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## INTRODUCTION

The Living Systems kit contains

- *Teacher Toolkit: Living Systems*
  - 1 *Investigations Guide: Living Systems*
  - 1 *Teacher Resources: Living Systems*
  - 1 *FOSS Science Resources: Living Systems*
- *FOSS Science Resources: Living Systems* (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 Safety Data Sheets (SDS), go to [www.FOSSweb.com](http://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

	Equipment Condition
1 <i>Teacher Toolkit: Living Systems</i> (1 <i>Investigations Guide</i> , 1 <i>Teacher Resources</i> , and 1 <i>FOSS Science Resources: Living Systems</i> ★)	
36 Bags, black, plastic, 30 cm (12") long	
8 Basins	
36 Binder clips, small	
8 Containers, 1 L	
10 Cups, plastic, 250 mL (9 oz.)	
8 Food-web card sets, Monterey Bay, 12/set	
8 Food-web card sets, Woods Ecosystem, 20/set	
16 Hand lenses	
8 Jars, plastic, with screw lid with holes, 2 L	
8 Marking pens, permanent ★	
8 Meter tapes	
1 Posters, <i>Leaf Venation</i> , 3/set	
2 Posters, <i>Outdoor Safety</i> and <i>Science Safety</i>	
1 Poster set, <i>Conservation</i> , 4/set	
50 Rubber bands, #33	
1 Spray mister	
8 Syringes, 50 mL	

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

★ These items might occasionally need replacement.

## Drawer 2—permanent equipment

Equipment Condition

16	Bags, clear, plastic, 30 cm (12") long	
12	Bags, clear, plastic, 36 × 51 cm (14" × 20")	
8	Beakers, plastic, 100 mL	
1	Bottle brush	
16	Bottles, plastic, clear, 237 mL (8 oz.)	
1	Butterfly cage with vial holder	
36	Containers, 1/2 L	
5	Container lids, 1/2 L	
20	Cup lids with hole, 250 mL	
16	Cups, plastic, 500 mL (16 oz.)	
20	Cups with hole, plastic, 250 mL (9 oz.)	
18	Dowels, 8 mm diameter, 35 cm (14") long	
8	Graduated cylinders, 50 mL	
18	Pipes, rigid, long, 15 cm (6")	
18	Pipes, rigid, short, 7.5 cm (3")	
1	Poster, <i>Circulatory and Respiratory System</i>	
1	Poster, <i>The Heart</i>	
16	Rubber stoppers, with 2 holes, #2	
8	Spoons, 5 mL	
1	String, ball ⚡	
1	Teacher sample lung volume bag, permanent	
8	Thermometers, Celsius	
40	Tubing pieces, flexible, 45 cm (18")	
32	Valves, one way	
3	Vials, with caps, 12 dram	
4	Volume tubes	
20	Zip bags, plastic, 4 L ⚡	

### NOTE

This module includes access to FOSSweb, which includes the streaming videos and online activities used throughout the module.

## Drawer 3—consumable equipment

100	Index cards, unlined	
100	Lung volume bag mouthpieces	
60	Lung volume bags	
9	Seed packages, wheat, 2 oz./package	
300	Self-stick notes	
100	Straws, jumbo, clear	
3	Yeast, bakers, dry, bags, 0.5 kg/bag	
75	Zip bags, plastic, 1 L	

⚡ 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
- Computer with Internet access
- Drawing utensils (pencils, colored pencils, marking pens)
- Glue sticks
- 1 Projection system
- Science notebooks (composition books)
- 8 Scissors
- Self-stick notes (for review sessions)

### **For outdoor investigations**

- 1 Bag for carrying materials
- Camera (optional)

### **Investigation 1: Systems**

- 1 Crate or carton, about 30 cm × 50 cm
- 8 Marking pens
- Natural ground litter
- Newspaper
- Organic kitchen waste
- 1 Paper cutter
- 1 Piece of luggage
- 8 Pieces of recycled paper
- 150 Redworms (compost worms)
- Soil from a garden

### **Investigation 2: Nutrient Systems**

- 1 Box of animal crackers
- 4 Bottles, soft-drink, empty, 2 L
- 1 Construction paper piece, red or orange

- Flour, cup, 236 mL (1 cup)
- 1 Hole punch
- 1 Ice chest or hot plate/large coffee urn
- Mallow leaves, fresh (optional)
- Measuring spoon, 1.25 mL (1/4 tsp.)
- Orange, fresh (optional)
- 5–10 Painted lady butterfly larvae
- Paper towels
- 1 Paring knife (optional)
- Potting soil, about 16 L
- Sugar, 350 mL (about 1.5 cups)
- Water, hot, 40–50°C

### Investigation 3: Transport Systems

- Bleach, household, 15–30 mL
- Detergent
- Leaves (optional)
- Masking tape
- Paper towels, very absorbent
- Paper towels, ordinary
- Transparent tape

### Investigations 4: Sensory Systems

- 16 Half sheets of paper (optional)
- 1 Hole punch
- Paper towels
- 16 Pieces of scratch paper
- Transparent tape

## PLANNING *for Live Organisms*

Some organisms come in the kit (seeds, yeast). Other organisms you will need to provide (redworms, butterfly larvae). Plan ahead so that you have healthy organisms in your classroom when students are ready to start the investigations.

### ▶ NOTE

Do not purchase the larger earthworms called night crawlers. Night crawlers will not work for this activity.

### 1. Acquire redworms (Investigation 1)

You will need 150 redworms (compost worms, *Eisenia fetida*) to be distributed equally among the several worm habitats your students assemble. These can be ordered from Delta Education or from a local supplier of live organisms. You may be able to purchase them inexpensively from a bait shop. The small compost worms sold for bait are called red wigglers.

### 2. Plan for redworms at the end of the module

You have a number of options for dealing with the redworms at the end of the module. The organisms might find a permanent home in your classroom or in a worm farm or compost pile at your school or elsewhere in your community. The redworms will not survive outside of a rich compost environment. You can also check with your district to see if there is a plan for reusing FOSS living organisms.

### 3. Acquire painted lady butterfly larvae (Investigation 2)

Painted lady caterpillars can be purchased at a number of biological supply houses. Delta Education sells coupons for the painted lady butterflies and the redworms used in this module. Coupons for each kind of organism are available separately, so you can perhaps get redworms locally and purchase coupons for the butterfly larvae. A coupon provides enough organisms for one class using the **Living Systems Module**. Because each coupon is redeemed separately, you receive the organisms on the schedule that you plan. It is important that you plan ahead. Allow 4 weeks to receive your butterflies after you send in the coupon. You can also redeem your organism coupons by faxing them to Delta at 1-800-282-9560.

Purchase five to ten butterfly larvae. The larvae arrive in a small cup with a supply of food medium that looks a lot like guacamole. The larvae should stay right in the little cup until they pupate.

To raise a second generation of larvae, find a source of fresh mallow or hollyhock leaves. Or refrigerate the medium once the first larvae pupate and use the medium again for the next generation.

The butterflies live only a short time so they will most likely live to the end of their lifetime during this module. You should never release butterflies that you culture. They would probably not survive, yet any organism not native to your local environment might upset the local ecological balance. Organisms can be terminated by putting them in a freezer for a day.

#### 4. Check seeds and yeast (Investigation 2)

There are enough wheat seeds in a new kit for three classes of 32 students to conduct 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.

The yeast will be good for several years if kept cool and dry. Check the package and proof the yeast ahead of time by setting up a bag with yeast, warm water, and sugar as described in Investigation 2, Part 1, Guiding the Investigation, Steps 6 and 13.

#### 5. 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 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.

## 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
- Squirrels
- Tubifex worm
- Wild blueberry

## Monterey Bay organisms, 12/set

- Bat star
- Garibaldi
- Giant kelp
- Hermit crab
- Marine bacteria
- Phytoplankton
- Purple sea urchin
- Red octopus
- Sea otter
- Sillago fish
- Urban snail
- Zooplankton



## NOTE

One sample of the permanent lung volume bag from Delta Education is included in the kit so you can see the alternative equipment option. This bag is a different size from the consumable bag so the calibrations will be different.

## 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 will be used up during the investigations (index cards, straws, zip bags), and others will wear out and need replacement (marking pens, string). Before throwing items out, consider ways to recycle them, and get your students involved in this process.

### 2. Inventory parts

A number of small pieces of equipment need to be inventoried (tubing, valves, rubber stoppers, rigid pipes, spoons). Do an inventory at the beginning of the module, and have students do this after each investigation.

### 3. Check food-web cards

There are two different sets of food-web cards—one for the woods ecosystem and one for the Monterey Bay ecosystem (kelp forest). The food-web cards contain organism cards for each of these ecosystems. There are eight copies of each set of cards. Check that all the sets are complete.

### 4. Plan for cleanup

This module uses containers and tools that must be cleaned, dried, and inventoried if they are to stay in top condition. This responsibility should be assumed by students. Assign one group to do this after each session. Plan where this cleanup will take place in the classroom (if you have a sink) or elsewhere in the school.

All the plastic items in the kits are meant to be rinsed, dried, and reused.

Plan for the disposal of liquids. A collection bucket works well when there is no sink.

### 5. Plan to recycle the lung volume equipment

In Investigation 3, Part 3, the lung volume bags and mouthpieces are consumable equipment for health reasons. Students calibrate the bags using the process on teacher masters 8–10. Plan how to recycle the materials appropriately at the end of the investigation.

Permanent lung volume bags with printed calibrations are available as an alternative equipment option from Delta Education. These materials must be disinfected with bleach water after each use.



## 6. Review safety issues indoors and outdoors

Two safety posters are included in the kit, one for science indoors and one for working outdoors. You should review the guidelines with students and hang the posters in the room as a reminder. Step 3 of 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. Students with latex allergies should not handle the rubber stoppers.

## 7. Photocopy notebook sheets

You will need to make copies of science notebook sheets before each investigation. See Step 9 of 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 [www.FOSSweb.com](http://www.FOSSweb.com).

## 8. 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.

This module uses a number of videos on FOSSweb. Familiarize yourself with how to access these resources on FOSSweb in the “Resources by Investigation” section. Plan to have a projection system with computer and Internet access whenever there is something for the class to view.

## 9. Plan for 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 may 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.

## 10. Acquire books from library

Check your local library for books that relate to this module. Visit FOSSweb for a list of appropriate trade books.

## 11. 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 the Home/School Connection teacher masters for each investigation.



### EL NOTE

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

### TEACHING NOTE

The **Letter to Family** and **Home/School Connections** are also available electronically on FOSSweb.

## **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](http://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.

- Make sure all planting containers, cups, bottles, graduated cylinders, volume tubes, syringes, rubber stoppers, and spoons are clean and dry.
- Make sure thermometers are protected in bubblewrap material.
- Check that unused seeds and yeast are properly bagged.
- Rebag all tubes and valves used in the heart model.
- Recycle the used lung volume mouthpieces and bags appropriately.
- Take posters down from your classroom walls and store them flat in the bottom of the kit drawer.
- Check the 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 in 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.