Science Resources Book**
  "Tools and Machines"                                                     |                                                 |
| • A twirler is a simple winged system that spins when it interacts with air; performance is affected by variables, including wing size, shape, and angle. | **Science Resources Book**
  "All about Simple Machines"                                              |                                                 |
| • A wheel-and-axle system comprises a circular rotating disk (wheel) mounted on an axial shaft (axle). | **Science Resources Book**
  "Rolling, Rolling, Rolling!"                                             |                                                 |
| • Spheres are round in all dimensions, so they can roll in any direction. | **Science Resources Book**
  "Rolling, Rolling, Rolling!"                                             |                                                 |
| • Marbles roll down a runway as long as the runway does not angle up to a point higher than the starting position. | **Science Resources Book**
  "Strings in Motion"                                                       |                                                 |
| • Vibrating objects make sound; sound always comes from a vibrating object. | **Science Resources Book**
  "Strings in Motion"                                                       |                                                 |
| • Pitch is how high or low a sound is; high-pitched sounds come from objects that vibrate rapidly. | **Science Resources Book**
  "Strings in Motion"                                                       |                                                 |
| • Volume is how loud or soft a sound is.                                | **Science Resources Book**
  "Strings in Motion"                                                       |                                                 |
| • Sound sources can be natural or human-made.                           | **Science Resources Book**
  "Strings in Motion"                                                       |                                                 |
| • The magnetic force can apply pushes and pulls.                        | **Science Resources Book**
  "Move It, but Don’t Touch It"
  "Tools and Machines"                                                     |                                                 |
| • The magnetic force can move other magnets and some objects from a distance. | **Science Resources Book**
  "Move It, but Don’t Touch It"
  "Tools and Machines"                                                     |                                                 |
| • Tools and machines are designed technologies to make work easier.      | **Science Resources Book**
  "Move It, but Don’t Touch It"
  "Tools and Machines"                                                     |                                                 |
FOSS CONCEPTUAL FRAMEWORK

In the last half decade, teaching and learning research has focused on learning progressions. The idea behind a learning progression is that core ideas in science are complex and wide-reaching, requiring years to develop fully—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 students can and should understand about these core ideas in primary school years, and progressively more complex and sophisticated things they should know as they gain experience and develop cognitive abilities. When we as educators can determine those logical progressions, we can develop meaningful and effective curriculum for students.

FOSS has elaborated learning progressions for core ideas in science for kindergarten through grade 8. Developing a learning progression involves identifying successively more sophisticated ways of thinking about a core idea 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).

The FOSS modules are organized into three domains: physical science, earth science, and life science. Each domain is divided into two strands, as shown in the table below for the FOSS Elementary Program. Each strand represents a core idea in science and has a conceptual framework.

- Physical Science: matter; energy and change
- Earth and Space Science: dynamic atmosphere; rocks and landforms
- Life Science: structure and function; complex systems

The sequence 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.

Information about the FOSS learning progression appears in the conceptual framework (page 7), which shows the structure of scientific knowledge taught and assessed in this module, and the content sequence (pages 10-11), a graphic and narrative description that puts this single module into a K–8 strand progression.

Full Option Science System
In addition to the science content development, every module provides opportunities for students to engage in and understand the importance of 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 and clarify 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 media (numbers, words, tables, graphs, images, diagrams, equations) to represent and 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 proposed solutions to problems.

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

**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 available evidence.

**Engaging in argumentation from evidence**
- Defend explanations, develop evidence based on data, examine one’s own understanding in light of the evidence offered by others, and challenge peers while 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, in collaboration with peers.

*Balance and Motion Module*
BACKGROUND FOR THE CONCEPTUAL FRAMEWORK in Balance and Motion

Balance

Balance is the everyday word used to describe a state of equilibrium. A physicist would say that a state of equilibrium is reached when the net force acting on a body or system is zero. If a strong force pushing one way is balanced by an equally strong force pushing the opposite way, the net force is zero, and a state of equilibrium is achieved.

A dramatic example of balance in action is a high-wire artist at work. Up on the wire she dances and turns, defying the force of gravity trying to bring her tumbling down. What makes the act difficult is that she is prancing about on a wire. The base of support is exceptionally small. In order to maintain her balance, the aerialist must keep her center of gravity (the point around which her body mass is equally distributed) directly over the base of support. As soon as the center of gravity strays beyond the base, down she goes.

You can demonstrate this yourself by balancing your own body on bases of different sizes. First, imagine standing on a golf ball. The base of support is extremely small—probably smaller than a dime. For most of us, it would be only a second or two before we toppled. Next, stand on one foot. This base is many times larger than the golf ball, and balancing is fairly easy. But, inevitably, we all lose concentration and let the center of gravity wander out over the base of support, and we lose balance. If you expand your base and stand on two feet, particularly if they are spread a comfortable distance apart, you can stand all day without losing balance. The larger the base, the greater the stability. For the most stable position of all, lie down on your back. This is the most stable position a person can assume, with no danger of losing balance.

If we return to the high wire for a moment, we look up to see a clown riding a bicycle on the wire. This stunt is possible because the bicycle has been engineered to balance on the wire by itself, even with a rider aboard. A huge mass is attached below the bicycle. The center of gravity of the bicycle-and-mass system has been moved to a point under the point of support. In effect the bicycle and rider are hanging from the wire like a piece of laundry hanging on the line. The part of the system sticking up above the wire (bicycle and rider) is exceeded by the mass of the counterweight hanging down beneath. What looks to be a death-defying, reckless stunt is actually a stable, predictable system in action.
If a force is applied to a stable or balanced body or system, the net imbalance in force might cause the body to change position. If the system recovers and returns to its starting position, the system is stable. Students grapple with this kind of stability in the first investigation, as they balance pencils on their points using counterweighting, and build mobiles that always return to their balanced positions. At other times an applied force produces a permanent change of position. Change of position is motion.

Position

Position is a concept that will grow and become more profound over many years. In this module, students describe the position of components in a system relative to other components in the same system (comparative position). Where are the clothespins (counterweights) positioned to create a stable balanced system? Where are disks positioned to make a top spin the fastest? What is the best starting position to roll a cup down a ramp to end up at a predetermined location?

Students will be introduced to linear motion (motion in straight lines) and rotational motion (motion around a point or line). When students roll marbles down a convoluted runway, the turning, looping, swerving path of the marble is an example of linear motion. The marble always proceeds in a straight line until it is acted on by some force to alter its direction of motion. The little forces applied by the sides of the runway constantly redirect the motion of the marble. When carefully analyzed, the path of the marble can be observed to be a progression of short, straight travels between redirecting forces.

**Conceptual Framework**

**Physical Science, Energy and Change: Balance and Motion**

**Motion and Stability: Forces and Interactions**

**Concept A**  
The motion of an object is determined by the sum of the forces (pushes and pulls) acting on it.

- You need a force to start moving, change the direction of, or stop an object.
- Objects and systems that turn on a central axis exhibit rotational motion.
- Sound comes from vibrating objects; pitch is how high or low a sound is; volume is how loud or soft a sound is.
- Tools and machines are used by humans to make work easier.

**Concept B**  
All interactions between objects arise from a few types of forces, primarily gravity and electromagnetism.

- The force of gravity pulls objects to Earth’s surface.
- Magnets pull steel objects; magnets push or pull other magnets.

**Concept C**  
Stability or instability in a system depends on the balance of competing interactions (forces).

- A stable position is one that is steady; the object is not falling over.
- The way an object balances can be changed by counterweighting.

**Energy Transfer and Conservation**

**Concept A**  
Energy is a quantitative property (condition) of a system that depends on the motion and interactions of matter and radiation within the system.

- A runway must be high at the start and low at the finish for a sphere to roll the complete length.
Force

Newton’s first law of motion states that objects at rest stay at rest, and objects in motion stay in uniform motion unless they are acted on by a net force. For primary students, this means that things move (and stop) because they get pushed or pulled. A force is a push or a pull, and in a module where everything is in motion, there are lots of pushes and pulls going on. Big pushes and pulls result in big movements; little pushes and pulls result in little movements.

Some forces are pretty obvious—pulling on the zoomer string makes the disk spin; pushing on the shaft of the top makes it spin; pushing a wheel-and-axle system across the table puts it in motion. Other forces are not so obvious. Systems rolling down a ramp seem to spring into motion all by themselves. Dropping a twirler causes it to spin in air.

These phenomena occur as a result of the force of gravity. Students know the results of gravitational attraction: things fall, things roll downhill, liquids pour, and so on. These are all examples of movement, so there must be a force at work. But it is difficult to identify exactly what is exerting the pull or push to make these movements happen.

Gravity pulls everything toward the center of Earth. Things will move toward the center of Earth until they meet up with a force that opposes the force of gravity and prevents any further movement. Holding something, resting on the floor or Earth’s surface, hanging from a string, and gluing something to a wall represent the application of force equal to, but opposite in direction to, the force of gravity.

Realizing that gravity is the force that makes everything go down is an appropriate place to start. Twirlers go down, cups roll down, marbles roll down, and things fall down because of gravity. Take advantage of the many opportunities to introduce this fundamental notion into the investigations as you work through the module.

Machines and Tools

Machines are devices for manipulating force. Some are natural, like the wedge shape of a woodpecker’s bill and the muscle-and-joint design of animals’ limbs. Many are human inventions to make work easier or more efficient. If the load is too heavy or the task too difficult to accomplish with brute push or pull, we can use a machine to increase the amount of force or to distribute the load in a more manageable way. Students know intuitively that tools like hammers make it possible to drive nails, and crowbars make it possible to break things apart.
These tools exert a lot of force to make things move. Hand tools are applications of simple machines. And students know that large, complex machines, like farm equipment and construction machines, can lift and move amazing amounts of material. Machines can apply a lot of force to move large, heavy things.

**Magnetism: Force at a Distance**

As far as we know, only four forces are at work in the universe. Two of them, the strong force and the weak force, act only inside atoms. The third force is gravity, and we know it makes things fall down even though we are not entirely sure why. Everything else happens as a result of the fourth force, electromagnetism.

Electromagnetism is the most pervasive of all forces, accounting for the obvious phenomena of electricity and magnetism, but it also gives matter shape and strength, and makes it possible for you and me to run, eat, feel, think, and grow. Understanding the electromagnetic force is a lifelong undertaking.

Students start by exploring magnets and sharing what they observe. One thing magnets do is push. They also pull. Pushes and pulls are forces, so magnets have a detectable force field surrounding them. And the force can act at a distance; magnets don’t have to touch to affect one another.

**Sound**

The last kind of motion that students investigate in this module is vibration. Objects that vibrate between about 25 times a second and 25,000 times a second create pressure pulses in the air that stimulate receptors in our ears. The receptors send messages to the brain, and we hear sounds. Different frequencies of vibration stimulate different receptors, and in this way we discriminate different pitches of sound. The amplitude, or amount of energy in the vibrations, determines the intensity of the receptor response, and this translates into volume. So from a vibrating object, like a string, gong, or reed, we perceive sound.

Students will work with an apparatus that works like a bass fiddle to investigate vibrating strings. With a large system, they can sometimes see the string moving, either rapidly or slowly, and make the connection between the rate of vibration and the pitch of the sound. If students recognize that sound originates from a vibrating object, and that different objects (strings) make different pitches, they are on their way to understanding this challenging and interesting field of science.
**Energy and Change Content Sequence**

This table shows the five FOSS modules and courses that address the content sequence “energy and change” for grades K–8. Running through the sequence are two progressions—motion and stability: forces and interactions and energy transfer and conservation. The supporting elements in each module (somewhat abbreviated) are listed. The elements for the Balance and Motion Module are expanded to show how they fit into the sequence.

<table>
<thead>
<tr>
<th>Module or course</th>
<th>Motion and Stability: Forces and Interactions</th>
<th>Energy Transfer and Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electronics</strong></td>
<td>• A circuit is a pathway through which electric current (energy) can transfer to produce light and other effects.</td>
<td>• Energy can be moved from place to place by electric currents.</td>
</tr>
<tr>
<td></td>
<td>• Voltage (electromotive force) is the push that moves electric current through a circuit.</td>
<td>• Current (electric energy) is the amount of charge moving past a point in a conductor in a unit of time.</td>
</tr>
<tr>
<td></td>
<td>• Resistance is a property of materials that impedes the flow of electric current.</td>
<td>• The sum of the voltage drops in a circuit is equal to the voltage available at the source.</td>
</tr>
<tr>
<td></td>
<td>• There is a relationship (Ohm’s law) between resistance, voltage, and electric current in a circuit.</td>
<td>• Voltage drop is proportional to resistance.</td>
</tr>
<tr>
<td><strong>Force and Motion</strong></td>
<td>• A net force is the sum of the forces acting on a mass; a net force applied to a mass results in acceleration of the mass.</td>
<td>• Resistances in series add; resistances in parallel add inversely.</td>
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<tr>
<td></td>
<td>• Gravity is a force pulling two masses toward each other; the strength of the force depends on the objects’ masses.</td>
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<tr>
<td></td>
<td>• The heavier the object, the greater the force needed to achieve the same change in motion.</td>
<td></td>
</tr>
<tr>
<td><strong>Motion, Force, and Models</strong></td>
<td>• Any change of motion requires a force.</td>
<td>• When two objects interact, each one exerts a force on the other, causing energy transfer between them.</td>
</tr>
<tr>
<td></td>
<td>• Gravity is a pulling force that acts between all masses.</td>
<td>• Friction increases energy transfer to the surrounding environment by heating or accelerating the interacting materials.</td>
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<tr>
<td></td>
<td>• Patterns of motion can be observed; when there are regular patterns of motion, future patterns can be predicted.</td>
<td></td>
</tr>
<tr>
<td><strong>Energy and Electromagnetism</strong></td>
<td>• Magnets interact with each other and with materials that contain iron.</td>
<td>• The faster an object is moving, the more energy it has.</td>
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<tr>
<td></td>
<td>• Like poles of magnets repel each other; opposite poles attract. The magnetic force declines with distance.</td>
<td>• Motion of one object can transfer to motion of other objects in a collision; a larger force causes larger change in motion.</td>
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<tr>
<td></td>
<td>• Conductors are materials through which electric current can flow; all metals are conductors.</td>
<td>• Kinetic energy is energy of motion; potential energy is energy of position.</td>
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<tr>
<td><strong>Balance and Motion</strong></td>
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</tbody>
</table>
### Conceptual Framework

**Balance and Motion Module**

<table>
<thead>
<tr>
<th>Balance and Motion</th>
<th>Motion and Stability: Forces and Interactions</th>
<th>Energy Transfer and Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Objects can be balanced in many ways; counterweights can balance an object.</td>
<td>• A bigger push or pull makes things go faster.</td>
</tr>
<tr>
<td></td>
<td>• Pushing or pulling on an object can change the speed or direction of its motion (rolling, rotation, vibration) and can start or stop it.</td>
<td>• A runway must be high at the start and low at the finish for a sphere to roll the complete length.</td>
</tr>
<tr>
<td></td>
<td>• Magnetic force acts at a distance to make objects move by pushing or pulling.</td>
<td>• Sound comes from vibrating objects.</td>
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<tr>
<td></td>
<td></td>
<td>• Large objects vibrate slowly and produce low-pitched sound; small objects vibrate quickly and produce high-pitched sounds.</td>
</tr>
</tbody>
</table>
The Balance and Motion Module aligns with the NRC Framework. The module addresses these K–2 grade band endpoints described for core ideas from the national framework for physical sciences and for engineering, technology, and the application of science.

Physical Sciences

Core idea PS2: Motion and stability: forces and interactions—How can one explain and predict interactions between objects and within systems?

• PS2.B: What underlying forces explain the variety of interactions observed? [Objects pull or push each other when they collide or are connected. Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. An object sliding on a surface or sitting on a slope experiences a pull due to friction between the object and the surface that opposes its motion.]

• PS2.C: Why are some physical systems more stable than others? [Whether an object stays still or moves often depends on the effects of multiple pushes and pulls on it. It is useful to investigate what pushes and pulls keep something in place as well as what makes something change or move.]

Core idea PS3: Energy—How is energy transferred and conserved?

• PS3.C: How are forces related to energy? [A bigger push or pull makes things go faster.]

Core idea PS4: Waves and their applications in technologies for information transfer—How are waves used to transfer energy and information?

• PS4.A: What are the characteristic properties and behaviors of waves? [Sound can make matter vibrate, and vibrating matter can make sound.]

• PS4.C: How are instruments that transmit and detect waves used to extend human senses? [People use their senses to learn about the world around them. Their eyes detect light, their ears detect sound, and they can feel vibrations by touch.]
Conceptual Framework

Engineering, Technology, and Applications of Science

Core idea ETS1: Engineering design—How do engineers solve problems?

- ETS1.A: What is a design for? What are the criteria and constraints of a successful solution? [A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems might have many acceptable solutions. Asking questions, making observations, and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem.]

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

- ETS2.B: How do science, engineering, and the technologies that result from them affect the ways in which people live? How do they affect the natural world? [People depend on various technologies in their lives; human life would be very different without technology. Humans design products by applying some knowledge of the natural world and build them with materials derived from the natural world, even when the materials are not themselves natural—for example, spoons made from refined metals. Thus, developing and using technology has impacts on the natural world.]
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 (five in this module)
- Assessment

Teacher Resources. This collection of resources contains these chapters.
- FOSS Introduction
- 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: Balance and Motion* 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.

*Balance and Motion 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 (five 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, and 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. (How can spinning motion be changed?) 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 what causes twirlers to rotate. 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, and 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.
Balancing and Motion — Overview

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.

**10. Assess progress: scientific practices**

Visit groups while students work on their balancing tasks. Observe their activities, looking for evidence that students are exercising scientific practices.

**What to Look For**

- *Students share discoveries with one another.*
- *Students explore possibilities for counterweight placement.*
- *Students share their reasoning with one another.*
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 might 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.

Embedded even deeper in the FOSS pedagogical practice is a bolder philosophical stance. Because language arts commands the greatest amount of the instructional day’s time, FOSS has devoted a lot of creative energy defining and exploring the relationship between science learning and the development of language-arts skills. FOSS elucidates its position in the Science-Centered Language Development chapter.
**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.

**NOTE**

The FOSS digital resources are available online at FOSSweb. You can always access the most up-to-date technology information, including help and troubleshooting, on FOSSweb. See the FOSSweb and Technology chapter for a complete list of these resources.
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.
  • FOSS Introduction
  • 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.

NOTE
The Spanish masters are available only on FOSSweb.
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.


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 might 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 balance and motion can be conducted with small groups at a learning center. For example, making mobiles in Investigation 1, Part 4, 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. Let your teacher know if you have never been stung by a bee.
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. Never 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.
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 8 weeks be devoted to this module. Take your time, and explore the subject thoroughly.

**Active-investigation (A) sessions** include hands-on work with materials, 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.

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<th>Week</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
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<td>A/W</td>
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<td>START Inv. 2 Part 3</td>
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<td>A/ R</td>
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<td>A/W</td>
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<td>A/ W</td>
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<td>A/ W</td>
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<td>A/ W</td>
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<td>I-Check 5</td>
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# FOSS K–8 Scope and Sequence

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