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INTRODUCTION

The Environments kit contains

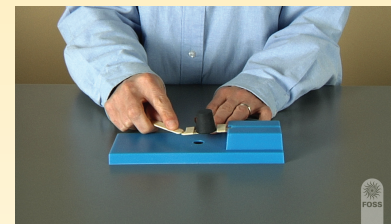
- *Teacher Toolkit: Environments*
 - 1 *Investigations Guide: Environments*
 - 1 *Teacher Resources: Environments*
 - 1 *FOSS Science Resources: Environments*
- *FOSS Science Resources: Environments* (class set of student books)
- Permanent equipment for one class of 32 students
- Consumable equipment for three classes of 32 students

FOSS modules use central materials distribution. You organize all the materials for an investigation on a single table called the materials station. As the investigation progresses, one member of each group gets materials as they are needed, and another returns the materials when the investigation is completed. You place items at the station—students do the rest.

Individual photos of each piece of FOSS equipment are available online for printing. For updates to information on materials used in this module and access to the Materials Safety Data Sheets (MSDS), go to www.FOSSweb.com. Links to replacement-part lists and customer service are also available on FOSSweb.

► NOTE

To see how all of the materials in the module are set up and used, view the teacher preparation video on FOSSweb.



► NOTE

Delta Education Customer Service can be reached at 1-800-258-1302.



KIT INVENTORY *List*

Drawer 1—permanent equipment

Equipment Condition

* The student books, if included in your purchase, are shipped separately.

1	<i>Teacher Toolkit: Environments (1 Investigations Guide, 1 Teacher Resources, and 1 FOSS Science Resources: Environments)</i>	
32	<i>FOSS Science Resources: Environments</i> , student books *	
10	Construction paper, black, sheets ✪	
50	Craft sticks ✪	
8	Critter Replicators	
32	Hand lenses	
8	Metric rulers, clear plastic, 15 cm	
8	Food Web cards, sets, Mono Lake, 12/set	
8	Food Web cards, sets, Woods Ecosystem, 20/set	
4	Noisemakers, clackers	
4	Noisemakers, clapping hands	
4	Noisemakers, clickers	
4	Noisemakers, cow bells	
4	Noisemakers, finger cymbals	
4	Noisemakers, gear clicker	
4	Noisemakers, jingle bells	
32	Paper bags	
1	Poster set, <i>Conservation</i> , 4/set	
2	Posters, <i>Science Safety</i> and <i>Outdoor Safety</i>	
4	Posters, <i>Mealworm Larva</i> , <i>Mealworm Pupa</i> , <i>Mealworm Adult (Darkling Beetle)</i> , <i>Mealworm Stages (Darkling Beetle Stages)</i>	
50	Rubber bands, #33 ✪	
1	Transparent tape, roll ✪	
8	FOSS trays, plastic	
16	Tray columns, plastic tube	
100	Zip bags, 1 L ✪	

Drawer 1—consumable equipment

1	Animal shapes set (7 sheets each brown, gray, green, red)	
1	Brine shrimp eggs, vial	
1	Fish food, flakes, package	
100	Index cards	
1	Kosher salt, box, 3 lb (1.5 kg)/box	
1	Seed package, barley	

✪ These items might occasionally need replacement.

Equipment Condition

1	Seed package, clover	
3	Seed packages, corn	
3	Seed packages, pea	
1	Seed package, radish	
4	Self-stick notes, pads, 100/pad	
1	Water conditioner, bottle	
40	Zip bags, 4 L	

Drawer 2—permanent equipment

8	Basins, 8 L	
1	Baster	
8	Beakers, 100 mL	
1	Beaker, 1 L	
25	Boundary markers (vinyl stake wire flags)	
10	Containers, 1/4 L	
40	Containers, 1/2 L	
8	Containers, 1 L	
12	Container lids, 1/4 L containers ☼	
8	Container lids, 1 L containers	
50	Cups, plastic, 250 mL ☼	
50	Cup lids, plastic ☼	
1	Collecting net (fish net)	
2	Fish tunnels	
8	Minispoons	
2	Pitchers	
8	Screens, large mesh, 15 cm square	
8	Spoons, 5 mL	
10	Spoons, plastic	
2	Thermometers, Celsius	
10	Vials, with caps, 12 dram	

NOTE

This module includes access to FOSSweb, which includes the streaming videos, interactive simulations, virtual investigations, and tutorials used throughout the module.

Drawer 3—permanent equipment

12	Basin covers, 6 L	
12	Basins, clear plastic, 6 L	
1	Gravel, bag, 1 kg ☼	

☼ These items might occasionally need replacement.

MATERIALS *Supplied by the Teacher*

Each part of each investigation has a Materials section that describes the materials required for that part. It lists materials needed for each student or group of students and for the class.

Be aware that you must supply some items. These are indicated with an asterisk (*) in the materials list for each part of the investigation. Here is a summary list of those items by investigation.

For all investigations

- Chart paper and marking pen
- Drawing utensils (pencils, crayons, colored pencils, marking pens)
- Glue sticks
- Paper towels
- 1 Projection system
- Science notebooks (composition books)
- 32 Scissors
- Self-stick notes (if you need additional for review sessions)

For outdoor investigations

- 1 Bag for carrying materials
- 1 Camera (optional)
- 32 Clipboards
- 1 Marking pen, whiteboard
- 1 Timer, minutes
- Whistle
- 1 Whiteboard, portable, or chart paper and cardboard backing

Investigation 1: Environmental Factors

- Apple, carrot, or potato
- Bran, wheat
- Cold environment such as a refrigerator
- 150 Isopods
- Leaf and ground litter, moist
- Low-power microscopes (optional)
- 1 Paring knife
- 150 Mealworms
- Newspaper
- Potting soil
- 16 Recycled paper, 20 × 30 cm, sheets

- 1 Pushpin
- 1 Sheet, white (optional)
 - Water

Investigation 2: Aquatic Environments

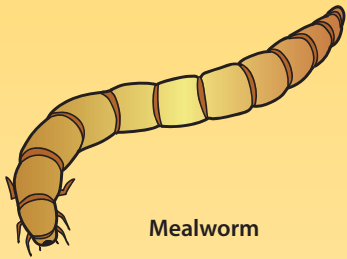
- 30 Amphipods (especially *Gammarus*)
 - 1 Bottle, plastic
- 4–6 Elodea sprigs
 - 2 Goldfish
 - 10 Guppies
 - 1 Hole punch
- 520 Food markers, such as raw elbow macaroni or short pieces of plastic straws
 - 1 Paper cutter
 - Paper bags, large (optional)
- 10–12 Pond snails, small
 - Rice or beans (optional for noisemakers)
 - Rubber bands (optional for noisemakers)
 - Tap water, aged or treated
 - Recycled paper, white, 20 × 30 cm, sheets

Investigation 3: Brine Shrimp Hatching

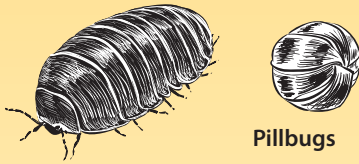
- 1 Marking pen, permanent, black
- 1 Paper cutter
- 32 Safety goggles
 - Bottled water
 - White paper
 - Yeast (optional)

Investigation 4: Range of Tolerance

- 2 Sheets of cardboard or poster board (about 76 × 60 cm)
 - Chart paper
- 64 Marking pens, pencils, or crayons (8 black, 8 brown, 8 red, 8 green, 8 blue, 8 yellow, 8 orange, 8 purple)
 - Newspaper
- 8 Paper, white, 20 × 30 cm, sheets
- 32 Safety goggles
 - Potting soil, 24 liters
 - Water



Mealworm



Pillbugs



Sowbug



SAFETY NOTE

Find out if any students are allergic to wheat. The mealworms are often shipped to the school in wheat bran.

TEACHING NOTE

For the latest information about aquatic-organism care and regional regulations, go to FOSSweb.



PLANNING for Live Organisms

Some organisms come in the kit (seeds of barley, corn, clover, radish, and pea, and brine shrimp eggs). Other organisms you will need to provide. Plan ahead so that you have healthy organisms in your classroom when students are ready to start the investigations.

1. Check seeds (Investigations 1 and 4)

There are enough seeds in a new kit for three classes of 32 students to conduct all the investigations, with seeds left over. Check the package date on the seeds, and if the seeds are more than 2 years old, consider ordering fresh seeds. This will increase the chances of successful seed germination.

We recommend that you order the seeds from Delta Education to make sure that you have the best variety for classroom use and student safety. If you need the seeds immediately and want to buy them at a local store, get untreated seeds. Some seeds, particularly corn, are sometimes powdered with fungicide (you can tell because they will be pink instead of yellow). Provide only untreated seeds for classroom use. The barley seeds used in this module are special salt-tolerant seeds that will not be available in local stores.

2. Acquire mealworms and isopods (Investigation 1)

You will need about 150 mealworms and 150 isopods for Investigation 1. Purchase mealworm larvae from a local pet store or biological supply company and put the larvae, some bran, and a piece of carrot or apple in a plastic container. Depending on the age of the larvae, you can get adult beetles in a few weeks. If you plan ahead, you can have a ready supply of adult beetles (*Tenebrio*) by maintaining a culture in the classroom.

Isopods are best collected by you and your students from local outdoor areas. You can order isopods, as well as beetles, from Delta Education.

3. Acquire aquatic organisms (Investigation 2)

Goldfish, guppies, pond snails, and elodea can be purchased at local pet stores. We encourage you to use local sources for these, especially the goldfish and guppies, as they do not always fare well during shipment. Work with your local pet shop to get healthy, inexpensive goldfish, but not feeder goldfish. It has been our experience that feeder goldfish, although they are the cheapest, don't always survive in the classroom aquarium. Freshwater aquatic amphipods such as *Gammarus* (scuds) need to be ordered from Delta Education.

4. Caring for fish

Common goldfish are usually bright orange, but they can be white, black, or multicolored. The stock from which they are derived is a flat tan gray, and occasionally you will find a native-colored fish among the feeders. It is impossible to tell males and females apart, unless, of course, you are a goldfish.

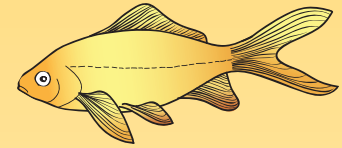
Guppies are small fish that bear live young. The feeder-guppy females are larger and usually a uniform beige or silver-gray. Their abdomens become quite large when they are gravid (carrying young). The males are smaller and have longer, flowing tails. Males are the ones with spots of multiple colors. Fancy guppies that have been bred for showy colors can be dazzling.

Goldfish and guppies are among the hardiest aquarium fish and the easiest to care for. Students will enjoy observing their behavior and caring for them as they become part of your classroom. Although they are easy to care for, there are some things that you should keep in mind to ensure success with your new aquarium. Suitable water, sufficient oxygen, correct temperature (within a fairly large range for these fish), and correct feeding are the most important things to consider.

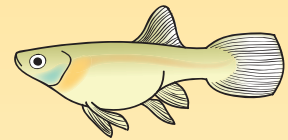
Chlorine used in water treatment is toxic to fish. Chlorine will diffuse out of water when it is exposed to air for a day. This is called aging. Plan to keep some aged tap water on hand at all times for the goldfish. For specific information on the water needs of your fish, refer to Investigation 2, Getting Ready for Part 1.

Goldfish and guppies don't place many demands on the aquarist. They need unpolluted water, but it is not necessary to provide extra oxygen with an air pump. You might see some mortality when you introduce new fish into your aquarium, but this is often due to transportation stress. As long as the fish are not crowded, they will be able to get enough oxygen just from what is dissolved at the surface of the water. (You might have heard that the rule of thumb is 3–4 liters (L) of water per goldfish.)

Goldfish and guppies will eat a wide variety of food, but the most convenient is a commercial flake food, provided in the kit. This kind of food floats, and the fish will quickly learn to come to the surface to eat. They should be fed once a day, but will do fine without food over the weekend. The most important thing about feeding is not to overfeed! Overfeeding can be lethal. To determine the proper amount of food, watch to make sure that the fish eat their food completely in a few minutes. If you keep plants such as elodea in the aquarium, the fish might nibble on the



Goldfish



Female guppy



Male guppy

greenery for additional food from time to time. Other things fish will eat are insect larvae, *Tubifex* worms, aquatic plants, and snail eggs.

Goldfish and guppies generally do not require an aquarium heater, although you might want to purchase one if your classroom gets below 15°C (65°F) on weekends. Fish cannot tolerate extremely warm water, either. Check the water temperature in hot weather. If the water is above 29.5°C (85°F), add cool, aged water to lower the temperature.

The aquarium requires some light for the plants to grow, but should not be in direct sunlight. Direct sunlight encourages algae growth, which turns the water green. Nutrients added to the water in the form of fish waste also encourage the algae growth.

Guppies are quite prolific and will probably give birth during their stay in your classroom. In fact, you might observe the arrival of baby guppies a day or two after the adults are put in their basin aquarium. The stress of transportation might induce a gravid female to release the babies. Adult guppies will eat the young, so you should supply the aquarium with plenty of *Elodea* in which the babies can hide, or move the adults to a separate tank. Students will enjoy watching the baby guppies grow. Goldfish lay eggs; they do not give live birth. Although they are prolific in nature, they usually will not breed in a small aquarium.

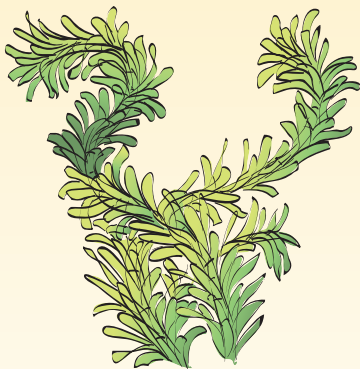
If a fish dies, you might want to leave it in the aquarium until students come to school, but dead fish foul the water, so they should be removed from the aquarium as soon as possible. Some students might be upset that a fish has died. Rather than simply throwing a dead fish away, take it outside and bury it in the ground near a plant. Discuss how this will help fertilize the plant, giving it additional nutrients to help it grow as the body of the fish decays.

Live guppies and goldfish should never be released in ponds or creeks. Allow them to live out their short lives in your classroom.

5. Provide aquatic plants (Investigation 2)

Buy or collect from a local pond some small aquatic plants for the aquarium. We recommend getting 4–6 sprigs of elodea, also known as *Anacharis*. (It looks like a little green feather boa.) You can order it from Delta Education when you order your crayfish, or you can pick it up locally at a pet store that deals with fish. If elodea is not available, try another inexpensive aquatic plant.

NOTE: There are several different species of elodea, and some of them are restricted in some states. Ask your supplier for the species that can safely be distributed in your state.



Elodea

6. Check brine shrimp (Investigation 3)

Brine shrimp eggs don't last forever in nature or in a FOSS kit. Check the package date on the eggs; if it is more than 2 years old, order new eggs. Brine shrimp eggs are usually available at local pet shops. See Step 5 of Getting Ready for Investigation 3, Part 1, for details on how to test the eggs with your local bottled water.

7. Dealing with organisms at the end of the module

You have a number of options for dealing with the organisms at the end of the module. The organisms might find a permanent home in your classroom. You will need to provide containers for permanent habitats if the kit will be used by another teacher. Or check with your district to see if there is a plan for reusing FOSS living organisms.

Aquatic organisms obtained from pet stores or Delta Education should never be released into the local environment. There is always a chance that an introduced species might displace a native species in the environment, so releasing such organisms is never an option. This applies to any plants such as elodea as well.

As a last resort, you can put the organisms in a bag and place them in a freezer overnight to euthanize them prior to disposal.

8. Respect living organisms

FOSS believes that studying live organisms is a critical part of any life science curriculum—it is especially important to support the philosophy that children learn best through direct experiences. FOSS is committed to including the study of live organisms in the program.

We know that the use of organisms comes with a unique set of challenges, but we think it's well worth the effort. We continue to support and abide by federal and state regulations and NSTA (National Science Teachers Association) guidelines for the responsible treatment of animals in the classroom, while taking steps to ensure that children have hands-on life science experiences, and teachers and school districts have a variety of options to obtain organisms.

TEACHING NOTE

It is important for students to understand the reasons for not releasing nonnative plants and animals into local environments. For the latest information about aquatic-organism care and regional regulations, go to FOSSweb.

PREPARING *the Kit for Your Classroom*

Some preparation is required each time you use the kit. Doing these things before beginning the module will make daily setup quicker and easier.

1. Check consumable materials

A number of items in the kit are listed as consumable. Some of these items may be used up during the investigations (craft sticks, seeds, string, brine shrimp eggs, and fish food), and others will wear out and need replacement (glue sticks, zip bags, and plastic cups). Before throwing items out, consider ways to recycle them, and get your students involved in this process.

2. Care and reuse of containers

All the containers in the module are to be rinsed and reused. Do not use soap to clean containers that will become environments for organisms later. It is a good idea to rinse containers before using them in your class.

3. Plan for use of the equipment

Many of these investigations require using the equipment continuously for an extended period of time. The 6 liter (L) basins are used as terrariums for Investigation 1 and for two class aquariums in Investigation 3. The 1/2 L containers are used in the last investigation as planters.

4. Locate the FOSS trays and tubes

The clear plastic FOSS tray was designed specially for this module. Each group of four students uses one tray. It holds four 1/2 L planters or brine shrimp hatcheries. The trays can be stacked two high to conserve space when storing experiments in progress. Use four plastic tubes to provide the support columns between two trays. Check that all the trays and tubes are in the kit.

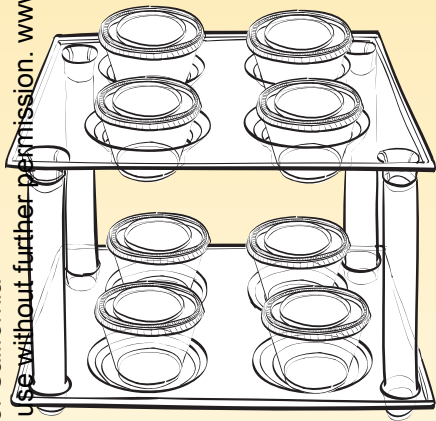
5. Familiarize yourself with the basins

Familiarize yourself with the different basins used in this module.

- Twelve clear, 6 L basins are provided. They are used for a beetle habitat (one), isopod habitats (eight), class aquariums (two), and temporary environment for aquatic plants, snails, and scuds (one or two).
- Eight 8 L basins are used for collecting leaf-litter critters outdoors and for distributing soil.

6. Familiarize yourself with the spoons

The kit has three sizes of spoons. The smallest is the minispoon. It is used to measure clover seeds and brine shrimp eggs. The



5 milliliter (mL) spoon is used to measure salt. The plastic spoon that you might take on a picnic is used to move little animals around in their environments.

7. Provide soil

You must provide potting soil. The salty soil from Investigation 4 should be discarded; new soil should be purchased when a new class starts the module. You will need a total of 27 L.

- Investigation 1: 3 L of soil
- Investigation 4: 24 L of soil

8. Check kosher salt

Kosher salt is used in Investigations 3 and 4. In each of these investigations, students prepare salt concentrations according to a recipe. These recipes are based on the brand of kosher salt packaged in the equipment kit—one 5 mL spoon of the salt has a mass of about 4 grams (g). Other brands of kosher salt have different grain size (and density). One 5 mL spoon of another brand might weigh 7 g. Be aware that not all kosher salt is exactly the same, and, even if you follow the recipes in the investigation perfectly, the resulting concentrations might be different, and you will get different outcomes in the experiments.

9. Check zip bags

In Investigation 4, students put the planters in large zip bags to investigate water tolerance of young plants. These zip bags should be used by three classes before they are replaced. Check the supply of 4 L zip bags in the kit.

10. Check Critter Replicators

Check the condition of the 8 Critter Replicators used in Investigation 1, Part 3. Make repairs as needed. Teacher masters for the covers and wheel transparencies are included in *Teacher Resources*.

11. Check Food Web Cards

The Food Web Cards contain two different sets of organism cards—Woods Ecosystem and Mono Lake. There are eight copies of each set of cards. Check that all the sets are complete.

12. Photocopy notebook sheets

You will need to make copies of science notebook sheets before each investigation. See Getting Ready for Investigation 1, Part 1, for ways to organize the science notebook sheets for this module. If you use a projection system, you can download electronic copies of the sheets from FOSSweb for projection.

Woods Ecosystem organisms, 20/set

- American robin
- Aquatic snail
- Bacteria
- Black bear
- Brook trout
- Chipmunk
- Coyote
- Dead plants and animals
- Earthworm
- Grama grass
- Great blue heron
- Green algae
- Grouse
- Hare
- Mayfly
- Pine trees
- Red-tailed hawk
- Scuds
- *Tubifex* worm
- Wild blueberry

Mono Lake organisms, 12/set

- Bottom algae
- Brine fly
- Brine shrimp
- California gull
- Caspian tern
- Coyote
- Eared grebe
- Floating algae
- Halobacteria
- Red-necked phalarope
- Snowy plover
- Wilson's phalarope

EL NOTE

You might want to print out the FOSS equipment photo cards (from FOSSweb) to add to the word wall to help students with vocabulary.



13. Plan for the word wall

As the module progresses, you will add new vocabulary words to a word wall or pocket chart and model writing and responding to focus questions. Plan how you will do this in your classroom.

You might also find it beneficial to use a pocket chart to display the equipment photo cards as reference for students as they gather needed items from the materials station for each part. Print the photo cards from FOSSweb.

14. Consider safety issues indoors and outdoors

Two safety posters are included in the kit, *Science Safety* and *Outdoor Safety*. You should review the guidelines with students and post the posters in the room as a reminder. Getting Ready for Investigation 1, Part 1, offers suggestions for this discussion. Also be aware of any allergies that students in your class might have to plants (peas and clover seeds are legumes), including wheat bran used to feed mealworms. The mealworms shipped from Delta Education might include wheat bran.

Use the four *Conservation* posters to discuss the importance of conserving natural resources.

You will see a warning label on some science notebook sheets. The label is required by the US Consumer Product Safety Commission (CPSC) whenever students work with chemicals. The label should act as a reminder to you and students to exercise particular safety precautions when working with materials in the investigations where the sheets are used. In this module, kosher salt is the chemical requiring this safety labeling.

CPSC also requires that chemicals be stored in a location away from the kit in the classroom.

15. Plan for letter home and home/school connections

You will need to make copies of teacher master 1, Letter to Family, for the module and of the Home/School Connection teacher masters for each investigation. Space is left at the top so you can copy the letter on your school letterhead. The *Letter to Family* and *Home/School Connections* are also available electronically on FOSSweb.

WARNING — This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

TEACHING NOTE

Families can get more information on Home/School Connections from FOSSweb.



16. Check FOSSweb for resources

Go to FOSSweb, register as a FOSS teacher, and review the print and digital resources available for this module, including the eGuide, eBook, and Resources by Investigation, such as streaming videos, virtual investigations, and tutorials. Be sure to check FOSSweb often for updates and new resources.



CARE, Reuse, and Recycling

When you finish teaching the module, inventory the kit carefully. Note the items that were used up, lost, or broken, and immediately arrange to replace the items. Use a photocopy of the materials list (the Kit Inventory List), and put your marks in the “Equipment Condition” column. Refill packages and replacement parts are available for FOSS by calling Delta Education at 1-800-258-1302 or by using the online replacement-part catalog (www.DeltaEducation.com).

Standard refill packages of consumable items are available from Delta Education. A refill package for a module includes sufficient quantities of all consumable materials (except those provided by the teacher) to use the kit with three classes of 32 students.

Here are a few tips on storing the equipment after use.

- Clean all the containers, lids, cups, vials, and basins with water only (no soap), and dry them thoroughly.
- Make sure the gravel is dry before returning it to the kit.
- Recycle the soil that did not have salt added to it. Put it in a secure bag.
- Repackage any remaining seeds, and label the package with the date they were resealed.
- Make sure this kit is stored in a location free from critters that might enjoy a meal of seeds.
- Sort the organism cards, and place each set in its plastic bag.
- Make sure all the posters are stored flat on the bottom of Drawer 1.
- Check quantity of consumables, and order more if necessary.

The items in the kit have been selected for their ease of use and durability. Small items should be inventoried (a good job for students under your supervision) and put into zip bags for storage. Any items that are no longer useful for science should be properly recycled. This is a good opportunity to get students involved in making decisions about what items can be recycled.