Air and Weather

Air and Weather > Investigation 1: *Exploring Air* >
Part 3: *Parachutes*, page 17

Parachutes

When to Go Out

Repeat Part 3, taking students outside to fly the parachutes.

Outdoor Objective

Students will compare the flights of the parachute inside to outside and notice the impact of moving air (wind) and air currents on the parachute.

Materials

For Each Student	Parachute
For the Class	3–5 Extra parachutes already made by teacher
	Extra supplies to fix small repairs
	Tape (for failing dots)

Make extra parachutes to bring outside in case a few fall apart. You may also need to make quick repairs. Also, be sure the stickers are permanent and not removable.

Getting Ready

Time: 10–15 min.

Site: If it is really windy you may want to wait for another day as the parachute design is not made to withstand strong winds. You could also try the leeward side of the building (the windward side is where the wind hits first, the leeward side is the opposite side).

Caution: If there is a chance the wind direction could blow the parachutes into the street, go to a different side of the building.

Guiding the Investigation

1. After building and using the parachutes inside, take them outside.
2. Let students drop and release the parachutes from the ground several times.

Outdoor Activities At a Glance

Priority activities appear in green.

What You Might Find:

It does not take much wind to have some real fun with these parachutes. Students will experience how the wind affects the parachutes and may even experience updrafts when the parachutes are carried up into the sky.

Many students will use their parachutes like a kite, running with it behind them. They will be reluctant to let theirs go, possibly afraid that they will lose it. You may want to bring your own parachute to model how exciting it can be to let it go. Give students plenty of time to practice, waiting for the wind to be right to carry their parachutes the farthest.

"We were doing this lesson outside when an updraft carried one of the parachutes 100 feet into the sky. We all stopped and watched as the tiny parachute sailed out of sight."

Erica Beck Spencer
Science Specialist

3. For extra excitement (and better effect), you could release parachutes from chairs or the playground structures. You might also have an assistant release a parachute from an open window a few stories up.
4. Let students think of other ways to make their parachutes fly better.

Air and Weather > Investigation 1: *Exploring Air* > Part 6: *Balloon Rockets*, page 34

Balloon Rockets

When to Go Out

Part 6, Step 7 (page 38) is conducted outdoors. Take students outside to see how far balloons will travel without a zip line. You could also do all of Part 6 (pages 34–38) outside if space is an issue in the classroom. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will observe that without a flight line the balloon's motion is irregular and that the flight line controlled the motion of the balloon.

Getting Ready

Time: 10–15 min.

Site: An area in which your entire class can stand in a circle.

Conservation: All balloons must be collected, even if they pop, because they are very dangerous to wildlife. Make this explicit to students. This is an important lesson for students.

Safety Note: Be sure to find out if any students have a latex allergy before using the balloons. Air pumps should be used to inflate balloons.

Guiding the Investigation

1. After doing the balloon rocket activity indoors, ask, *How far do you think the balloon will travel if we just let it go without the zip bag?*
2. Tell students that you will go outside as a class to investigate how far the balloons will travel.
3. Once outside, have students form a large circle so that they are facing each other. Tell students that after you release the balloon rockets, they will find their balloon and stand where it landed.

4. After all students have their balloons inflated, count to three and release them at the same time.
5. Have students observe where the balloons ended up. Ask, *Did the wind impact how the balloons moved?*
6. If you have time, try the activity again and have students focus on how and where their balloon moves.
7. Collect all the balloons, go back inside, and discuss how the balloons traveled. Ask, *Why was the balloon's movement different than when the balloons were on the flight lines?*

Air and Weather > Investigation 2: *Observing Weather* > Part 1: *Weather Calendars*, page 8

Weather Calendars

When to Go Out

Step 2 (page 11) is conducted outdoors. Students go out to do a mini-observation of the weather using the senses. Refer to the FOSS Teacher Guide for complete instructions.

You can expand this by taking Weather Walks to make additional observations throughout this module (and the year). Brief observations can even be done while lining up after recess, or before school.

Outdoor Objective

Students will monitor the changes in the weather, learn to notice their own experience of weather, and increase their weather vocabulary.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For the Class	A variety of weather instruments: thermometers, wind vanes, and the instruments students are making in class

Getting Ready

Time: 10 min. for a brief check, 20 min. for more extended observation and discussion.

Site: Select a walking circuit that the class will follow for each weather observation (out the front door, around to the oak tree, etc.) to help students slow down and look around.

What You Might Find:

Students may not be accustomed to noticing the weather, or using a new vocabulary to describe something so amorphous. Take the time to sit and observe what is around you. You will often see things change before your eyes. The Sun may go behind a cloud or wind may start to blow. Discuss what words might work to describe these events.

"In addition to keeping a class weather calendar, each of my students had a weather journal. At least once a week, we went outside for a 'weather walk' and then wrote in our journals. The students had a word bank in the back that they added to each time we learned a new term."

Erin Flynn
Science Specialist

Guiding the Investigation

Establishing a Weather Observing Routine may help students get more out of their weather watching. Setting behavior expectations in place at the beginning helps establish the routine.

1. Tell students this is different from the previous, more energetic activities of flying parachutes and balloon rockets, and will require being quiet.
2. Go outdoors and do a slow walk along a defined circuit around the schoolyard. Gather in a circle to silently observe the weather. Talk about what students notice. Ask, *What words could be used to describe the weather? How does it feel to be out in it?*
3. Use the weather instruments you brought out to record temperature, wind direction, etc.
4. Back inside, record your findings on your class weather calendar.
5. Repeat as often as possible in all sorts of weather.

Air and Weather > Investigation 2: *Observing Weather* > Part 2: *Measuring Temperature*, page 14

Measuring Temperature

When to Go Out

Steps 4 and 5 (pages 17–18) are conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will observe different temperature readings in sunny and shady areas.

Guiding the Investigation

1. After recording the indoor temperature, go outside to feel the air. Have students predict whether the temperature outside will be colder or warmer when compared to the classroom thermometer reading.
2. Read the temperature in two or more locations: a sunny and a shady spot. Use the previously mentioned "Weather Observing Routine."
3. Try putting one thermometer on one side of a tree in the Sun and one on the opposite side in the shade. The thermometers will be near each other but temperatures will be significantly different.

Air and Weather > Investigation 2: *Observing Weather* >
Part 3: *Watching Clouds*, page 21

Watching Clouds

When to Go Out

Steps 3–4 (pages 22–23) are conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will observe clouds changing constantly, in color, size, and shape; they will observe that different types of clouds are associated with different types of weather. Students will see that the wind moves clouds.

Getting Ready

Time: 10–15 min.

Safety Note: Remind students that it is extremely dangerous to look directly at the Sun.

Guiding the Investigation

Follow your Weather Observing Routine.

Air and Weather > Investigation 2: *Observing Weather* >
Part 4: *Measuring Rain*, page 24

Measuring Rain

When to Go Out

Steps 4–5 (pages 26–27) are conducted outdoors. Students go outside to set up a rain gauge. Consider making this an ongoing investigation. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will learn that a rain gauge is a weather instrument that measures rainwater and snow.

Getting Ready

Time: 5–10 min.

Site: You may want to attach the rain gauge to a fire escape using metal wire so that it is not tampered with on the ground level. Put 1 cm of oil in the rain gauge to keep the water from evaporating from the rain gauge. Don't forget to subtract that 1 cm when looking for a rain total.

What You Might Find:

You may be able to do this multiple times during the day, such as when lining up in the morning or coming in from recess. Clouds change very quickly so observing those changes may be more interesting to students than what they see at any one point in time.

"We had a wonderful time observing the clouds. We actually laid down in the grass and looked up at the clouds. The students talked about the clouds moving and at one point the Sun kept going behind the clouds. My students said it was 'gray out' when the Sun went behind the clouds and sunny when the Sun came back out."

Michelle Teleau
Science Specialist

Air and Weather > Investigation 3: *Wind Explorations* >
Part 1: *Bubbles in the Wind*, page 8

Bubbles in the Wind

When to Go Out

Steps 3–6 (pages 10–11) are conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will observe evidence of wind speed and wind direction based on the movement of bubbles.

Getting Ready

Site: An area where your entire class can sit down and there is some movement of air. It does not take a lot of wind to see the bubbles move.

Conservation: If using small plastic cups save them and reuse them for years to come. Paper cups are a better option.

Air and Weather > Investigation 3: *Wind Explorations* >
Part 2: *Wind Speed*, page 12

Wind Speed

When to Go Out

Step 7 (page 15) is conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will observe differences in wind speed based on the number of rotations of the anemometer.

Air and Weather > Investigation 3: *Wind Explorations* >
Part 3: *Pinwheels*, page 17

Pinwheels

When to Go Out

Step 6 (page 20) is conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will observe differences in wind speed based on the number of rotations of the pinwheels. Students compare the use of the pinwheel to that of the anemometer.

Guiding the Investigation

1. After making and using pinwheels inside, take students outside to the windward side of the building.
2. Students should experiment with how to increase the number of revolutions. Students will discover that if they hold the pinwheel at a certain angle to the wind, it will spin faster.
3. Walk around the building for students to identify that certain locations are better than others for making their pinwheel spin faster.
4. If there isn't any wind, students can move with the pinwheel to make it spin. Take pinwheels on any weather observation walks to measure wind speed.

"In addition to making pinwheels, my kids made 'wind flags'… it was nice for each kid to have a weather tool to hold on our weather walks!"

Erin Flynn
Science Specialist

Air and Weather > Investigation 3: *Wind Explorations* >
Part 4: *Wind Vanes*, page 22

Wind Vanes

When to Go Out

Steps 4–6 (page 26) are conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will observe that wind vanes tell which direction the wind is coming from and that the wind direction is always changing.

Air and Weather > Investigation 3: *Wind Explorations* >
Part 5: *Kites*, page 28

Kites

When to Go Out

Step 7 (page 32) is conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will synthesize the information learned about anemometers and wind vanes to best fly their kites.

Guiding the Investigation

Go outside and observe the anemometer and the wind vane. Discuss the direction of the wind and whether there is enough wind to fly kites. Then, as FOSS® says, "… let 'em fly!"

Note: Many of the FOSS® Extensions on pages 35–36 can be done outdoors.

Air and Weather > Investigation 4: *Looking for Change* >
Part 3: *The Night Sky*, page 19

The Night Sky

When to Go Out

Step 2 (page 22) is conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students visualize and compare the phases of the Moon. They will learn that the Moon can be seen during the day and night, and see that the Moon is not always in the same location.

Guiding the Investigation

Go outside to observe the Moon when it is in the third quarter during the school day. Students make night-time Moon observations for homework.

Animals Two by Two

Animals Two by Two > Investigation 2: *Land and Water Snails* >
Part 1: *Land Snails*, page 9

Go On a Schoolyard Field Trip to Look for Snails

FOSS® Extension, page 27

When to Go Out

This activity should be done prior to Investigation 2, Part 1 (if you do not have snails). If you already have snails for your class, do this activity following Part 1.

Note: The United States Department of Agriculture (USDA) requires a permit for the purchase of *Helix aspersa* and other land snails. For more information, go to Delta Education's website at www.deltaeducation.com.

Outdoor Objective

Students will learn where to look for land snails and collect a class sample to use for this investigation.

Materials

For Each Student	1 Hand lens
For the Teacher	1 Clipboard with paper
	1 Container for snail terrarium

Getting Ready

Time: 15–20 min.

Site: Look in schoolyard for evidence of land snails in shady, moist, wooded areas before taking students outside. Snails are nocturnal and are easiest to find early in the day.

Conservation: Teach students how to gently turn leaves over without breaking the leaf off; how to gently turn logs over to look underneath them and carefully replace them; and how to pick up a snail by slowly sliding it along the surface to which it is attached while gently lifting upwards.

Seasonal Tip: Snails hibernate in the winter.

Outdoor Activities At a Glance

Investigation 2

Go On a Schoolyard Field Trip to Look for Snails (FOSS® Extension)

Observe Locally Gathered Land Snails on Natural Surfaces (BSI Extension)

Compare Slugs to Snails (FOSS® Extension)

Observe Snail Trails Outdoors (FOSS® Extension)

Investigation 3

Take a Schoolyard Field Trip to Look for Worms (FOSS® Extension)

Investigation 4

Go On a Schoolyard Field Trip to Look for Isopods (FOSS® Extension)

Investigation 5

Observe and Compare Two Schoolyard Birds (BSI Extension)

Priority activities appear in green.

Guiding the Investigation

1. Gather students outside in a circle for discussion.
2. Discuss places where students may find snails.
3. Students will then spread out to search for snails.
4. When the first snail or two is found, gather students to show them where it lives and observe it for a few minutes.
5. Try to find as many snails as you can, ideally one per student or one per pair.
6. While students are looking at the snail, ask them to describe where they found it (i.e., in a moist log) and record this information on your clipboard.
7. Look for mucus trails left by the snails.
8. Return inside to discuss your findings. If you are keeping the snails, have students gently place them in the terrarium.

Animals Two by Two > Investigation 2: *Land and Water Snails* >
Part 2: *Snail Races*, page 14

Observe Locally Gathered Land Snails on Natural Surfaces

Boston Schoolyard Initiative Extension

When to Go Out

After completing Part 2 indoors, bring your locally collected land snails outside for this activity.

Outdoor Objective

Students will temporarily bring their snails outside to observe how they move on various natural surfaces.

Materials

For Each Pair	2 Hand lenses
	1 Plastic cup
	1 Vial
For the Class/Teacher	1 Pitcher of water
	1 Whistle (attention getter)
	Snails

Getting Ready

Time: 20–30 min.

Site: Set up in an area near vegetation in the shade that offers various surfaces such as rocks, tree trunks or logs, and leaves.

Conservation: Make sure that students understand that all snails need to be returned to the classroom for further study. At the end of the investigation, land snails should be returned to the location where they were first found.

Seasonal Tips: It may harm the snails to do this activity outdoors in the winter, but you could bring the natural surfaces inside and try it.

Caution: Remind students to keep snails out of direct sunlight.

"This was my favorite activity in the kit. The students really enjoyed it and loved seeing the snails on different surfaces. It really showed them how snails exist in the environment."

Sarah Trantina
K–2 Classroom Teacher

What You Might Find:

Early in the school year your students may not have the attention span to handle testing so many different things in the same lesson. You may want to have students test the three leaves during one lesson and test the sticks and rocks during a second lesson.

Students may find that the snail eats one leaf and not another. This will generate a great discussion.

Guiding the Investigation

1. Gather students outside in a circle to discuss the activity.
2. Remind students how to handle the snails and to place them only on moist surfaces. Show students how to moisten a leaf. They will need to observe the snail with a partner (unless you have one snail per child).
3. Ask students to gather 3 different kinds of leaves, 2 rocks they can hold with their hands, and 1 or 2 sticks.
4. After students have gathered these objects, sit in a circle in a shady spot. Fill up each pair of students' cups halfway with water.
5. Start with the three different types of leaves. Students will sprinkle water on their leaves and then gently place their snail on one leaf at a time for about 2 minutes.
6. Have students carefully observe what the snail does, how it moves, and what it eats.
7. Repeat with the other kinds of leaves.
8. Follow the same process with the rocks and branches.
9. Return indoors to discuss what students have discovered and record their observations on a chart. If students have science notebooks, you may choose to have them record their observations in words and drawings prior to the class discussion.

Animals Two by Two > Investigation 2: *Land and Water Snails* >
Part 3: ***Observing Water Snails***, page 18

Compare Slugs to Snails

FOSS® Extension, page 27

When to Go Out

After completing Part 3, try the extension that suggests comparing slugs to land snails by going outdoors to observe them in their habitat.

Outdoor Objective

Students search for slugs in the schoolyard and compare their body structure, habitat, and behavior to those of snails.

Materials

For Each Student	1 Hand lens
For the Teacher	1 Clipboard with paper

Getting Ready

Time: 15–20 min.

Site: Slugs eat at night. During the day, they rest in dark, damp places such as under pots, bricks, rocks, or dead logs.

Guiding the Investigation

Follow the steps in the previous lesson, "Go On a Schoolyard Field Trip to Look for Snails" substituting "slugs" for "snails."

Animals Two by Two > Investigation 2: *Land and Water Snails* >
Part 4: *Shells*, page 22

Observe Snail Trails Outdoors

FOSS® Extension, page 27

When to Go Out

Following Part 4, try the extension that suggests looking for the trails left by snails overnight.

Outdoor Objective

Students learn about snail behavior and habitat by looking at where their mucus trails are found.

Animals Two by Two > Investigation 3: *Big and Little Worms* >
Part 3: *Comparing Redworms to Night Crawlers*, page 17

Take a Schoolyard Field Trip to Look for Worms

FOSS® Extension, page 22

When to Go Out

Following Part 3, take students outside to look for worms. In addition to going out after a rainstorm, as the extension suggests, you may want to look for worms in the soil and under rocks at other times as well.

Outdoor Objective

Students observe worm behavior and learn that worms live in the earth all around them. Students can also set up a compost area to attract worms.

Guiding the Investigation

1. Discuss what might cause worms to come out of the ground. Have students dig for worms in the school garden or put the class worms into the garden to enrich the soil.
2. Another suggestion is to begin a compost bin with your students in the schoolyard.

Animals Two by Two > Investigation 4: *Pill Bugs and Sow Bugs* >
Part 2: *Identifying Isopods*, page 12

Go On a Schoolyard Field Trip to Look for Isopods

FOSS® Extension, page 24

When to Go Out

This activity can be done anytime during Investigation 4.

Outdoor Objective

Students observe isopods in the schoolyard and look for evidence of how sow bugs or pill bugs are different in structure and behavior.

Getting Ready

Site: Look for isopods under stones, clay flowerpots, fallen tree branches, plant litter on the ground, or in a compost bin. You could also put out chunks of raw potato overnight to attract isopods.

Animals Two by Two > Investigation 5: *Eggs and Chicks*

Observe and Compare Two Schoolyard Birds

Boston Schoolyard Initiative Extension

When to Go Out

If you are unable to do Investigation 5 where you hatch chicks, you can observe birds in the schoolyard.

Outdoor Objective

Students search for, observe, identify, compare, and draw two birds found in the schoolyard.

Materials

For Each Student	Science notebook
	1 Clipboard
	Crayons
For the Teacher	Extra crayons

"We read the **Animals Two by Two** *section on isopods first and discussed where we might find them. We then scouted out good areas to search and the students felt the ownership of putting their ideas to work. Later, on their own at recess, I found the kids discussing bugs and looking for them, and wondering why they would be in certain areas and not others."*

Patricia Smith
K Classroom Teacher

"We couldn't do chicks and eggs but we could talk about birds outside. We sketched pigeons. The kids were looking, and observing in such detail, they even observed different types of pigeons."

Patricia Smith
K Classroom Teacher

Getting Ready

Time: 15–25 min. (Depends upon students' attention spans.) Do this over the course of 3 or more days.

Site: Find a quiet area with room for the whole class to sit. A good location to observe birds is under a tree. In a city classroom, you may want to select from pigeons, sea gulls, starlings, blue jays, or other common birds that you are guaranteed to see each time you go out.

Seasonal Tips: In the winter, send a note to parents to introduce this activity and ask that students come to school dressed appropriately.

Guiding the Investigation

1. Instruct students inside about how quiet and still they need to be for birds to feel safe. Teach them to point to the birds if they want others to see a bird instead of using words. You may want to practice (sitting with notebooks and being quiet) indoors first.
2. Each day guide the investigation by focusing on one of the following:
   - Identify, observe, and watch the two selected birds
   - Compare the structure of the birds (refer to Part 3 for questioning strategies)
3. Have students record their notes on each bird on facing pages of their science notebooks so they are displayed side by side when the notebook is open. This makes it easier for students to make comparisons.

Insects

Insects > Investigation 1: *Mealworms* >
Part 2: *Larva, Pupa, Adult*, page 16

Beetle, Insect, or Bug Hunt

When to Go Out

Following Part 2, students go outside to look for insects at different stages of their life cycles. You could combine this lesson and the next lesson if you do not have time for both.

Outdoor Objective

Students will utilize their prior knowledge to search for insects in the schoolyard habitat, and discover insects at different stages of their lives.

Materials

For Each Pair 2 Hand lenses
3 Jars or vials

If you are going to keep the insects in the classroom, make sure that you poke holes in the lids.

Student sheet no. 27 *Home/School Connection* could be used during this investigation.

Getting Ready

Time: 15–30 min. Flexible—depending on how much time you want to devote to it.

Conservation: You will need to teach students how to carefully look for insects without destroying their habitats. If students are too excited and acting recklessly, stop the investigation, return to the classroom, and review how to tread gently. Try again another day.

Seasonal Tips: To search for insects in the winter, ask, *Where would I go if I were an insect trying to stay warm*? Because of the cold, insects will take shelter inside rotting logs, deeper in the soil, under leaves, and other ground debris. Collect soil and debris on the ground and put it in a terrarium indoors. Within a very short time, life will spontaneously erupt, including plants, spiders, and insects. Look for acorns and galls and open them indoors.

Caution: Have students use a leaf or stick to carefully lift insects into the containers.

Safety Note: Be careful to collect insects that don't bite or sting.

Outdoor Activities At a Glance

Investigation 1
Beetle, Insect, or Bug Hunt
Bring Insects to Class (FOSS® Extension)

Investigation 2
Look for Moths (FOSS® Extension)

Investigation 3
Look for Milkweed Bugs in the Wild (FOSS® Extension)

Investigation 4
Look for Evidence of Insects

Investigation 5
Raise Local Larvae (FOSS® Extension)
Pollination (OBIS Activity)

Investigation 6
Take a Field Trip to a Natural Area, Vacant Lot, or Pond (FOSS® Extension)

Priority activities appear in green.

What You Might Find:

Some students will have no trouble with this activity. You may want to pair these students with more apprehensive ones.

Many students will not know how to look for insects without guidance from you. Model how to do it and show excitement when you see something.

"If you were there, you would have heard things like, 'Look what I have!' and then a sudden rush of students around that person. At one point, students turned over a rock and found an entire ant colony. Even I jumped!"

Eric Meuse
Science Specialist

If some students are apprehensive, they can have you look at an insect before they collect it. Once they know an insect won't bite, they will be less fearful.

Guiding the Investigation

1. Outdoors (or indoors) ask students what makes something an insect. Do not tell them the answer. Use this as a preassessment for the module.
2. Discuss what living things need to survive.
3. Ask students where they think they might find insects or bugs and set the boundaries for the search.
4. Walk to one of the places students suggested and model how to gently turn over a rock to look underneath, how to look on the underside of a few leaves, and how to look under dead plant matter or logs. Tell students that you want to leave everything exactly as you found it to respect the animals that live there.
5. With their partners, students search until they find an insect or bug to place in their container along with a piece of the leaf or wood on which they found the insect.
6. Students can continue searching for another insect or sit together in your meeting spot and observe the insect while they wait for the rest of the class.
7. Once inside, students display their insect on their desks and walk around the room looking at their classmates' found treasures.
8. Have a classroom discussion about observations and discoveries.
9. Within 24 hours, return the insects to approximately the same location in which they were found.

Insects > Investigation 1: *Mealworms* >
Part 2: *Larva, Pupa, Adult*, page 16

Bring Insects to Class

FOSS® Extension, page 27

When to Go Out

At any point during this module, you may encourage students to bring insects in to create a classroom "Rotating Insect Zoo." After a day or two, students return the insects to their natural habitats.

Outdoor Objective

Students will collect insects on their own and observe their characteristics and behaviors.

Materials

You may want to send home student sheet no. 27 *Home/School Connection* to help parents and students with the collection process.

Guiding the Investigation

1. Remind students how to carefully look for insects without hurting them or their homes.
2. Review the characteristics of an insect.
3. Allow time for the whole class to look for additional insects, or assign different groups each day to bring in new insects for a "Rotating Insect Zoo."
4. Create a display area (or "zoo") in which students can place their insects. Have students visit the "zoo" in small groups to observe and compare the different insects found.
5. If there is time, students may record their observations about one or more of the insects in their notebooks, paying close attention to the body parts.
6. At the end of the day, students who brought insects to class should return them to their outdoor habitat to be replaced with new insects the next day brought in by different students.

"The observing never stopped. Every day students brought in creatures they were finding outside. Next time I would create a 'sightings calendar' so students could record their findings over time."

Teresa Strong
Science Specialist

Insects > **Investigation 2: *Waxworms***

Look for Moths

FOSS® Extension, page 27

When to Go Out

Assign as homework anytime during Investigation 2**.**

Outdoor Objective

Students will identify one way to attract moths in order to study them better.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil

Getting Ready

Seasonal Tip: In warmer weather, you'll see more insects.

Guiding the Investigation

1. Students will look for moths near their outdoor lights at home at night. There will be fewer moths in the city than in the country, but it is still worth a look. If students have a screen on their door, instruct them to turn on the porch light, wait awhile, and look for moths from indoors.
2. Discuss students' findings in class. Why might some students have seen moths and not others? Ask them to look again in a week or more. Do they see the same kinds of moths, in the same numbers?

Insects > Investigation 3: *Milkweed Bugs* >
Part 2: *Habitats*, page 12

Look for Milkweed Bugs in the Wild

FOSS® Extension, page 28

When to Go Out

Following Part 2, go outside to look for milkweed plants if you have them in your schoolyard or in a nearby vacant lot.

Outdoor Objective

Students will identify milkweed plants so they understand that they grow in the city and see milkweed bugs in their natural habitat.

Getting Ready

Seasonal Tip: Milkweed bugs are most likely to be found in late summer.

Guiding the Investigation

As suggested in the FOSS® Extension on page 28:

1. Look at the milkweed plants in your schoolyard. Look at them at different times of the year. Does their appearance change?
2. Encourage students to look for milkweed plants, and for milkweed bugs at home, in the schoolyard, and around the city.

"At first, students were really unsure of what to look for. Once one student found a leaf with holes in it, other students followed. Soon they were able to find evidence of insects all over the schoolyard, including an anthill without the insects and the silk of caterpillar larvae."

Eric Meuse
Science Specialist

Insects > Investigation 4: *Silkworms* > *Home/School Connection*, page 32

Look for Evidence of Insects

When to Go Out

Following Part 5, take students outside to look for evidence of insects in the schoolyard.

Outdoor Objective

Students will use their knowledge of insects studied during the module to help them search for evidence of insect life in the natural world.

Materials

For Each Student
- 1 Hand lens
- Science notebook or student sheet no. 28 *Home/School Connection*
- 1 Clipboard
- 1 Pencil

"We had the good fortune of finding ladybug pupae and larvae in our schoolyard. Students have been bringing in mosquito larvae and grubs now that they know what to look for. Now they really understand that insects take different forms."

Teresa Strong
Science Specialist

Getting Ready

Time: 15–45 min. (Spend as much time as you can.)

Site: Check the area for anything from excessive mud to unsightly items before doing this activity.

Conservation: Students should be developing stewardship of their schoolyard and tread gently upon the natural areas. If not, it is time to model again what you expect.

Guiding the Investigation

1. Explain to students that today you will be going on a walk to look for evidence of insect activity. Gather some ideas of where you should look and what you might see.
2. Before going outside, have students set up their science notebooks. Questions for the Investigation: What evidence of insects do I see? What evidence of other living things do I see?
3. Walk to the area of the schoolyard with the most vegetation and let the investigating begin.
4. Look under leaves on bushes, look between the leaves, look at leaf litter on the ground, look on the sides of trees, etc.
5. Allow time for students to write in their notebooks while outside.

Insects > Investigation 5: *Butterflies*

Raise Local Larvae

FOSS® Extension, page 27

When to Go Out

Take students on a larvae-collecting/observation walk anytime during Investigation 5.

Outdoor Objective

Students will utilize their prior knowledge of butterflies to search for eggs, larvae, and chrysalises in the schoolyard habitat.

Guiding the Investigation

Look on host plants such as alfalfa, cabbages, oak trees, poplar trees, tomatoes, or many others for larvae, eggs, and chrysalises. Remember that if you take insects inside you need to bring in several of the surrounding leaves as well.

Pollination

OBIS Activity

When to Go Out

This activity can be done anytime during Investigation 5.

Outdoor Objective

Students will use artificial bees to explore how insects transfer pollen from one flower to another.

Materials

For Each Student	1 Piece of black construction paper
	1 Cotton swab
	Black and yellow markers
	1 Hand lens

If you are going to keep the insects in the classroom, make sure that you poke holes in the lids.

Student sheet no. 27 *Home/School Connection* could be used during this investigation.

Getting Ready

Time: 25–45 min.

Site: Do not do this after a heavy rain; the pollen will not come off of the plants very easily when they are wet. Select a site with several types of flowering plants that have pollen on them.

Seasonal: This activity works best in the spring when flowers are in abundance. In the fall or winter, you could bring in flowers that you purchase, but bring the flowers and "bees" outside to do the activity.

Safety Note: If you have students who are allergic to bees make sure they work on plants with flowers that do not have bees on them.

Guiding the Investigation

1. Have each student make a bee out of their cotton swab by striping it with yellow and black markers.
2. Distribute the black paper and hand lenses.

3. Gather your students around your selected site with their bees. Ask what bees do to get food. If no one knows, tell them the bees travel from flower to flower to collect pollen and nectar. Ask how they gather the pollen. Accept all answers and then tell students that their bees are going to visit a real flower.
4. Demonstrate how to gently brush the bee on top of the flower and then tap it on the black paper. Tiny pieces of pollen will fall onto the paper. Ask them to look at both the bee and the paper carefully with a hand lens.
5. Have them try this a few times.
6. Gather students together to discuss what they saw on the bees and the black paper. If nobody knows what it is, tell them this is pollen. Tell your students that bees and other insects pollinate flowers by taking the pollen from one flower to another of the same kind, which enables the flower to make seeds or fruit.
7. Back in the classroom, read a book that explains pollination.

Insects > Investigation 6: *Other Insects*

Take a Field Trip to a Natural Area, Vacant Lot, or Pond

FOSS® Extension, page 24

When to Go Out

If students have gone outside several times already, this activity will be extremely exciting and a great way to end the module.

Outdoor Objective

Students will discover the diversity of plant and insect life found in a vacant lot or an overgrown hillside. They will discover "urban wilds" they may have never noticed before.

Guiding the Investigation

Take a field trip to a "natural area, an overgrown vacant lot within easy walking distance, or a pond. Bring vials, cups, plastic bags, and hand lenses." Bring sweep nets (if you have them) and encourage students to "look for insects on the ground, on plants, and in the air."

Magnetism and Electricity

Magnetism and Electricity > Investigation 1: *The Force* >
Part 2: *Investigating More Magnetic Properties*, page 18

Magnetic Materials Outdoors

When to Go Out

Following Part 2, bring students outside to repeat Step 6 (page 21). Students look for materials that attract or repel magnets.

Outdoor Objective

Students will discover that iron is present in many fabricated and natural materials.

Materials

For Each Student
- Science notebook
- 1 Clipboard
- 1 Pencil
- 1 Magnet (Stick magnets to clipboards or distribute once outside.)
- Paper clips

You may want to "plant" authentic metal materials (e.g., nails, garden signs, etc.) ahead of time in the outdoor space for students to find depending on what your schoolyard contains. If you do this, place objects lower to the ground where students can reach.

Getting Ready

Time: 20–30 min.

Site: Select an area which contains a variety of metal objects (though students will be testing non-metal materials as well). Look for rivets on play structures, fencing, painted metal, flag poles, galvanized aluminum, etc. Students may find magnetic earth materials (magnetite) even in very small quantities of sand or dirt.

Caution: Remind students of proper outdoor behavior. They should not throw magnets up onto high objects. Remind students that these magnets can break if dropped. Do not allow students near cars with magnets. Magnets will scratch paint on cars.

Outdoor Activities At a Glance

Priority activities appear in green.

What You Might Find:

Students should have already discovered in the test bag that magnetite sticks to magnets. It is rich in iron. Students may find rocks, gravel, or dirt outside that contain iron.

Test all types of metal. Magnets may stick to some nails or bolts but not others because some aluminum may be galvanized.

Going outside for this investigation removes the danger of students testing magnets by getting too close to electrical outlets, computers, and credit cards.

Guiding the Investigation

1. Set up notebooks inside. Ask students to first make predictions about what they might find and then make a T-Chart on which to record their findings.
2. Outside students will get their magnets and become "Iron Detectors" as they begin testing what the magnets are attracted to. Students can use the paper clips to look for induced magnetism.
3. After a few minutes, gather students to share findings so that all students can hear about and then try what others have discovered.
4. Give students 5 more minutes to test more objects.
5. When the lesson is complete, discuss why objects are made of the materials they are.

Magnetism and Electricity > Investigation 1: *The Force* >
Part 2: *Investigating More Magnetic Properties*, page 18

Finding Directions and Make a Compass

FOSS® Extensions, page 36

When to Go Out

Following Part 2, take students outside with a compass to locate north, south, east, and west.

Outdoor Objective

Students will experience real-life use of a compass to determine directions.

Materials

For Each Group 1 Compass

Getting Ready

Time: 20 min. (Steps 1–5); 20–25 min. (Steps 6–8).

Site: Try to work in a location where students can see the Sun.

Guiding the Investigation

1. Give students a few minutes outdoors to explore using their compasses.
2. Explain that compasses are used to indicate what direction a person is moving in. Teach students to find north by holding the compass level and rotating it so that the N is under the red tip of the arrow.
3. Have students find north and point to it.
4. Help, or have classmates help the students who are confused.
5. Continue the activity by calling out directions and having students point in the named direction. Start slowly and talk through the first few directional calls such as "Point to west", then move to more challenging calls such as "Point to southwest" or "Point in a northeasterly direction."
6. If you have time, take this one step further using a series of directional commands to lead students on a "treasure hunt."

"Students are amazed when they actually see earth materials being attracted to the permanent magnets. Students also induced magnetism using their magnets and the iron fence that is around part of our schoolyard."

Dean Martin
Science Specialist

7. Students begin in one spot and follow your verbal or written commands (2 steps to the north, 3 steps to the southeast) to reach a destination such as the flag pole, or an oak tree.
8. If time allows, challenge students to develop their own "treasure hunt" working in small groups to develop a series of directional commands leading to a spot of their choosing.

What You Might Find:

Students have difficulty learning how to read the compass. Be patient with them as you instruct them how to use it. Practice makes perfect.

If you have time, take a minute to discuss where the Sun sets and where it rises.

Magnetism and Electricity > Investigation 2: *Making Connections* >
Part 3: *Finding Conductors and Insulators*, page 20

Insulators and Conductors in the Schoolyard

When to Go Out

Following Part 3, bring students outside to repeat the lesson.

Outdoor Objective

Students will determine if objects in the schoolyard are insulators or conductors.

Materials

For Each Group	1 Circuit board necklace
For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For the Class	Extra batteries and wires

Getting Ready

Time: 15–20 min. (Optional 10-minute discussion about lightning added at end of activity.)

Safety Note: Have students look at, but not test, utility poles. Ask them what material the poles are made of and why. Students should be taught not to play near these poles. Take a minute to talk about how students shouldn't throw things around (or over) power lines, fly kites near them, or climb trees near them.

Guiding the Investigation

1. Students should make predictions about what things will be conductors and insulators. Then have them make a T-Chart in their notebooks to record their discoveries.
2. Students should walk around the designated area testing for insulators and conductors.
3. Discuss results and ask, *Did anything surprise you? Why are certain things made of conductive materials while others are insulators?* Students can brainstorm ideas about why insulators are safer building materials than conductors and about why conductive material is used.
4. Have a discussion about safety during a lightning storm.

What You Might Find:

Guide students to try the hardware on the play structures (as well as the other parts), benches, fences, railings, door knobs, plants, rocks, tables, wood, cement, etc.

What You Might Try:

Students may have already discovered that their magnets were attracted to some objects and not others. Can they make the connection to this lesson with regard to insulators and conductors? If students discovered something with magnetite in it, does it conduct electricity?

"The kids just have more room to move around and explore outdoors, and I am not as worried about them touching things that they should not."

Erin Flynn
Science Specialist

Find Out How Houses (and Your School) Are Wired

FOSS® Extension, page 27

When to Go Out

Following the completion of their research (or following Part 3, if students do not do the research extension) go outside to see where electricity comes into the school building and surrounding buildings.

Outdoor Objective

Students will predict and confirm where the electricity comes into the school building.

Getting Ready

Time: 5–10 min.

Safety Note: Remind students of the dangers of electrical wires.

Guiding the Investigation

1. Students may do research on how homes, apartments, or offices are wired.
2. Have students write predictions in their notebooks about where the electricity comes into the school building.
3. Go outside and find out where the electricity comes into the school.
4. Ask students why they think the electrical wires are placed so high up. Ask them to imagine all the wires running through the building. Take a minute to look at all the wires attached to neighboring buildings.
5. If you have streetlights near the school have students think about where the wires are. Ask, *Are these parallel or series circuits*? You might ask a custodian to join you to help answer questions.

Magnetism and Electricity > Investigation 4: *Current Attractions* >
Part 1: *Building an Electromagnet*, page 8

Electromagnets in Use

When to Go Out

Prior to Part 1, take this mini field trip.

Getting Ready

Site: If you happen to teach near a junkyard or a construction site with a crane that has an electromagnet on it, arrange a mini field trip before you begin building electromagnets.

Guiding the Investigation

Students will be able to see that the crane operator is able to turn the powerful magnet on and off. After observing for a brief time, return to the classroom to begin the investigation. Reminder: At this stage do not yet introduce the term "electromagnet."

"Going outdoors builds enthusiasm and helps connect the science curriculum to the real world."

Erin Flynn
Science Specialist

Teacher Notes:

Pebbles, Sand, and Silt

Pebbles, Sand, and Silt > Investigation 1: *First Rocks* >
Part 2: *Washing Three Rocks,* page 13

Washing Rocks Outdoors

When to Go Out

Following Part 2, take students out to collect their own rocks in the schoolyard and repeat the washing activity outdoors.

Outdoor Objective

Students discover that if they look carefully, rocks can be found everywhere.

Materials

For Each Student	1 Plastic cup
	1 Hand lens
For the Class	1 Pitcher of water

Getting Ready

Time: 10–25 min. Flexible—depending on how much time you want to devote to it. You could combine this lesson and the next outdoor lesson if you do not have time for both.

Safety Note: Remind students to avoid broken glass or other dangerous items.

Conservation: Pour any remaining water on plants to reinforce the fact that plants need water to live, and to remind students to conserve water whenever possible.

Guiding the Investigation

1. Take students outside, set the boundaries, and ask each student to find three to five rocks.
2. You might ask students to search for rocks that are similar or dissimilar: in size, color, texture, or hardness.
3. Pour water into the students' cups after they have found their rocks.
4. Have students wash their rocks and observe what happens. Discuss where the dirt in the cup of water comes from. If time allows, they can find more rocks to wash.

Outdoor Activities At a Glance

Priority activities appear in green.

"My students found so many different rocks. I have no idea how they did it. I was so surprised!"

Teresa Strong
Science Specialist

"The excitement increased around the pebbles with each trip outside. Students regularly came in for the day with observations of a rock or stone."

Rose Reeves Harris
Grade 2 Classroom Teacher

5. You may decide to take some rocks indoors to begin the class collection (see below). Or you may choose to begin an Outdoor Rock Collection. Have students replace all other rocks. Some may wish to keep theirs.
6. Display the rocks in the classroom. Some teachers have used egg cartons to organize the display.

Pebbles, Sand, and Silt > Investigation 1: *First Rocks* > Part 5: *Start a Rock Collection*, page 26

Collecting Rocks in the Schoolyard

When to Go Out

Start a rock collection as early in the module as you can to help build excitement and to have more time for students to develop and use their collection. Take students outside following Part 3 (pages 18–21) or after Part 5 (pages 26–29).

Outdoor Objective

Students search for rocks and build a rock collection. Students see that rocks have a number of different properties and discover the great variety of rocks in the schoolyard (and the world at large).

Getting Ready

Time: 10–25 min. Flexible—depending on how much time you want to devote to it.

Safety Note: Remind students to avoid broken glass or other dangerous items.

Site: Begin an outdoor rock collection in a special location away from recess traffic.

Guiding the Investigation

1. Distribute containers, bags, or egg cartons to students to carry their rocks.
2. Gather your students outside to discuss good places to search for rocks and to remind them of the expectations for appropriate rocks (not too big). Review where Peter of *Peter and the Rocks* looked for rocks.

3. Set the amount of time students will be searching, call out time warnings periodically.
4. You may want to allow students to wash their rocks using the water you brought out.
5. Complete student sheet no. 2 *Rock Record* for at least one rock.

What You Might Find:

Students will enthusiastically engage in this activity and want to collect a number of rocks. Decide how many you can fit in your classroom, where they will be stored, and whether or not students can add to this collection over time. Students will become very attached to their rocks!

Pebbles, Sand, and Silt > Investigation 2: *River Rocks* >
Part 1: *Screening River Rocks,* page 8

Screening Schoolyard Earth Materials

When to Go Out

Following Part 1, repeat screening activity outdoors with earth materials found in the schoolyard.

Outdoor Objective

Students will repeat the screening rocks activity outside to see that most earth material comes in various sizes that can be separated for specific uses.

Materials

For Each Pair	1 Bag filled with the screens, plates, and containers from Part 1
	Spoons
For the Class	Extra containers and plates for additional sifting

Getting Ready

Time: 20–45 min. (Depending on how well your students have grasped the sifting process).

"The rocks they find themselves are so much more important to them!"

Teresa Strong
Science Specialist

"By the end of the lesson, there were pairs of kids just going back and forth and sifting. It was definitely **way** *beyond my expectations of what was going to be done."*

Eric Meuse
Science Specialist

What You Might Find:

Students will develop ownership of this process by repeating it outside. Most students LOVE the opportunity to dig in the dirt.

Students may need help remembering the steps to this complicated lesson. You may need to meet in your designated discussion spot to review directions again. Students may also need help gathering a cup of the earth materials.

You may find that some students have not dug in the dirt before and some may not like getting dirty. Let them know they can scrub their hands as soon as they get inside.

Safety Note: Remind students not to pick up broken glass or other dangerous items. Students should wash their hands after this activity as soon as you return to the school.

Guiding the Investigation

1. Repeat directions to students for sifting while inside.
2. Bring students to the pre-selected best location for sifting the widest variety of earth materials.
3. Demonstrate how to scrape the ground with spoons to collect a cup of earth material.
4. Have pairs of students begin working together to sift one cup.
5. Help students make the connection between what they are doing and the rock sorting in quarries, gardening, or even archaeological digs.
6. When students are done, they should dump their results back on the ground and begin again in a different location if time allows.
7. You may want to end the lesson inside by looking at pictures of rock sorting at quarries.

Pebbles, Sand, and Silt > Investigation 2: *River Rocks* >
Part 3: *Sand and Silt*, page 18

Looking for Sand and Silt in the Schoolyard

When to Go Out

Following Part 3 (pages 18–23), take students outside to look for silt and sand.

Outdoor Objective

Students will discover that sand and silt occur naturally in the schoolyard.

Materials

For Each Pair	1 Vial with a lid
	2 Spoons
For the Class	1 Pitcher of water
	Extra vials and lids

Guiding the Investigation

1. Students will collect the sand (a puddle on the pavement after a rainstorm is ideal).
2. Have students fill their vials with water, shake the vials, and then return the vials to the room to let them settle overnight.
3. The next day students should observe their vials. Remind students that the layer on top of the sand is silt. Students should touch the silt as they did in Part 3. Students should notice the slightly rough texture of the silt (not grainy like sand or smooth like clay).

What You Might Find:

Students may have a hard time finding clay in soil—but the search itself is worth the effort. Students will think about the make up of the soil and all the things that go into it.

"We went outside and dug, sifted, and collected. It was a big hit with the students!"

Nancy Mullane
Science Specialist

Visit a Quarry

FOSS® Extension, page 31

Outdoor Objective

Students will see various earth materials being sorted by size and the equipment that does the heavy work.

Guiding the Investigation

If you are lucky enough to be in a school near a quarry—visit it!

Look for Clay Soils

FOSS® Extension, page 32

When to Go Out

Following Part 4 (pages 24–29), go outside and look for soil containing clay—it is sticky like the clay students worked with inside.

Outdoor Objective

Students will discover that clay soil occurs naturally in some schoolyards, and where it doesn't, the process of searching for it helps students learn to distinguish different earth materials.

Materials

For Each Student	1 Craft stick
	1 Vial

Getting Ready

Time: 15–20 min.

Guiding the Investigation

1. Ask students where they think they might find clay in the schoolyard, and why.
2. Have students spread out and collect samples using their craft sticks to scrape soil into their vial.

3. If a student thinks they have found clay, gather together to have a look and discuss the evidence for whether or not it is clay.
4. Have students bring in their samples to compare with the clay they used in class. Ask, *How do they compare?*

Where You Might Find Rocks in Use:

Concrete, cement, asphalt, bricks, and mortar; the school building; sidewalk; steps; playground; adjacent buildings; nearby statues.

Students may be surprised that the mortar between bricks has tiny pebbles in it, that the asphalt actually has quite big pebbles in it, and that the bricks themselves contain little pebbles. You will need to encourage them to look very, very closely.

"My students used magnifying glasses to see the crystals. It was also important to them to touch the various rocks in different forms."

Nancy Mullane
Science Specialist

Pebbles, Sand, and Silt > Investigation 3: *Using Rocks* >
Part 1: *Rocks in Use*, page 8

Rocks in Use

When to Go Out

Part 1 is conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students search for rocks in use and expand upon their understanding of how earth materials can be used.

Materials

For Each Student	1 Hand lens
	Science notebook
	1 Clipboard
	1 Pencil

Guiding the Investigation

If possible, have students record their observations in their notebooks while they are outdoors and looking directly at the examples they find of earth materials in use.

Pebbles, Sand, and Silt > Investigation 3: *Using Rocks* >
Part 5: *Making Bricks*, page 24

Making Bricks

When to Go Out

Steps 2–7 (pages 27–28) can be done outdoors (as suggested in Getting Ready, Step 8). It's messy! Don't forget to look at some bricks while you are out.

"Students in the city see science as a classroom activity, not as something they are actually living within. Teaching outside is so enlightening for them."

Rose Reeves Harris
Grade 2 Classroom Teacher

Pebbles, Sand, and Silt > Investigation 4: *Soil Explorations* > Part 2: *Soil Search*, page 15

Searching for Soil in the Schoolyard

When to Go Out

Part 2 is conducted outdoors. Refer to the FOSS Teacher Guide for complete instructions.

Getting Ready

Site: Try looking in planted garden beds, under bark mulch, at the base of trees, under bushes, in the compacted ground near play areas, or at dirt that has accumulated on the asphalt. How do the soils compare?

Water

Water > Investigation 1: *Water Observations* >
Part 1: *Looking at Water*, page 8

Water on Various Surfaces

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 1, bring students outside to investigate how water interacts with different surfaces.

Outdoor Objective

Students will be able to describe how water interacts with various surfaces outdoors and compare these interactions with the experiment done inside.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For Each Group	1 Vial
	1 Large plastic cup of water with lid
For the Class	Extra water in case of spills
	Extra pencils

You may want to fill the vials with water and cap them for your students. Decide if your students would spill less measuring themselves or when opening the vials.

Getting Ready

Time: 20–30 min.

Site: Choose a site that contains a variety of possible surfaces: pavement, grass, hard-packed dirt, loose soil in garden area, concrete, large rock, log, etc.

Conservation: When you are finished, pour leftover water onto plants. Make this a rotating job for students. Remind them that it is important not to waste water and that plants need water to live.

Guiding the Investigation

1. Decide whether you, or your students, will select the various surfaces on which they will pour water. This will depend on whether your students are ready for a more independent experiment or need more guidance.

Outdoor Activities At a Glance

Investigation 1

Water on Various Surfaces (BSI Extension)

Water on an Outdoor Slope (BSI Extension)

After a Rainstorm (FOSS® Extension)

Investigation 2

Keeping Water Cold (BSI Extension)

Investigation 3

Evaporation Locations

Investigation 4

Waterwheels

Priority activities appear in green.

"I couldn't have set the stage for the rest of the Water unit any better if I had tried! Students loved doing this activity outdoors. They were all able to predict what they'd see."

Judean Patten-Clark
Science Specialist

What You Might Find:

If students finish early you may want to instruct them to try a different location. A good choice would be a slight variation on one of the first three choices. For example, on a sloped hardtop area versus a flat hardtop area.

Students will be eager to discuss their results after completing the outdoor investigation. It is not essential to address all misconceptions at this point. This is an opportunity for students to explore their understanding and share their ideas.

2. Before going outside tell students that they will pour one vial of water on three different locations and observe what happens to the water. Remind students how to measure one level vial.
3. Set up science notebooks: Have students set up their notebooks inside, by putting the date and title on their notebook page. If you have pre-selected the surfaces students will use, have them label their notebook with those three sites leaving enough space under each for illustrations and descriptions of their observations. If students are selecting their surfaces, have them write site number 1, 2, and 3 (to be labeled outdoors with the specific location).
4. Outdoors, students should go to the surfaces they wish to test. Some may need help identifying three possible locations.
5. Students then measure one vial and slowly pour it (in one spot) on the selected area.
6. When water has been absorbed or is clearly done moving down the slope and has pooled in one location, students should record what happened to the water.
7. Students then move onto the second and third locations and repeat.
8. Leave time for students to discuss their results.

Water > Investigation 1: *Water Observations* >
Part 3: *Water on a Slope*, page 19

Water on an Outdoor Slope

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 3, take students outside to pour water on different slopes and surfaces. Due to the large amounts of water used, this works best as a class demonstration.

A Note on Rain: The results of this lesson vary drastically depending on how much rain you have had. For example, on a steep dirt slope, after a lot of rain, you may discover that the poured water will not run down the hill as predicted, but will soak into the ground quickly. When the weather has been drier for a few days, on this same slope, most of the water will run down the hill with very little absorbed by the earth. Most of the time the water on a steep slope travels the farthest (excluding the paved area).

On a gradual slope, students will witness that the water is absorbed more by the earth and does not travel as far. The gradual slope does not seem to be as impacted by the amount of rain. The water travels to the lowest point, moves slowly, and does not go much more than 1–2 meters.

Students should see that water on steeper slopes runs faster and farther than on more gradual slopes. If it has rained a lot, you may not see this. Although this is still a valuable lesson, it may confuse your students. If the water on a steep slope soaked into the ground immediately, then discuss the results with your students and try the lesson again when it is drier, and then compare the results. Doing this activity on drier earth materials supports the lesson in the **Water Module** more directly.

Outdoor Objective

Students will observe and describe what happens to water poured on various outdoor surfaces and slopes and compare the results to those observed in the classroom activity.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For the Class	4–5 2-liter bottles of water

Getting Ready

Time: 45 min.

Site: Select four different slopes. All sites have surfaces worth exploring. Try to have surfaces as similar as possible (e.g., packed dirt) so the changing variable is the slope. Here are some suggestions:

- "Flat" paved surface (black top in schoolyard)
- "Flat" dirt surface
- Gentle sloping surface (dirt or grassy area)
- Steep incline or hill if you have them on site (dirt or grassy area)

Seasonal Tips: If doing this activity in the winter, be careful not to pour the water on areas where students walk and could slip on ice.

"The level of excitement that comes with this activity is just incredible."

Michelle Teleau
Science Specialist

"I love doing an activity inside and outside because you're doing something very cold the first time. The second time they're constantly taking something from what they did inside but then they're applying it to the reality of outside."

Eric Meuse
Science Specialist

What You Might Find:

This is an exciting and engaging activity. Students will want to cheer on the water as it slowly makes its way across the pavement. It is worth being patient and waiting for the water to make it to the drain. It will be very exciting and eye-opening when it makes it there.

You may need to remind yourself that students are learning, and this excitement should be acknowledged and not seen as a behavior problem. (Put those overly excited students to work carrying water!)

All schoolyards are different and have great surfaces for this experiment. Think openly about your schoolyard before dismissing this activity as one you cannot do.

Guiding the Investigation

1. Tell students that you will slowly and steadily pour equal amounts of water on four different slopes and surfaces and observe what happens. Have students set up their notebooks before going outside. Leave at least a half a page for each surface.
2. Outdoors have students gather around to observe a student volunteer pour water onto the paved "flat" surface. The water will flow toward the nearest drain. **(Do not point out the drain yet!)**
3. Have the student pour 2 liters of water in a slow and steady stream onto the pavement in one spot (do not spread the water out).
4. Students should record what they observe immediately after the water stops moving.
5. Ask students why the water went to the drain. At this point, tell them the designers of the play area/parking area intentionally sloped the pavement to the drain to conduct rainwater away from the building.
6. As a group, move to the next location and repeat the pour. Chose another volunteer to pour this time.
7. Have students record their observations in their notebooks after each location.
8. Repeat until you have poured water in all four locations.
9. Instruct students not to block the streams of water with their shoes or any other object. If the water comes to them, they should move out of the way. If the water naturally flows towards a rock or stick, instruct students to leave it there and observe what happens.

Water > Investigation 1: *Water Observations* >
Part 3: *Water on a Slope*, page 19

After a Rainstorm

FOSS® Extension, page 27

When to Go Out

After a rainstorm, take students outside to observe the effects of flowing water and erosion. If there is a dirt pile somewhere in the schoolyard, look there first. Also look at the bottom of slopes for channels made by the flowing water.

Outdoor Objective

Students will see evidence that water flows down slopes in the schoolyard and moves earth materials with it.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil

Getting Ready

Time: 15–20 min.

Guiding the Investigation

1. Ask students where they might expect to find erosion, and have them spread out to look.
2. When students first find signs of erosion, gather together to discuss what they found. Ask, *Is this erosion the result of water flowing? How can you tell? What evidence is there that the flowing water moved earth materials from one place to another?*
3. Ask students to look around the schoolyard for other examples of erosion.

Water > Investigation 2: *Hot Water, Cold Water* >
Part 3: *Water as Ice*, page 19

Keeping Water Cold

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 3, bring students outside to build a container to keep water cold (or hot).

Outdoor Objective

Choosing from a variety of construction materials, students will design an insulated container to keep water cold (or hot), and then test their relative effectiveness.

Materials

For Each Group	1 chilled vial of water (Part 2)
	Scissors (Part 1) (The teacher should carry these out and distribute once groups are sitting.)
For the Class	Various materials such as foil, foam, felt, sand, plastic bags, boxes, cotton balls, newspaper, or other things that could be used as insulators (Part 1)
	Extra chilled vials of water in case of spills (Part 2)
	Tape

Gather the various materials listed above and equally divide the materials into boxes or bags (one per group). Also distribute equal amounts of tape to each group. Wrap the tape around a craft stick for easy distribution. (To do this quickly, use the length of your desk to measure pieces of masking tape and then wrap.)

To distribute equal amounts of sand, fill bags of sand, put one on each side of a balance and make equal, take one bag off, put another on, and make equal. Repeat until all the bags weigh the same amount.

Give the vials several hours to chill by placing them in the back of a refrigerator where it is coldest.

Getting Ready

Time: 2 sessions: One 45–60 minute session to build the insulated containers. The second session is for making observations: 10 minutes at the beginning and 10 minutes at the end.

Seasonal Tips: If doing this during the winter, you could use warm water in the vials instead and try to keep them warm. In winter, you probably want to do Part 1 of this lesson inside and Part 2 outside.

Conservation: When students finish their insulated containers, gather the leftover materials to reuse or recycle.

Guiding the Investigation

Part 1:

1. Ask students how they think they could keep water cold. Accept all answers.
2. Tell students that today they are going to build a container with their groups to keep water as cold as possible. Then they will test how well their containers work during the next class.
3. Students may only use the materials in the bags distributed to each group.
4. Take the class outside to the building spot. Students can spread out with their groups and begin building. To add a bit of excitement to the activity, do not let students open their bags until you say, "Begin building now!"
5. Once the building begins, give students time updates and remind them that after 40 minutes (or the time you allot), they will not be able to modify their design.
6. When time is up, have students collect all materials and bring them back inside. They should label their creations with their group name. You may want to collect the scissors yourself.

Part 2:

1. Carry the vials of cold water and the thermometers outdoors. The students should bring their containers, notebooks, and pencils.
2. Select a site that has partial shade. Set up near the shade, but not in it. Students will sit with their groups.
3. Pass out the vials and thermometers. Have students measure the temperature of the water, then place a cap on the vial, and put the vial into their containers.
4. Wait 30 minutes. You could read a selection from the *FOSS Science Stories* or do one of the extensions in the module.

"This activity really served to introduce students to the idea of good insulators. I thought it was a good real-world application of the hot and cold water explorations from Investigation 2."

Judean Patten-Clark
Science Specialist

5. During the last 10 minutes of class (wait as long as you possibly can), take the vials out of the containers and measure the temperature.
6. Students should record the temperature of their vial.
7. In the classroom, create a chart listing each group, the insulators in the group's container, and the first and second temperature reading. Which insulators worked the best? Ask if anyone did anything else to try to keep their container as cool as possible. Ask, *How could we find out for sure which insulator was the best?*

Water > Investigation 3: *Water Vapor* >
Part 2: *Evaporation Locations*, page 12

Evaporation Locations

When to Go Out

Following Part 2, take students outside to expand this investigation. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will expand their experiment by adding an outdoor location.

Getting Ready

Site: Select an outdoor location in an area that won't be trampled by students (possibly a fire escape). Be aware that wind may tip the cup over. You could put a rock in the cup to weigh it down; technically this would raise the water and change the surface area, which would increase the evaporation time. Also, rain may fill the cup, but these are both issues you could discuss with your students.

Water > Investigation 4: *Waterworks* >
Part 2: *Waterwheels*, page 12

Waterwheels

Try doing this activity outside instead of inside. It's a wet one! Refer to the FOSS Teacher Guide for complete instructions.

Landforms

Landforms > Investigation 1: *Schoolyard Models* >
Part 1: *Schoolyard Models*, page 8

Schoolyard Models Outdoors

When to Go Out

Following Step 5, go outdoors to help students build more accurate models. Refer to pages 8–15 of the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will create more accurate models based on observation of the schoolyard, and use sticks, stones, and natural materials to enhance their models.

Getting Ready

Site: Make sure students will be in view when they are working on their models. Select a level area to work. Rocks or sticks may be used to prop up the tray. Some students will work better on a low seat wall or at tables rather than sitting on the ground.

Seasonal Tips: If the weather is too cold to build the models outdoors walk the school grounds as a class and discuss the primary structures and landforms. Take digital photographs of the structures and landforms for students to observe indoors.

Conservation: Encourage students to use objects they find on the ground in their models, but not to pick *living* flowers, leaves, or twigs.

Guiding the Investigation

1. Bring materials outdoors and take a few minutes to tour the schoolyard. Help students distinguish permanent structures and landforms from temporary features (snow banks and dirt piles).
2. Give students a few minutes to physically explore the area they will be modeling to get a feel for the size and relationships of the structures and landforms it contains. Students might pace out the length of one feature to compare with another; or use outstretched arms to estimate size or compare the distances between structures. Students might try lying down on the ground to compare the angle of different slopes.

Outdoor Activities At a Glance

Investigation 1

Part 1: Schoolyard Models Outdoors

Investigation 2

Parts 1 and 2: Erosion and Deposition

Look for Erosion and Deposition in the Schoolyard
(FOSS® Extension)

Investigation 3

Parts 1 and 2: Slope and Flood

Water on an Outdoor Slope
(BSI Extension)

Schoolyard "Mountain" Model
(BSI Extension)

Investigation 4

Making Model Mountains in the Schoolyard
(BSI Extension)

Investigation 5

Find the Slope
(FOSS® Extension)

Priority activities appear in **green.**

"I took my class outside to walk the perimeter of the schoolyard, stopping every so often to note important schoolyard features. They were excited."

Judean Patten-Clark
Science Specialist

"We did this on a windy day. My students saw the surface of their plateau blowing away and instantly made the connection that wind can contribute to erosion."

Erica Beck Spencer
Science Specialist

Landforms > Investigation 2: *Stream Tables* >
Part 1: *Erosion*, page 8 and Part 2: *Deposition*, page 16

Erosion and Deposition

When to Go Out

Parts 1 and 2 may be conducted outdoors. Refer to page 8 (Part 1) and page 16 (Part 2) of the FOSS Teacher Guide for complete instructions.

Outdoor Objective

In Parts 1 and 2 respectively, students will see and feel the natural elements, such as wind, acting upon their stream tables and use sticks and rocks to affect the flow of water. Students will compare their classroom and outdoor investigations.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For Each Group	Sealed bags for earth materials
	1 Pitcher of water
	Sticks and/or rocks

Getting Ready

Time: 30–50 min. for each part

Site: Select an area that allows students to spread out to maximize their work space.

Safety Note: Remind students not to throw rocks or point sticks at others during Part 2.

Conservation: At the end of the activity, pour any unused water on plants in the schoolyard.

Guiding the Investigation

1. Ask students to record stream-table observations in their notebooks while they are outdoors. Use the questions in the FOSS Teacher Guide to guide their observations. If time allows, have students rotate to look at other groups' stream tables and note differences or similarities.
2. During Part 2, students may want to use sticks or rocks they find outdoors to alter the stream's course.

Landforms > Investigation 2: *Stream Tables* >
Part 1: *Erosion*, page 8 and Part 2: *Deposition*, page 16

Look for Erosion and Deposition in the Schoolyard

FOSS® Extension, page 24

When to Go Out

Following Parts 1 and 2, go outside to look for evidence of erosion and deposition in the schoolyard. You may want to go out several times during this investigation to see if there are visible changes (especially after a hard rain).

Outdoor Objective

Students will observe erosion and deposition at work in the schoolyard, and see how the processes they observed in the stream tables affect earth materials in a real landscape.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
	Student sheet no. 8 *Landform Vocabulary*
For the Teacher	3–8 vials for collecting sediment

Getting Ready

Time: 10–20 min.

Site: Go out ahead of time to scout out the most visible signs of erosion. In addition to bare dirt areas, or pronounced hills, look carefully at sloping asphalt, the area surrounding storm drains and sewers, and along the edges where pavement and earth materials meet.

Seasonal Tip: In the winter, there may be signs of snow melt having carried and deposited sediment toward storm drains.

Guiding the Investigation

1. Review what students have observed in their stream tables. Ask, *Could we find examples of erosion and deposition in the schoolyard? Where? Why do you think so?*
2. Begin looking as a whole class at one of the areas of the schoolyard where students predicted they might find erosion. Ask, *What evidence, if any, is there that water has flowed here? What course did the water take? What direction was it flowing? How do you*

What You Might Find:

If students don't record what they are observing in their stream tables they may forget what they saw.

Carrying the trays back inside may disturb some of the key features in the stream tables.

know? Was sediment or other material carried along by the water? Was it deposited in different places according to the size of the sediment?

3. Students will search the schoolyard for additional signs of erosion and deposition. Ask them to note the location and to sketch and label each example they find using student sheet no. 8 *Landform Vocabulary*.
4. If it has recently rained, stop to look at the material at the edge of a puddle. Collect some of this earth material in a vial. When you are back in the classroom, fill the vial with water, shake, and observe the layers of sediment. Look at the vials again the next day to observe the settling of the sediment. Have students identify the layers as sand, silt, or clay.

What You Might Find:

In addition to sediment, you may find pine needles, leaf litter, or paper debris that have been carried by water.

Landforms > Investigation 3: *Go With the Flow* > Part 1: *Slope*, page 8 and Part 2: *Flood*, page 15

Slope and Flood

When to Go Out

Parts 1 and 2 may be conducted outdoors. Refer to page 8 (Part 1) and page 15 (Part 2) of the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will make connections between what they are observing in the stream tables and what happens to the earth.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For Each Group	Stream tables
	1 Pitcher of water
	Standard or flood cups
For the Teacher	Extra sand/clay mixture

Getting Ready

Time: 30–50 min. for each part

Site: Select an area that allows groups to spread out.

Conservation: At the end of the activity, pour any unused water on plants in the schoolyard.

Guiding the Investigation

1. Set up the stream tables indoors and review student sheet no. 10 *Stream-Table Map*.
2. Carry supplies outdoors and set up the stream tables, making sure they are level.
3. Distribute water and let the streams flow.
4. When students have finished recording their observations, give them a few minutes to circulate to look at other groups' stream tables and record differences or similarities in their science notebooks.

Landforms > Investigation 3: *Go With the Flow* >
Part 1: *Slope*, page 8

Water on an Outdoor Slope

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 1, take students outside to compare the carrying capacity and resulting erosion of water poured on four different slopes. Due to the size of this experiment and the amounts of water used, this works best as a classroom demonstration.

A note on rain: After heavy rains, water on a steep dirt slope may not run down the hill as predicted but will quickly soak into the ground. When the weather has been relatively dry, students will usually see that the water on the steepest slope runs faster and travels furthest (with the exception of the water poured on pavement which may travel further since none is absorbed and there are few, if any, obstructions). If the water on a steep slope soaked into the ground immediately, discuss the results with your students. Try the lesson again when it is drier and compare the results. Students are capable of understanding these difficult concepts, but should be prompted to think and write about why what they observed occurred.

Outdoor Objective

Students will confirm that the slope of the land affects erosion and deposition in the schoolyard as it did in the stream tables. They will also observe how steeper slopes result in faster flowing water which can carry larger loads of material.

"The level of excitement that comes with this activity is just incredible."

Michelle Teleau
Science Specialist

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For the Class	4–5 Pitchers of water

Getting Ready

Time: 45 min.

Site: Select four slopes in the schoolyard on which to pour water. Using bare dirt is ideal, but pavement could be used if sediment, leaf litter, or other debris is available to be carried by the water.

Safety Note: If doing this activity in the winter be careful not to pour the water on areas which will be hazardous if iced over.

Guiding the Investigation

1. Review with students how the slopes in their stream tables affected the flow of water. Discuss what they think will happen as you slowly and steadily pour equal amounts of water on the selected slopes in the schoolyard.
2. Have students set up their notebooks before going out, leaving at least half a page to take notes on each of the slopes they will be testing.
3. Begin with the first slope. Ask students not to block the streams of water with their shoes or any other object but if the water naturally flows toward a rock or stick leave it in place and observe what happens. Ask students to watch for differences in how fast the water flows and how much sediment it carries with it.
4. As students watch the water move, encourage them to talk about where it will end up, and whether it will deposit any material along the way. Ask, *Is the water carrying sediment with it when it flows? Where is the sediment being deposited? How does the movement on the gradual slope compare with the steeper slope?*
5. Give students time to record observations in their notebooks as soon as the water has stopped moving. Repeat the procedure at each location to compare the speed, force, and carrying capacity of the water on different slopes and surfaces. Ask, *What happens on bare dirt compared to the pavement? Is the earth material in the stream's course eroding? What happens if you pour all the pitchers at once?*

6. Summarize the discussion back in the classroom. Ask, *How was what you saw in the classroom similar to what happened in your stream tables?*

Schoolyard "Mountain" Model

Boston Schoolyard Initiative Extension

When to Go Out

Following the previous "Water on an Outdoor Slope" outdoor extension.

Outdoor Objective

Students will observe and describe the effect of pouring water on top of a model mountain and compare their results to those in the stream-table slope activity.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For the Class	A model "mountain" of mounded earth
	1 Pitcher of water
	2 Standard cups

Getting Ready

Time: 20–30 min.

Site: Go out ahead of time to find a dirt area and dig a large hole using 1–2 meters of the dirt to create a model mountain. Plant rocks, pebbles, and sticks in the mountain to represent different types of land formations. Pat down the base of the mountain firmly and leave the top a little looser. The mountain should have various contours. Leave the mountain intact so you can return to it for Investigation 4. Make sure there is enough room around the mountain for the whole class to stand and observe.

Seasonal Tip: In the winter, the ground will be frozen so you may need to bring in several bags of potting soil.

Safety Note: If you dig a hole to get the dirt, make sure you cover the hole so no one falls or trips.

"Going outside to do this activity helped students gain a better understanding of the concept of erosion and deposition because they were able to see how the water eroded the mountain over time, and also how the water can carry sediment and other things down stream with it."

Dean Martin
Science Specialist

"My students were better able to understand the topographical maps once it came time to look at them. City hall will often have contour maps. Look for an area next to your school that has a large hill or slope and see if students can find it on a contour map."

Dean Martin
Science Specialist

Guiding the Investigation

1. Gather students around Mount "Your School Name" and discuss the various ways that erosion can happen.
2. Blow over the top of the mountain and have students observe the earth's material being moved by your breath. Make sure students understand that wind is one way that erosion happens.
3. Next, have students observe and record in their science notebooks the effects of water on the mountain to simulate how rivers and strong rains can impact erosion. Pour the water through the standard cup used during the stream-table experiments.

Landforms > Investigation 4: *Build a Mountain* >
Part 1: *Making a Topographic Map*, page 8

Making Model Mountains in the Schoolyard

Boston Schoolyard Initiative Extension

Outdoor Objective

Following Part 1, students will build model mountains (or hills) out of earth materials and observe them from various perspectives to better understand topography.

Getting Ready

Time: 20 min. (10 min. to build and 10 min. to discuss)

Site: Make sure there are enough stones, large and small rocks, dirt, and wood pieces for students to build with.

Guiding the Investigation

1. Instruct groups that they will have 10 minutes to build a miniature mountain or hill using stones, dirt, and wood pieces they find on the ground.
2. After students have built their model mountains, call for attention and discuss "bird's eye view" and how this is represented on a topographical map.

Landforms > Investigation 5: *Bird's-Eye View* >
Part 1: *Mt. Shasta Topographic Map*, page 8

Find the Slope

FOSS® Extension, page 35

Refer to the FOSS Teacher Guide for complete instructions for how to find the slope of a small schoolyard landform.

Levers and Pulleys

Advance Preparation for Outdoor Activities

Using the schoolyard in this module allows students to experience real-world applications of levers and pulleys. Teachers have found these outdoor activities to be very useful in helping students understand how simple machines give the user an advantage by reducing effort.

Look for opportunities for students to perform simple but real work using levers in the schoolyard. You need four very simple tasks, such as raking leaves, sweeping debris, digging, planting, or shoveling. The principal, custodian, or school gardeners may have suggestions.

Plan to borrow or purchase the tools needed for these activities ahead of time. Make sure borrowed tools are labeled. Some teachers have found small grants to help purchase tools, such as scales and pulleys.

Levers and Pulleys > Investigation 1: *Levers* >
Part 3: *Lever Experiment B*, page 24

Start the Search Outdoors

FOSS® Home/School Connection, page 32

When to Go Out

Following Part 3, take students outside to search for simple machines in the schoolyard after they have read "Simple Machines" in *FOSS Science Stories: Levers and Pulleys.*

Outdoor Objective

Students will discover how often simple machines are found in the real world and how they are used to make work easier.

Materials

For Each Student	Science notebook or student sheet no. 32 *Home/School Connection*
	1 Clipboard
	1 Pencil

Getting Ready

Time: 15–20 min.

Site: Look at benches, ramps, fire escapes, doors, play structures, railings, and sidewalk ramps.

Caution: Remind students not to play on the play structure during their investigations.

Outdoor Activities At a Glance

Advance Preparation for Outdoor Activities

Investigation 1
Start the Search Outdoors
(FOSS® Home/School Connection)

Investigation 2
Do Schoolyard Work Using Levers (BSI Extension)

Investigation 3
Do Real Work With Pulleys
(FOSS® Extension)

Broomstick-Pulley System
(FOSS® Home/School Connection)

Testing: Do Simple Machines Really Make the Work Easier?
(BSI Extension)

Priority activities appear in **green.**

What You Might Find:

If any construction or gardening is under way on school grounds, take students out to look for simple machines at work. Watch for any opportunities students might have to use tools, such as hammers or screwdrivers.

Guiding the Investigation

1. Review the six simple machines with your class. Ask, *Do you think we can find any of these in the schoolyard? Where?*
2. Pass out student sheet no. 32 *Home/School Connection* with the inclined plane, wedge, and screw on it. Have students turn the paper over, and make a three-column chart listing the three other simple machines: lever, pulley, and wheel and axle. Ask students to list the examples they find in the schoolyard in each column.
3. As you look at each simple machine that students find, ask, *What work is this machine doing? Why did the designer (of this bench, ramp, flag pole, etc.) use a simple machine here?*
4. Back in the classroom, create a chart listing the examples found for each simple machine. Encourage students to add to the list if they find additional examples over the course of the module.

Levers and Pulleys > Investigation 2: *More Leverage* > Part 4: *Lever Pictures*, page 23

Do Schoolyard Work Using Levers

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 4, take students outside to perform needed tasks in the schoolyard using tools (levers), such as rakes and shovels.

Outdoor Objective

Students will help take care of their schoolyard and experience how (class-1, class-2, and class-3) levers can reduce effort and make work easier. Students will discover where they should place their hands to maximize efficiency of the tools. They will also label the fulcrum, effort, and load.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For the Class	Levers, such as rakes, brooms, hoes, shovels, bulb hole diggers, spades, wheelbarrows, or 2-wheeled trash barrels
	Bags or barrels
	Bulbs or plants

Getting Ready

Time: 45–60 min.

Site: Select areas where work is needed in the schoolyard. See Seasonal Tips.

Seasonal Tips: In the fall, students can rake leaves into barrels, bags, or piles; they can also plant bulbs. In the winter, students can shovel snow or rake up remaining leaves. In the spring, students can plant or turn the soil to prepare it for planting. In any season, compost can be turned or the pavement can be swept clear of wood chips, gravel, or litter. Make sure you know where raked leaves should be left.

Safety Note: Be aware of allergies that might limit what some students can do. Send home a notice letting parents know, and asking that students wear appropriate clothes. You might also invite them to help too!

Guiding the Investigation

1. Review the real-world examples of levers the class discussed in Part 3. Tell students they will be doing needed work in the schoolyard using class-1, class-2, and class-3 levers. They will also learn how tools function as levers.
2. Divide into groups and assign each group to a station. Describe the work students will do at each station; examples include raking, sweeping, digging, and spreading mulch.
3. Explain that their first task as a group is to figure out how they would hold their tool (where they would place their hands) to get the least leverage and the greatest leverage. Use tape to mark the fulcrum, load, and effort. Model an inefficient way of holding a tool like trying to rake leaves with both hands at the top of the rake. Ask, *Is there a better way to hold this tool?* Allow students to figure this out on their own! After marking their tool with tape, they should make a sketch in their science notebook labeling the fulcrum, effort, and load.
4. Give students enough time to feel the satisfaction of having completed their task.
5. Consider asking students to compare the effort involved in using a push broom vs. a sweep broom; kid-sized vs. adult-sized tools; or trowels vs. spade shovels depending on the tasks you are doing.

What You Might Find:

If you put a message out to the staff and families ahead of time requesting tools, you may be able to get all the tools you need. Make sure all borrowed tools are labeled!

"Most of my students felt enormous satisfaction from doing this hard work in the schoolyard and I could tell they were proud of their effort (and dirty hands). My students even asked if they could continue the work at recess the next day. So I went out with them at recess to work some more."

Erica Beck Spencer
Science Specialist

6. Allow time for the class to visit each station to hear the group's report on what they learned about their tool, including whether it is a class-1, -2, or -3 lever, and to show off the work they did.
7. Return to the classroom to wash hands and reflect on what students observed.

Levers and Pulleys > Investigation 3: *Pulleys* > Part 3: *Pulley Game*, page 21

Do Real Work With Pulleys

FOSS® Extension, page 28

When to Go Out

Following Part 3, take students outside to lift heavier weights.

Outdoor Objective

Students will rig up and experiment with working pulley systems in order to reduce the perceived effort needed to lift the load and experience real-world applications of the work that pulleys do.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For the Class	2–4 Pulleys (one or two fixed pulleys attached to a tree limb or play structure)
	Strong rope (approximately 12 meters long)
	1 Load or a 15–35 liter bucket filled with sand, gravel, or bags of cement
	1 Pair of work gloves

Getting Ready

Time: 15–20 min.

Site: Attach 1–2 fixed pulleys to a play structure or a strong tree branch. Heavy-duty pulleys and strong rope can be found in hardware stores.

Safety Note: Work gloves will prevent rope burns. Make sure you have rope designed to hold the weight you will be lifting. If you do not know how to tie a proper bowline, find someone who does. Remove the rope from the fixed pulley when you are done with this activity.

Guiding the Investigation

1. Review what students have learned about pulleys and tell them you will be going outside to see if they can use their knowledge to figure out how to lift a heavy load (a large bucket of sand).
2. At your outdoor station, allow plenty of time for students to try lifting the load without a simple machine.
3. Ask students to draw in their notebooks a pulley system that they think will work. Have them share their ideas and explore various pulley systems. Let this be a class challenge that your students solve together.
4. Once students have a system that works, make sure everyone has a chance to try it.
5. On the way into the classroom, have students observe the schoolyard or neighboring yards for any pulleys.

Levers and Pulleys > Investigation 3: *Pulleys* >
Part 3: *Pulley Game*, page 21

Broomstick-Pulley System

FOSS® Home/School Connection, page 28

When to Go Out

Following Part 3, take students outside to give them more room to do this exercise.

Outdoor Objective

Students will make broomstick-pulley systems and use them to overcome the resistive force of others trying to prevent the sticks from being pulled together.

Materials

For the Class
- 1–2 Pieces of thin, smooth rope about 15 meters
- 2–4 Broomsticks
- 1–2 Pairs of work gloves

Getting Ready

Time: 15–20 min.

Site: Select a grassy area where students can spread out.

Caution: It is important to use good knots. Two half hitches or a bowline would work for attaching the rope to one of the broomsticks.

Guiding the Investigation

Take students outside and follow the directions on student sheet no. 34 *Home/School Connection*. If you have access to four brooms, two groups will be able to try this at the same time.

Testing: Do Simple Machines Really Make the Work Easier?

Boston Schoolyard Initiative Extension

When to Go Out

Take students outside before you begin the module or at the end of the module to summarize learning. This is an assessment opportunity.

Outdoor Objective

Students will rotate through four stations to measure the effort needed to lift real-world loads with and without simple machines.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For the Class	4 Strong bags with 3 bricks in each
	4 Strong scales
	4 Large pulleys
	2 Studs (5 cm x 15 cm x 2 m)
	2 Fulcrums

Getting Ready

Time: 45–60 min.

Site: Set up two pulley systems on a play structure as separate stations. Space between the four stations helps groups stay focused on the task. You will need pulleys larger than those in the kit. You will need heavier duty pulleys and scales than those provided in the kit. Possible sources include fish and tackle or sporting goods stores.

Guiding the Investigation

1. Ask, *What is the point of using simple machines?*
2. Tell students they will go outside to measure the effort of three simple machines. There will be four stations: two pulley stations, one lever station, and one inclined plane. They will rotate through all four stations and measure the load with and without the use of a simple machine.
3. Have students set up their notebooks inside with four sections to record the results and draw the simple machines.
4. Go outside and demonstrate what students will do at the four stations. Show students how they will attach the scale to measure the load. Remind students that they need to record the effort without using the simple machine first; then they will record the effort using the simple machine. Students should also record whether they gained a mechanical advantage or a directional advantage.

   Class-1 Lever: Students will use one hand to lift the bag without using the lever. Then students will place the load on one end of the lever and again use one hand to lift it. Students may move the fulcrum around to try to reduce the effort.
   Inclined Plane: Take one of the 5 x 15 cm studs and rest one end on the ground and the other end about 1 m off the ground on a rock wall or part of the play structure. Students will slide one of the bags of bricks up the incline with a scale attached to the handle of the bag. Pull the bag up while holding on to the scale and measure the effort.
   One Pulley System (Single-fixed): Attach one pulley above the students' heads to the play structure, so that rope can easily slide through it.
   Two Pulley System (Single-fixed/Single-moveable): Attach one pulley to the play structure and tie a rope to the bottom hook on it. Let the rope fall to the ground; run this rope end through another pulley, which will be attached to the bag. Lead the rope back up through the fixed pulley and down again.
5. Have an equal number of students at each station. Together they will measure and record their results. Students will have about 8 minutes at each station.
6. Gather students together to discuss the results and ask, *Do simple machines really make the work easier?*

"Using the heavier weights in the schoolyard made it really click for them that if you have something that's* really *heavy, a lever or a pulley or an inclined plane is going to make doing that work easier."

Erin Flynn
Science Specialist

Teacher Notes:

New Plants

New Plants > Investigation 1: *Brassica Seeds* >
Part 1: *Introducing Recording*, page 8

Adopt a Plant

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 1, take students outside to select a schoolyard plant that they will observe over the next few weeks.

Outdoor Objective

Students will observe plant growth, development, and change over time in new and mature plants found in the schoolyard. Students will discover that the plants they see growing outdoors have the same characteristics as the plants in the classroom.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
	1 Craft stick with name written in *permanent* marker
For the Teacher	Digital camera (optional)

Getting Ready

Time: 10–25 min.

Site: Weeds make wonderful plants for observation in addition to other plants (flowers, shrubs, trees) in the schoolyard. Alert the custodian and others of your plan so the plants are not cut down mid-observation.

Seasonal Tips: In the fall, students will see plants dying back, and changes in color, buds, cones, and fruit. In the winter, students can observe plants that have died, gone into dormancy, or are evergreen. Try digging under the snow for berries, buds, cones, or fruit. In the spring, students can mark off a patch of earth when it is bare and watch as new plants emerge.

Safety Note: Be aware of any harmful plants in your schoolyard, such as poison ivy or stinging nettle.

Guiding the Investigation

1. Tell students they will be learning about plants, outdoors as well as indoors. Ask, *What plants do we have in our schoolyard?*

Outdoor Activities At a Glance

Priority activities appear in green.

What You Might Find:

Students can become quite attached to their plants.

Some students will discover bugs on or near their plants, smells, maybe even sounds—a whole mini-world connected to their plant.

"It was great for students to see how the plants changed and grew. It is important for them to understand that the plant life cycle is a natural process, not something that only happens in small cups in the classroom! It was also great for the students to compare and contrast the different types of plants that they were observing. Some grew slower or faster than others."

Erin Flynn
Science Specialist

How do you think they got there? Have you ever noticed them changing? What kinds of changes have you seen?

2. Tell students they will each get to select their own plant in the schoolyard to observe over time, and they will report on how it changes. Encourage them to choose a plant that interests them. Have students date their notebook pages and remind them how to label their drawings.
3. Take students outside and give them three minutes to select a plant within the area you define. After three minutes, students should be seated and drawing in their notebooks. Instruct students to draw a close up of one part of the plant as well as the whole plant.
4. After students have found their plants, help students put their craft sticks gently in the ground. If you can, take photographs of students with their plants.
5. Invite students to share their plant observations with the class.
6. Repeat the outdoor observations as often as you can (2–4 times) during the module. At the end of the module, display students' drawings and notes on the changes they observed.

New Plants > Investigation 1: *Brassica Seeds* >
Part 3: *Observing Brassica Growth*, page 23

Look for Roadside Brassica

FOSS® Extension, page 32

When to Go Out

Take students outside anytime after the brassica plants have gone through their entire life cycle to look for wild mustard, a brassica found throughout the U.S.

Outdoor Objective

Students will discover that the brassica plants they are studying have a wild counterpart, and compare the two.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil

Getting Ready

Time: 10–25 min.

Site: Try to find wild brassica near the school before having the students hunt for it. Wild brassica may tolerate some shade, but is most likely to be found in direct sunlight.

Seasonal Tips: In the spring and fall, gather the seeds of the wild brassica and scatter them in the schoolyard.

Guiding the Investigation

1. Explain to students what wild brassica is and what it looks like. Each plant can produce up to 3500 seeds and seeds can remain dormant in the soil for up to 60 years.
2. Lead your students in the right direction, but let them locate and identify the plants on their own.
3. Wild brassica are larger than the brassica plants students have grown inside, but have many similar characteristics. Have students compare the indoor and outdoor plants and record their observations in their notebooks.

New Plants > Investigation 2: *Grass and Grain Seeds* >
Part 2: *Mowing the Lawn*, page 15

Lawn Diversity

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 2, take students outside to observe an actual lawn.

Outdoor Objective

Students will make a connection between the lawns they are growing in class with the lawn in the schoolyard, and will observe the diversity of plants in an ordinary lawn.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
	1 Lawn in a cup
For Each Pair	1/4 of a transparency (cut each transparency into four rectangles)

Getting Ready

Time: 15–25 min.

Site: Many students may not know what a lawn is, so take the time to show them.

Advance Preparation for Outdoor Activities

For the planting activities, you will need to plan ahead to

- **find a class garden area.**
- **find a local gardener to help, if needed.**
- **assemble tools.**
- **obtain plant material and soil amendments (local nurseries may be happy to donate).**
- **show students how they will continue caring for their garden**

What You Might Find:

Students will not notice much at first, but they will begin to make more observations after a few minutes. If groups are sitting close together, encourage them to share their findings with each other. When one pair finds an ant, others will quickly find one too.

Seasonal Tips: In the winter, you can still see a diversity of plants.

Safety Note: Remind students to avoid broken glass or other dangerous items.

Guiding the Investigation

1. Ask students, *What is a lawn? Is there anything other than grass in a lawn?*
2. Tell students they will go outside to observe the schoolyard lawn and record what they find in their notebooks.
3. Show students the transparency rectangles. Tell them they will work with a partner to lay the transparency on a section of the schoolyard lawn, observe, and draw what they see under it. Distribute the transparencies to students. Have students trace the rectangle into their notebooks and title the page "What's in our Lawn?"
4. Bring students out to a grassy area of the schoolyard and have them sit down with their notebooks and transparencies to begin their observations. Remind students not to move the transparency once they select their spot.
5. Gather students together to share observations and compare the outside lawns to their lawns in a cup. Ask students to report on the living and nonliving things they saw. Collect all transparencies so that you can use them again.

New Plants > Investigation 2: *Grass and Grain Seeds*

Plant Radish-Seed Gardens

FOSS® Extension, page 30

When to Go Out

Take students outside anytime during Investigation 2 to plant radish seeds.

Outdoor Objective

Students will observe that seeds are living and grow into new plants. Students will learn that some of these plants produce food for humans.

Materials

For the Class
- Gardening tools (trowels, watering cans, craft sticks, string)
- Soil amendments (lime, peat moss, sand)

Getting Ready

Time: 10–25 min. Return outdoors to care for and observe plants over time.

Site: Use existing planting beds, or install raised beds, buckets, or pots in a sunny protected area, near a water source.

Caution: Avoid giving students the idea that the seeds they plant are *theirs*. They will be very disappointed if their seeds don't come up. Instead, focus on the *class* garden.

Guiding the Investigation

1. Check the soil to see if amendments are needed. This will increase the likelihood of plants thriving. Loosen soil if needed by turning it over before students dig in.
2. Ask students to think about what plants need to help select the best planting location. Mark off the area with string and post signs to let the school community know it is a class garden.
3. Take students outside to plant. Try planting in various locations (both inside and outside), at varying depths, or with varying amounts of water. Ask, *How are these seeds dispersed and "planted" in the wild?*
4. Schedule watering, weeding, and care of the garden. A few students could rotate responsibility outside of, or during class.

New Plants > Investigation 2: *Grass and Grain Seeds*

Grow Flowers from Seed

FOSS® Extension, page 31

When to Go Out

Take students outside anytime during Investigation 2 to plant flower seeds.

Outdoor Objective

Students will observe that seeds are living and growing into new plants that develop in a sequence called a life cycle.

Materials

For the Class
- Gardening tools (trowels, watering cans, craft sticks, string)
- Soil amendments (lime, peat moss, sand)

What You Might Find:

Planting outside takes a lot of time and commitment, but is also extraordinarily rewarding.

"It is truly possible to have a garden in a small space. I was skeptical but have been amazed at how many types of plants we were able to squeeze into a miniature plot. I have also been surprised by the pride our second graders feel for the garden. They check those plants every day, during recess or whenever they get a chance."

Erin Flynn
Science Specialist

"Planting flower seeds really helped my students understand the conditions that plants need to survive. They were very excited about planting."

Michelle Teleau
Science Specialist

Guiding the Investigation

Refer to the FOSS Teacher Guide to have students grow flowers inside, under the lights with the brassica plants. If the season allows, try planting some flowers outside using these steps.

1. Select a planting bed. Make and post signs to let the school community know it is a class garden.
2. Prepare soil as needed before taking students outside, or with students if time allows. Plant seeds and water. Try spreading wildflower seeds or sunflower seeds.
3. Schedule watering, weeding, and care of the garden.
4. Invite students to continue to observe their garden throughout the module and beyond. Harvest seeds from the dried flowers in the fall and plant them.

New Plants > Investigation 2: *Grass and Grain Seeds*

Symmetry Walk

Boston Schoolyard Initiative Extension

When to Go Out

Take students outside during Investigation 2 to look for symmetry in leaves and flowers.

Outdoor Objective

Students will observe that symmetry occurs frequently in nature.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil

Getting Ready

Time: 10–20 min.

Seasonal Tips: In the winter, look for symmetry in the way buds are positioned on tree twigs—alternating, parallel, etc. Look for leaf scars on the twigs from last year's leaves.

Guiding the Investigation

1. Tell students they will go on a "Symmetry Walk" to look for plant symmetry in nature. Ask, *Where do you think we might see examples of symmetry in the schoolyard?*

2. Have students divide their notebook pages into fourths. Ask them to draw 2–4 plant parts they think are symmetrical. Model one example on the board and divide it along the line of symmetry.
3. Bring students outside, define the boundaries, and allow students to search and sketch several examples in their notebooks.
4. Gather students together and invite them to show what they found. Consider creating an indoor display of students' drawings.

New Plants > Investigation 3: *Stems* >
Part 2: *New Plants from Cuttings*, page 14

Look for Plants Reproducing Vegetatively

Boston Schoolyard Initiative Extension

When to Go Out

Take students outside after completing Part 2.

Outdoor Objective

Students will observe reproducing outdoor plants and will understand that this is another way nature creates new plants.

Materials

For the Class	25 cm of brightly colored marking tape
	Scissors

Getting Ready

Time: 25–45 min.

Site: Look in your schoolyard for ivy, mint, thyme, oregano, crab grass, purslane, chickweed, strawberries, geraniums, squash, or rhododendrons.

Seasonal Tip: To keep plants available for winter study by preventing them from freezing, mulch over the plants you plan to use in the fall.

Guiding the Investigation

1. Take students outside to look for plants that creep across the ground. Have students check to see if these plants have put down roots along their stems. When you find a stem from a mother plant that has rooted itself into the ground, make sure every student has a chance to observe it.

2. Carefully snip the stem between the two plants and tie the marking tape around the plant, so that you can find it again. Make it clear to students that you are not harming the plant; in fact you are helping to make a new plant.
3. After several weeks (and some rain or watering), observe the plant again. Students should see that there are now two thriving plants.

New Plants > Investigation 3: *Stems* >
Part 3: *Spuds*, page 19

Spuds Outside

When to Go Out

Take students outside after completing Part 3. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will observe that potato eyes will grow into new plants that make more potatoes.

Getting Ready

Time: 10–25 min. Return outdoors to care for and observe plants over time.

Site: Use existing planting beds, or install raised beds, buckets, or pots in a sunny protected area, near a water source.

New Plants > Investigation 4: *Bulbs and Roots* >
Part 1: *Bulbs*, page 7

Plant Flower Bulbs Outside

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 1, take students outside during the fall or early winter. Refer to the "Plant Radish-Seed Gardens" activity on pages 4–5 for a complete list of materials and instructions.

Outdoor Objective

Students will discover another way to grow a new plant when they plant bulbs in their schoolyard.

Getting Ready

Time: 10–25 min. Return outdoors to care for and observe plants over time.

Physics of Sound

Physics of Sound > Investigation 1: *Dropping In* >
Part 1: *Drop Challenge*, page 8

Outdoor Sounds

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 1 and again later in the module, take students outside to listen for sounds.

Outdoor Objective

Students will practice sound discrimination in a different environment and increase their vocabulary for describing the properties of sounds. Students become more aware of the sounds all around them and how much information those sounds provide.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
	1 Blindfold (optional)
For the Teacher	1 Watch or stopwatch

Getting Ready

Time: 10–20 min.

Site: Select an area that is conducive to sitting still and listening.

Caution: Tell students you will keep your eyes open if it will help them relax and feel safe closing their eyes to listen.

Seasonal Tip: In cold weather, do this activity as a "sound walk."

Guiding the Investigation

1. After reading, "'Seeing' the World through Sound" in *FOSS Science Stories: Physics of Sound*, review the types of sounds you have been exploring in class. Ask, *What sounds might we hear outdoors? How will outdoor sounds be different?*
2. Have students set up a T-Chart in their notebooks labeled "Sounds" and "Properties" and then ask them to list sounds they predict they will hear outdoors. Explain that the class will be sitting and listening silently outside to hear as many sounds as possible.

Outdoor Activities At a Glance

Priority activities appear in green.

What You Might Find:

Two minutes may feel like a long time for students. Try to give students the full two minutes without rushing it.

Outdoor sounds may be louder or further away than indoor sounds. Students may require a different kind of listening since you often cannot see the object making a sound.

"My kids enjoyed listening to all the sounds outside. They 'tuned' in right away to the more obvious noises like the trucks and sirens. But, as we listened more closely, we heard noises of birds fluttering and working."

Mark Walter
Science Specialist

3. Take students outside and help them settle in before beginning a silent "two-minute listen." Try not to rush this activity. It will take a little while for students to get past the most obvious sounds, to those that are more subtle or unfamiliar.
4. After two minutes, have students record the sounds and the properties of the sounds they heard in their science notebooks. Encourage them to be quiet and continue listening while they are writing.
5. When time is up, share discoveries and observations. Ask if students heard the sounds they had predicted they would hear. Ask, *Was it always possible to tell what was making the sound? What do the sounds we are hearing tell us about what is happening in the neighborhood?* Ask students what they experienced as well as what they heard.
6. Listen together to a sound and describe its properties. Did different students use the same or different words to describe the same sound? Ask, *Does a nearby car sound the same as one far away? Do all birds sound the same?*
7. Add new words or ideas from this experience to the classroom word bank or content/inquiry chart.

Physics of Sound > Investigation 1: *Dropping In* > Part 3: *Sound and Vibrations*, page 21

Sounds of Schoolyard Wildlife

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 3, take students outside to listen for animal sounds.

Outdoor Objective

Students will improve their sound discrimination skills, and increase their awareness of animals in and around the schoolyard. Students will better understand that animals use sound to communicate information.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
For the Class	Binoculars (optional)

Getting Ready

Time: 10–20 min.

Site: Select an area with minimal conflicting noise, where wildlife is likely to be most evident. A field trip to a nearby park may be worthwhile.

Guiding the Investigation

1. After reading "Animal Babble" in *FOSS Science Stories*: *Physics of Sound*, ask, *What wildlife do you think we might see or hear in the schoolyard? What information about an animal do you think we might be able to tell by the sounds we hear? How big it is? What it is doing?*
2. Have students set up their notebooks so they can record the animals they see, the animals they hear, and the properties of those animal sounds.
3. Discuss how students should behave, so that they don't scare animals away. Ask, *How will the animals know we are there?* (From the noise we make!) Ask students where they think the class is most likely to hear animal sounds and try out the areas they suggest.
4. Ask students to be silent for two minutes, and then record the wildlife they see and hear in their science notebooks.
5. Quietly prompt students with questions from time to time. Ask, *Do you hear animals that you cannot see? Can you tell what the animals are doing from the sounds you hear? Can the animals hear us? How do you know? Do you see any animals that you do not hear? Why can't you hear this animal? What information do you think these animals are communicating by the sounds we are hearing?*
6. Add new words or ideas from this experience to the classroom word bank or content/inquiry chart.

What You Might Find:

Birds are likely to be the most visible or audible animals from the schoolyard. Birds provide a good opportunity to compare the sounds different birds make (chirp, twitter, honk, caw); or different sounds made by the same bird.

Squirrels, insects, dogs, and cats are other common animals you may hear.

If you do not find a lot of wildlife in your urban schoolyard, talk about why not. The experience may make students more attentive to wildlife they do encounter.

Physics of Sound > Investigation 1: *Dropping In* >
Part 3: *Sound and Vibrations*, page 21

Quietest and Noisiest Outdoor Locations

FOSS® Home/School Connection, page 32

When to Go Out

Following Part 3, take students outside to identify the quietest and noisiest locations in the schoolyard.

Outdoor Objective

Students will become aware of how the *volume* of sounds in the schoolyard varies with the location.

Materials

For Each Pair
- Science notebook or student sheet no. 33 *Home/School Connection*
- 1 Clipboard
- 1 Pencil

Getting Ready

Time: 20 min.

Guiding the Investigation

1. Instruct students to work in pairs using student sheet no. 33 *Home/School Connection* to find the quietest and the noisiest locations in the schoolyard. If time is limited, walk the grounds as a whole class to identify these areas.
2. Ask students which areas they identified as the quietest.
3. Ask students if they think the quietest and noisiest locations change throughout the day. If possible, come out to test predictions at a different time of day.
4. Take the whole class to several areas identified as quietest or noisiest. Ask, *Do the natural or human-made materials in an area affect the volume?*

Physics of Sound > Investigation 2: *Good Vibrations* > Part 1: *Vibration and Pitch*, page 8

Listening for Pitch Outdoors

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 1, take students outside to identify the pitch of outdoor sounds.

Outdoor Objective

Students will improve their ability to discriminate between high-, medium-, and low-pitched sounds in the schoolyard, and will apply what they have learned in class to the different sounds available outdoors.

Materials

For Each Student
- Science notebook
- 1 Clipboard
- 1 Pencil

Getting Ready

Time: 10–15 min.

Site: Select a site conducive to sitting and listening.

Seasonal Tip: Different seasons bring different sounds. Notice which sounds are seasonal.

Guiding the Investigation

1. Tell students their task is to listen to sounds in the schoolyard and identify the pitch of each sound. Have students make a three-column table in their notebooks with "High/Medium/Low" written across the top.
2. Help students settle into a listening position outdoors. Listen to a few sounds as a class and discuss whether they are high, medium, or low in pitch. Give students a few minutes to just listen before they begin recording the sounds they hear and the pitch of each.
3. Discuss what students heard. Is there agreement about the pitch of each sound?
4. Add new words or ideas from this experience to the classroom word bank or content/inquiry chart.

What You Might Find:

Students may hear differences in pitch between similar objects of different sizes including: birds, wind chimes, barking dogs, cars and trucks, construction tools, and/or people talking.

"My students needed the experience of hearing and identifying random outdoor everyday noises while determining if they have a high or low pitch. This practice trained their ears to listen for different sounds and helped them develop vocabulary to talk about these sounds."

Mark Walter
Science Specialist

Physics of Sound > Investigation 2: *Good Vibrations* > Part 2: *Length and Pitch*, page 13

Length and Pitch Outside

When to Go Out

Conduct Part 2, Steps 4–9 outdoors to give students more space in which to investigate the four instruments. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Students will discover how length affects the pitch of an instrument. Students are better able to distinguish the direction sounds are coming from and the pitch of those sounds by working in a larger open space.

"Being outside for this activity really allowed kids to listen carefully to the directions and the sounds that the instruments made. The space that the outdoors provided was crucial for this. Students gained more insight about the sounds each activity provided so they could really see and hear what was going on as the instrument was changed."

Mark Walter
Science Specialist

Getting Ready

Time: 30–40 min.

Site: Find a place where groups can spread out, away from conflicting noises (such as recess).

Physics of Sound > Investigation 3: *How Sound Travels* >
Part 2: *Sounds through Solids*, page 15

Sounds through Solids Outside

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 2, take students outside to experiment with how distance affects sound.

Outdoor Objective

Students will investigate whether the distance between the sound source and the sound receiver makes a difference when sound travels through a solid, and observe through experimentation that sound travels better through solids than through air.

Materials

For the Class
- 1 Tin-can telephone each with string that is 2, 4, 6, 8, 10, and 12 meters long
- 12 Noisemakers (2 per phone)

Getting Ready

Time: 15–20 min.

Site: Choose a site away from recess so that students can hear well.

Caution: In order to keep string from tangling, wind it around a 30-centimeter piece of cardboard.

Guiding the Investigation

1. Tell students that they will work outside with a partner to experiment further with the tin-can phones. Ask, *Do you think the sound will change when the length of the string on tin-can phones change?*
2. Describe to students that you have six phones, each with a different length of string. There will be four students per phone at a time—two working together on each end of a phone. Students will try all six phones and then compare the volume of the sound on each phone. Tell students that they will use

noisemakers instead of their voices in order to ensure that the volume of the sound produced remains constant.

3. Students will wait in line next to their partners while you set up the experiment. Pass out one noisemaker to each pair of students. Set the shortest phone on the ground close to the first two people in line. The four-meter phone will be about two meters away from the short one, also spread out on the ground. Continue this pattern until all six phones are unwound and stretched out on the ground (forming an upside-down pyramid shape).
4. When you are ready, have the first four students pick up the shortest phone and each side will take turns using their noisemaker. After each student has a turn being the sound source and the sound receiver, the partners will put the phone down on the ground and move on to the next longer phone. The second group will start with the shortest phone. It is important that students use the phones in order.
5. Have students try using noisemakers without the "phone" to compare the way sound travels through air.
6. Continue until all students have tried all of the phones twice.
7. Discuss observations and discoveries.
8. If students are waiting for their classmates to finish, they could sit back-to-back with their partner and listen for sounds and determine if they are high- or low-pitched sounds.

Physics of Sound > Investigation 3: *How Sound Travels* > Part 2: *Sounds through Solids*, page 15

Observe the Speed of Sound through Air

FOSS® Extension, page 22

When to Go Out

Following Part 2, take students outside to measure the time it takes sound to travel from a distant point to an observer. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Using the larger distances available outdoors, students will conduct an experiment to measure the delay in time between when a sound is produced and when the sound waves reach the student observer.

Materials

For Each Pair	1 Stopwatch
For the Class	1 Metal garbage can lid or something that will be loud when struck

Getting Ready

Time: 30–40 min.

Site: You will need an open space with at least 200 meters of distance between the sound source and the sound receivers, about two football fields long.

Caution: Because of the distance between student groups, two or more adults are needed for this activity.

Structures of Life

Structures of Life > Investigation 1: *Origin of Seeds* >
Part 3: *Seed Soak*, page 28

Outdoor Seed Search

FOSS® Home/School Connection, page 36

When to Go Out

Following the breakpoint in Investigation 1, Part 3, go outdoors to collect seeds for a class seed collection and/or notebook samples.

Outdoor Objective

Students will observe the variety of seeds found in the schoolyard. Students will consider what the shape suggests about how the seed travels away from the parent plant.

Materials

For Each Student	Science notebook, or student sheet no. 28 *Home/School Connection*
	1 Clipboard
	1 Pencil
	1 Hand lens
For the Class	Glue or tape
	Extra pencils
	Display materials for seed collection: egg cartons, trays, or clear plastic bags

Getting Ready

Time: 15–45 min.

Site: Look at flowers, weeds, bushes, and trees in landscaped areas, garden beds, and in uncultivated "urban wilds."

Seasonal Tips: In the winter, look for seeds still attached to plants, and for berries and pinecones. In the spring, students can take note of flowers and predict where they will later find seeds.

Safety Note: Familiarize yourself and your students with any noxious plants that may be in the schoolyard, such as poison ivy or stinging nettle. Caution students that "hitch-hiker" seeds have hooks that may be sharp.

Conservation: When you are finished with the seeds, have students disperse them outside.

Outdoor Activities At a Glance

Investigation 1

Outdoor Seed Search
(FOSS® Home/School Connection)

Seed Search
(FOSS® Home/School Connection)

Investigation 2

Search for Germinating Seeds
(BSI Extension)

Adopt a Plant (BSI Extension)

Investigation 3

Compare Arthropods
(FOSS® Home/School Connection)

Investigation 4

Snail Hunt

Investigation 5

Beetles in the Schoolyard

Priority activities appear in **green.**

What You Might Find:

Roadside *Brassica* seeds come in little pods and students may remember them from the FOSS® New Plants module.

"In October, we harvested marigold flowers we had planted in spring. I asked each student to count the seeds in a single flower. One student opened her flower in dismay, 'No way am I counting all these!' she moaned. 'Oh yes, you are,' I said, and used it as an opportunity to teach them how to count large numbers by arranging them in piles of ten or twenty. She had over a hundred seeds in one flower and was very proud of her work."

Dean Martin
Science Specialist

Guiding the Investigation

1. Ask students where they think they are most likely to find seeds in the schoolyard, and set the boundaries for the search.
2. Instruct students to find at least 4 different types of seeds to draw in their notebooks, and glue or tape onto student sheet no. 28 *Home/School Connection* (see page 36).
3. Ask students to record in their notebooks: a) the plant the seed came from, b) a few words describing the shape of the seed, and c) how they think this seed travels from the parent plant. Students can raise the seeds over their heads and drop them to see if they "fly."
4. Gather seeds to begin a class seed collection before going in. Students can continue to add to it throughout the module.
5. Back indoors, have students display their notebook pages and seed collections and tour the room to see the seeds their classmates found.
6. Discuss the structures of the seeds they found outdoors. Ask, *Do they differ from the seeds in common fruit? How and why?*
7. You might want to ask students to estimate and then count the number of seeds in a single flower. Many have a surprisingly large number of seeds. Discuss why this might be so.
8. Display the class seed collection in egg cartons, clear plastic bags, on trays, or on chart paper, so you can refer to it during the rest of the module.

Structures of Life > Investigation 1: *Origin of Seeds* >
Part 3: *Seed Soak*, page 28

Seed Search

FOSS® Home/School Connection, page 36

Students might bring in seeds from home to add to the class collection; or if you did not do the seed search as a class, assign it as homework.

Structures of Life > Investigation 2: *Growing Further* >
Part 1: *Germination*, page 8

Search for Germinating Seeds

Boston Schoolyard Initiative Extension

When to Go Out

Following Part 1, go outdoors to look for germinating seeds, or to mark out patches of soil to observe over time.

Outdoor Objective

Students will observe that the plant's life cycle is occurring at all times, all around them, and that the soil contains seeds not planted by humans.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
	1 Hand lens
	Student sheet no. 7 *Comparing Germinated Seeds* chart
For the Class	1 Trowel if collecting soil for a class terrarium

Getting Ready

Time: 20–30 min. several times during the module.

Site: Look for germinating seeds at: the base of trees, such as maples, or oak; in garden soil or a compost pile; or on the ground near a bird feeder. Put newspaper or cardboard over damp ground and check underneath them after a few days. Try turning the soil over with a shovel to bring weed seeds to the surface.

Seasonal Tips: In the fall, look for germinating seeds that may be found under fallen leaves, and for acorns near oak trees. In the winter, dig up some soil and bring it indoors to watch the warmed seeds sprout. In the spring, dig down into the soil to find germinating seeds.

Guiding the Investigation

1. Discuss where you might find germinating seeds in the schoolyard. Ask, *What conditions do seeds need to germinate?* Take students out to the schoolyard to look for germinating seeds.
2. Gather students to look at any germinating seeds that have been found and discuss what stage of growth they represent.
3. Ask students to look for four types of germinating seeds and to record their findings on the *Comparing Germinated Seeds* chart.
4. Before going back indoors, let a few students show the class the germinating seeds they found.
5. In colder months, bring some soil indoors to observe what happens. Keep it moist, and students may see seedlings emerge as the soil warms up over the next days and weeks.

"My students were amazed that there were so many seeds in dandelions, and that they were so tiny!"

Kate King
Classroom Teacher

"After a week, plants began to sprout in the dirt we had brought inside. My students were amazed that plants could grow out of the soil where there seemed to be no seeds. All their questions were a variation of 'How did those plants get there?' It helped them realize that plants have their own lives that are completely independent of people and that plants don't need people to put their seeds in the ground."

Teresa Strong
Science Specialist

Optional: Have students select a patch of earth to observe over time, keeping track of the number and type of plants that are visible in their patch over a period of a few weeks. Keep track of the weather conditions during this time and discuss how temperature and precipitation may affect seed germination.

Structures of Life > Investigation 2: *Growing Further* > Part 1: *Germination*, page 8

Adopt a Plant

Boston Schoolyard Initiative Extension

When to Go Out

Following Investigation 1, or as early as possible in the module since this is a longer-term observation.

Outdoor Objective

Students will observe that plants in the schoolyard have the same characteristics and structures of the plants they have been studying in class.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
	1 Hand lens
	1 Craft stick (with name written in permanent marker)
For the Class	Extra pencils, craft sticks, permanent marker
	Field guides (to identify plants)
	Camera (to photograph plants)

Getting Ready

Time: 10–25 min. At least three times during the module.

Seasonal Tips: In the fall, students will see plants die, or go into dormancy, leaving the seeds to go on. In the winter, students will observe plants in a dormant state. Some plants may be found under the insulating cover of snow, leaves, or compost. In early spring, there may be little to see the first time out. This will increase the excitement the next time students are out and plants are visible where there had only been dirt.

Safety Note: Be aware of any harmful plants in your schoolyard, such as poison ivy or stinging nettle.

Guiding the Investigation

1. Ask students to select a plant or tree to observe over the next few weeks. They will keep careful track of these changes through drawings and words in their science notebooks.
2. Have students mark their plants by: a) gently pushing a craft stick with their name on it into the earth under the plant; b) making a simple map in their notebook showing the plant relative to landmarks, or c) photographing each plant.
3. Ask students to describe their plants in pictures and words, labeling as many parts of the plants as they can. Draw the whole plant and a close-up of a leaf, branch, bud, flower, or seed.
4. Remind students that they will be observing the same plants several more times during the module.
5. Each time they visit their plant, ask them to draw it, label the drawing, and record any changes they observe. Ask, *Which part of the plant has changed? Is it larger or smaller than it was? Why do you think it changed?*

What You Might Find:

Students will discover aspects of their plant that they would never notice at a glance: bugs crawling on, under, or in the plant; color variations in the leaves; fragrances; and the appearance or disappearance of buds, leaves, flowers, or seeds.

Structures of Life > Investigation 3: *Meet the Crayfish* > Part 3: *Crayfish at Home*, page 20

Compare Arthropods

FOSS® Home/School Connection, page 32

When to Go Out

Following Part 3 or 4, go outside as a class to search for arthropods. You may also want to assign the activity as homework.

Outdoor Objective

Students will find living organisms, decide whether they are arthropods, and compare their structures to those of the crayfish.

Materials

For Each Student	Science notebook, or student sheet no. 30 *Home/School Connection*
	1 Clipboard
	1 Pencil
	1 Hand lens
	1 Cup or plastic tank for holding arthropods

Getting Ready

Time: 15–45 min. Flexible—depending on how much time you want to devote to it.

Site: Look under rocks, leaves, logs, trees, bushes, and other plants. You may find arthropods on pavement, play structures, or even on the side of your school building. Look on the surface of pooled water, in the water under rocks, and in leaf debris. Try shaking a tree branch over a white sheet laid on the ground.

Seasonal Tips: In the winter, arthropods are hard to see because they are not moving. Try bringing in a small sample of leaf litter. As the animals warm up, they will begin to move.

Safety Note: Refer to the safety tips on student sheet no. 30 *Home/School Connection*.

Conservation: Teach students how to look carefully for animals under rocks, logs, and leaves without disturbing their habitat.

Guiding the Investigation

1. Read about arthropods on student sheet no. 30 *Home/School Connection* together as a class. Ask students what types of arthropods they think they are most likely to find in the schoolyard, and where.
2. Assign (or allow students to select) the areas that they will search in small groups. Ask each student to search for an arthropod and to record their observations.
3. Allow a few students to show the class the organisms they found, and explain where they found it, and how they know whether or not it is an arthropod.
4. In small groups, or as a class, use Venn diagrams to group the organisms found into those that are arthropods and those that are not. Ask students why they placed each animal in the group they did.
5. Compare and contrast the structures of the animals found living in the same spaces.

Structures of Life > Investigation 4: *Meet the Land Snail* > Part 1: *Land Snails at Home*, page 8

Snail Hunt

When to Go Out

Prior to Part 1, look for snails to collect for this investigation.

Note: The United States Department of Agriculture (USDA) requires a permit for the purchase of *Helix aspersa* and other land snails. For more information, go to Delta Education's website at www.deltaeducation.com.

Outdoor Objective

Students will learn where to look for snails, observe them in their natural habitat, and then collect a class sample to use for this investigation.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
	1 Hand lens
For the Class	1 Container for collected snails

Getting Ready

Time: 15–20 min.

Site: Look for snails in shady, moist, wooded areas, such as under logs, on tree trunks, or on cool, damp concrete walls. Snails are nocturnal and easiest to find early in the day.

Seasonal Tip: Snails hibernate in the winter, so they dig down into the soil five inches or more to stay warm.

Guiding the Investigation

1. Discuss where students think they are most likely to find snails. Have students spread out and search.
2. If and when the first snail is found, gather around to look at where it was found and observe what it is doing.
3. Have students continue to look for snails. Students should record in their science notebooks where they found their snail, on what surface, and what it was doing. Students who do not find a snail should record where they looked, and the fact that there were no snails.
4. To bring snails indoors, have students gently pick them up and place them in containers with soil, leaves, or other materials from the spot they were found. It is essential to keep the snails moist or they will die.
5. Refer back to students' outdoor observations as they learn about snail habitats and behavior in class. Ask, *Do your classroom observations about snail habitats and behavior match what you observed in the schoolyard?*

"They saw that there really were animals living there in the leaves on the edge of the schoolyard, all having different structures to help them survive in the same place: wet skin, exoskeleton, curling behaviors."

Teresa Strong
Science Specialist

"I think my students understood the needs of the land snails better, after unsuccessfully searching for them in our schoolyard, searching for them at home, and then thinking about how to transport them from home to school."

Kate King
Classroom Teacher

"Students were able to compare structures across all sorts of animals: millipedes, beetles, worms, spiders, ants. It really reinforced their understanding that living things have different structures that they use for different reasons."

Erin Hashimoto
Science Specialist

"Some of my students saw the schoolyard habitat as dirty and dangerous and to be avoided at all costs. After holding back for a while and just watching, they built up confidence. Now some of these students are bringing in more bugs and critters for us to observe than anyone else."

Teresa Strong
Science Specialist

Structures of Life > Investigation 5: *Bess Beetles* >
Part 2: *Comparing Crayfish and Beetles*, page 13

Beetles in the Schoolyard

When to Go Out

Following Part 2, take students outside to search for other types of beetles. Read *The Life of Bess Beetles* in the Language Extension on page 30 to help guide your search.

Outdoor Objective

Students will search for beetles and observe the similarities and differences between the beetles they find and bess beetles.

Materials

For Each Student	Science notebook
	1 Clipboard
	1 Pencil
	1 Hand lens

Getting Ready

Site: Anytime of year, beetle larvae can be found in the top five inches of soil as white grubs. Look for intricate etchings that larvae will leave as they eat their way under the bark of logs and branches on the ground. Look for adults on flowers, trees, or under debris.

Guiding the Investigation

1. Discuss where students might find beetles. Have students spread out and search.
2. When someone finds a beetle, gather around to observe it. Ask, *How big is it? How fast is it? What colors, patterns, or structures does it have? Where was it? Was it eating anything? How does it compare to the bess beetle?*
3. Have students spread out to look for beetles and record their observations in their science notebooks.
4. Return inside to discuss your findings. If there is time, have students share their notebook entries with each other.

Wood and Paper

Wood and Paper > Investigation 1: *Getting to Know Wood* >
Part 2: *Wood Hunt*, page 15

Outdoor Wood Hunt

When to Go Out

Repeat Part 2 outdoors to look for objects made of wood.

Outdoor Objective

Students will test their understanding of the properties of wood by determining which objects in the schoolyard are made of wood. Students will observe that many useful objects found outdoors *are* made from wood, and begin to explore trees as wood.

Materials

For Each Student	1 Hand lens
For the Teacher	1 Whistle
	1 Container (for sticky notes and pens)
	1 Clipboard with paper
	1 Pencil

Getting Ready

Time: 7–15 min.

Site: Select the area in your schoolyard that contains the greatest variety of wood samples.

Guiding the Investigation

1. Review with students what they have been learning about wood. Ask, *Who can tell me what wood looks like? How can we tell if something is made of wood? What do you think we might find on the schoolyard that is wood?*
2. Tell students that their task outdoors will be to look for objects that are made of wood. The class will be making a list of wooden objects that are too large to pick up, and each student will also look for a small object to bring back into the classroom for closer observation.
3. Gather students in a circle outside. Ask students to look around the schoolyard for things they think are wood. After gathering suggestions, visit each object to test predictions. Ask, *How can we tell if this is made of wood?* On your clipboard, list each object and the evidence students give for whether it is wood.

Outdoor Activities At a Glance

Priority activities appear in green.

What You Might Find:

Students may not know that trees are made of wood. Make sure they are aware of this before the end of this activity.

Some schoolyards contain recycled plastic lumber, a composite material made of recycled plastic and wood. The texture typically simulates a wood grain. Have students explore this material to decide whether it is wood.

"My students were able to find more things than I had noticed. They started with trees and ended up looking at the bench in the field, a wooden horse to keep people from parking in certain areas, the wood parts in the building's structure, and a wooden utility pole. The students did a wonderful job and had fun."

Michelle Teleau
Science Specialist

4. Discuss student observations as you explore the schoolyard. Encourage them to touch the objects (being mindful of slivers) to feel their texture. They may also want to try tapping it to see if the sound offers any clues. Ask, *What does it feel like? Does the wood look like the samples indoors? If not, how can we tell it is wood?*
5. Discuss with the class what they found outdoors and whether anything surprised them. Make a chart listing the objects you found. Keep this chart to refer back to in Investigation 2. Ask students to draw the objects they found in their science notebooks.

Wood and Paper > Investigation 1: *Getting to Know Wood* > Part 3: *Wood and Water*, page 20

Wood and Water Outside

When to Go Out

Following Part 3, take students outside after all groups have finished working to place water droplets on outdoor wood samples. If you are doing Part 3 as a whole class activity, try to do this activity the same day.

Outdoor Objective

Students will discover that because wood absorbs water, wood used outdoors is often treated (with paint or varnish) to protect it from rain and snow.

Materials

For Each Pair	1 Dropper
	1 Cup
For the Teacher	2 Pitchers of water
	Extra droppers and cups

Getting Ready

Time: 15–20 min.

Site: Return to the area of the schoolyard with the greatest variety of wood samples.

Conservation: Always pour the remaining water on a plant or the grass when finishing an activity, so as not to waste water.

Guiding the Investigation

1. Briefly discuss what happens when students drop water on the wood samples they have been testing. Ask, *What do you think would happen if we dropped water on the wood we found in the schoolyard?*
2. Explain that students will use a dropper to put several drops of water on three wooden objects in the schoolyard and watch what happens.
3. Gather your students around a wooden object in the schoolyard. Place a few drops of water on the wood and discuss what happens. If the water beads up, ask, *Why do you think it didn't spread out and soak into the wood?* Discuss the fact that much of the wood used outdoors is treated.
4. Fill students' cups with approximately ½ liter of water and review their task. Divide the class into three groups and send each group to test their water droplets on a designated wooden object. After several minutes, rotate groups to the next object. Throughout the investigation, ask, *What happened when you put water on the wooden item? Why do you think this object does or doesn't absorb water?*
5. Be sure students understand that *unlike* the wood samples you tested in the classroom (which absorb different amounts of water because they are different types of wood), the wood objects found outdoors absorb water differently based on whether they have a protective (paint) covering.
6. Have students water a plant (or the grass) with their remaining water and then return to the classroom to discuss discoveries.

"My students were surprised at the reaction of the water on the wood surfaces. On the bench, the water didn't soak in, it just beaded up; on the wooden barricade (the horse), the water beaded for a minute and then soaked in. Some students noticed this difference and one said, 'One surface was smooth and shiny and the shiny part didn't let the water go in.' When asked why, she said, 'To protect it from the rain.' "

Michelle Teleau
Science Specialist

Wood and Paper > Investigation 1: *Getting to Know Wood*

Tree Observation Walk

Boston Schoolyard Initiative Extension

When to Go Out

Take students outside anytime during this module to collect information on the trees in your schoolyard.

Outdoor Objective

Students will discover that all trees are not alike and that different types of trees have different identifying characteristics: leaf shape, bark texture, color, size, shape, and type of wood they produce.

What You Might Find:

Some students may want to try objects that are not made of wood. This is a great opportunity to assess whether they can identify wood, and to let them explore the interaction of water with other materials, such as metal and concrete.

If it has rained recently, the wood may be saturated with water. The water will likely react differently on wet wood. If students do not notice this, make sure you mention it.

Materials

For Each Group	1 Resealable plastic bag containing paper and crayons for rubbings
For the Teacher	Tree field guide/identification book (optional)

Note: If you have the opportunity, cut a branch from one or more trees crosswise to show students the inside "wood" of the branch. Enlist extra help from adults or older students if you are sending student groups to work on different trees.

Getting Ready

Time: 20–30 min.

Site: Identify four trees of different species in the schoolyard. Include any trees represented in the wood samples (pine, basswood, redwood) if you have them.

Conservation: Teach students not to pull branches or leaves off of the trees because it damages the tree. Use leaves, twigs, and other parts of the tree that are found on the ground.

Seasonal Tips: In the winter, students will learn that trees can be identified by their bark, or by the few leaves or seedpods still clinging to their branches.

Guiding the Investigation

1. Briefly review the different types of wood students have been investigating and their different properties. Explain that these woods are different because they come from different types of trees. Ask, *How many different types of trees do you think we have in our schoolyard? How can you tell the difference between different types of trees?*

2. Tell students that today they will be going outside to observe trees and learn about how they are different from each other. Each group will be assigned one tree (on which they will become the experts). In every group, each student will have a job: drawing the leaf shape; collecting tree samples from the ground (leaf, twig, seedpod); measuring the girth of the trunk with their hands or arms; making a bark rubbing; and drawing the tree shape. Rehearse each job with students before going outside.

   For rubbings: Demonstrate how to do a rubbing to get a "picture" of the texture of an object by using the long edge of the crayon to rub across the paper. Distribute crayons and scrap paper; then have students practice inside on an object they choose. Outdoors, if possible, have one adult hold the

paper steady, while the student completes the bark rubbing to get the most accurate image. It will be easier for students to do the leaf rubbings indoors.

3. Take students outside to observe each of the trees you have selected and assign each tree to a group. Have students put their drawings, tree samples, and rubbings in their plastic bags to use indoors for their posters. Rotate as they work to help with the bark rubbings. Take photos of students with their trees.
4. Before returning indoors, allow each group to share their observations with the class.
5. Indoors, ask each group to make a tree poster or display about their tree including their drawings, samples, rubbings, and words. (My tree is a _____. Its bark is _____ (smooth, rough). The leaves are shaped like _____.)
6. Remind students that wood is another identifying characteristic of a tree, like the wood they have been discovering.

Wood and Paper > Investigation 2: *Changing Wood* > Part 3: *Making Sawdust Wood*, page 16

Making Sawdust Wood

If there is wind, the sawdust could blow away easily. Refer to the FOSS Teacher Guide for complete instructions.

Wood and Paper > Investigation 3: *Getting to Know Paper* > Part 1: *Paper Hunt*, page 8

"The Story of a Box"

When to Go Out

Following Part 1, take students outside to read "The Story of a Box" in *FOSS Science Stories: Wood and Paper.*

Outdoor Objective

Students will directly experience all facets of a tree, while learning about the process of how trees are turned into wood and paper.

Guiding the Investigation

1. Bring students out to the most beautiful tree in the schoolyard.
2. Have students comfortably sit under or near the tree to make silent observations.

"My students figured out which trees are widest by hugging them."

Michelle Teleau
Science Specialist

What You Might Find:

If you choose to do leaf rubbings, do them indoors. Most outdoor surfaces are too bumpy or textured and this will affect the quality of the rubbing.

You may want to introduce tree field guides to students before going outside, so that students can try to identify the trees without your help. This may be difficult for some students, but your more advanced students will enjoy the challenge.

Consider having students make an exhibit for your tree collection display at home with a family member for homework.

"I had students standing under a tree in our city schoolyard. We heard something above us and all looked up to see a downy woodpecker pecking at the tree. It was amazing. The students and I were totally mesmerized watching this beautiful bird 5 feet above our heads."

Erica Beck Spencer
Science Specialist

What You Might Find:

You may be surprised how long your students can sit and be still when observing the tree. If you have a student who will have trouble sitting on the ground, plan ahead. Some solutions are to have rug remnants or pieces of cardboard that students can sit on.

Taking two minutes of silent observation is a powerful experience with observable benefits for all students. Some teachers repeat silent observation each time they go outside with students.

3. Read "The Story of a Box" in *FOSS Science Stories: Wood and Paper* out loud. Ask, *If we wanted to turn this tree into paper, what would we need to do?*
4. Allow time for students to look closely at their tree and to draw or write about what they see and how it feels to sit under it. Remind them to look at the bark, the shape of the leaves, the size of the tree, and any seedpods or flowers. Ask, *Do you think any animals live in the tree? What makes you think so? Do you hear any sounds in the tree?*
5. End with a discussion on how many things trees offer: shelter for animals, leaves for winter ground cover, shade, and paper and wood.

Wood and Paper > Investigation 4: *Changing Paper* > Part 2: *Papier-Mâché*, page 14

Papier-Mâché

Part 2 may be conducted outside. Refer to the FOSS Teacher Guide for complete instructions.

Wood and Paper > Investigation 5: *Constructions* > Part 3: *Wood and Paper Sculptures*, page 18

Wood and Paper Sculptures

When to Go Out

Part 3 may be conducted outside. Bring students outside again later to observe any changes to the sculptures that are left outside. Refer to the FOSS Teacher Guide for complete instructions.

Outdoor Objective

Using their knowledge of the properties of wood and paper, students will build sculptures and observe them over time to see how the materials withstand the weather. Students will also observe that some beautiful wooden objects can be found in nature, and others are made by people.

Materials

For Each Student	1 Bag
	Twigs, sticks, or bark

Getting Ready

Conservation: If you leave sculptures outside to weather, make sure that when the paper items disintegrate that you collect the remaining paper pulp.

Caution: Remind students not to tear branches or bark off of trees; this could damage or hurt the trees.

Guiding the Investigation

1. Go outside with your class to collect twigs, sticks, or bark that have fallen off of trees.
2. Choose an area where students can work, and follow the steps on pages 20–21 in the FOSS Teacher Guide.
3. Once students are finished, consider if it is safe to display the sculptures outside. Students can observe over time how the wood and paper sculptures withstand the weather.

Teacher Notes: