

15-9130

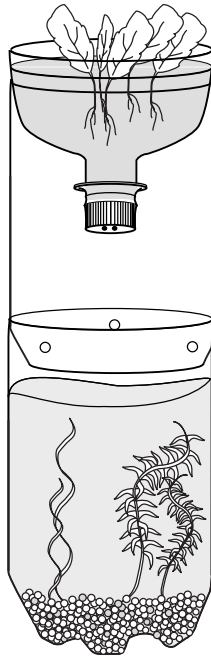
Demonstration Kit

15-9132

Classroom Set

TerrAqua Column

Instructions



Introduction

Students learn how to cut plastic bottles, assemble them, and create an experimental system that includes a terrestrial and an aquatic environment and models some interactions between land and water. The system is known as a TerrAqua column. Students can use the bottle environment for observational or experimental purposes.

The demonstration kit contains materials and instructions for creating 2 TerrAqua columns. The classroom kit is designed for 4 groups of up to 6 students each and includes materials for 8 columns, so that each group has 2. The first TerrAqua column serves as a control. The second serves as an experimental column in which a variable can be altered. The effects of these substances on the aquatic and terrestrial environments can be monitored in the experimental column. Both kits use the same instructions. Make an overhead transparency of the instructions or photocopy them for each group (pages 5 and 6). Living materials are shipped approximately 2 weeks after the kit arrives.

Objectives

- Build a TerrAqua column.
- Observe developing seedlings.
- Observe interactions between terrestrial and aquatic environment.
- Conduct an experiment about the effects of variations in application of fertilizer or some other variable on the growth and development of plants.

Background

Terrestrial and aquatic ecosystems are frequently viewed as two separate and independent entities. However, land and water systems are connected in many ways. One of the major links between terrestrial and aquatic ecosystems is water.

Water is essential for terrestrial communities and usually finds its way to wetlands, rivers, lakes, and oceans. As it passes through the soils of fields and forests, water picks up compounds such as nutrients and agricultural chemicals. These compounds enter aquatic communities, modifying the biological, physical, and chemical aspects of those communities.

Recent concerns about interactions between land use and water quality have led to the study of nutrient and chemical flow from terrestrial to aquatic ecosystems. Fertilizers and pesticides used for lawn care and agriculture make their way into aquatic systems, causing water-quality problems ranging from algal growth to build-up of toxins in drinking water.

Various aspects of terrestrial and aquatic systems can be monitored, e.g., growth of plants and algae. For plants in the terrestrial system, percent germination, height, weight, leaf size, length of life cycle, and seed production can serve as measures of plant health. Populations of algae, aquatic plants, and animals can be monitored in aquatic systems. Changes in soil microorganism populations and soil structure can also be monitored.

Classroom Tips

If you are using the classroom kit, you should organize the class as follows:

Divide students into 4 groups. Each group should be given 4 2-liter plastic soda bottles, potting mix (groups share this), 100 radish seeds (count these out before class), 4 plastic pipets for watering, ½ bag water-worn pebbles (divide before class), 1 bunch corkscrew vallisneria, 1 bunch elodea, 4–5 snails, 1 ruler, 1 set of instructions (photocopied from this manual).

Groups will share scissors. Groups will also share fertilizer*. A gallon milk jug is ideal for holding the fertilizer solution. After mixing the solution, be sure to label it.

Each bottle cap (6 total) needs to have several small holes drilled or punched into it before class begins. As an alternative, you can use cheesecloth and a rubber band to cap the bottle.

*Fertilizer cubes have been included in the kit as a possible experimental variable. To make a standard concentration of liquid fertilizer, add 1 fertilizer cube to 1 gallon of water. To make lower or higher concentrations for experimental purposes, simply adjust the water or fertilizer quantity as you wish. If you decide to experiment with fertilizer as a class, student groups can use different concentrations of solution on their experimental columns and then compare observations over a period of time. Alternatively, groups can add fertilizer solution at

different frequencies, rather than different concentrations. No matter how you or your students design your experiment(s), be sure to stress the importance of adequate controls.

Safety Note: You may want to do all the bottle cutting yourself, or assign the job to the students. If you have the students cut their own bottles, you still need to make all the beginning cuts with a sharp knife or carton cutter before students finish the cuts with scissors.

Extra bottles should be collected to replace those which are cut incorrectly.

Students follow instructions on pages 5 and 6 to construct the TerrAqua Columns.

Materials

Demonstration Kit (15-9130)

1 1-L bag potting mix
1 pk radish seeds
2 plastic pipets (for watering)
1 bag water-worn pebbles
1 pieces of corkscrew vallisneria
1 bunch of elodea
12 pond snails
1 fertilizer cube
1 plastic ruler
1 scissors
instructions

Classroom Kit (15-9132)

4 1-L bags potting mix
1 pk radish seeds (500)
16 plastic pipets (for watering)
2 bags water-worn pebbles
6 pieces corkscrew vallisneria
6 bunches elodea
18 pond snails
3 fertilizer cubes
6 plastic rulers
2 scissors
instructions (make photocopies for each group or an overhead transparency)

Needed, but not supplied

4 2-L plastic bottles
1 nail or drill for making holes in bottle cap, or cheesecloth and a rubber band
1 roll transparent tape
sharp knife, or carton cutter
hole punch

16 2-L plastic bottles
4 nails or a drill for making holes in a bottle cap, or cheesecloth and a rubber band
1 roll transparent tape
sharp knife, or carton cutter
hole punch

Procedure for Constructing TerrAqua Column

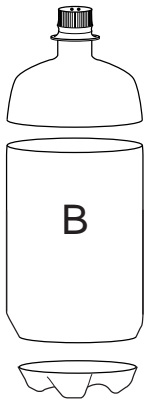
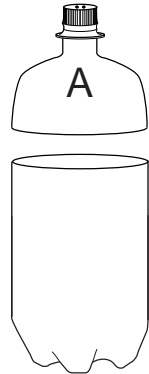
This kit calls for the construction of two TerrAqua columns by one or more groups. Each column is composed of two units. The upper unit is terrestrial and the bottom unit is aquatic.

Follow instructions for making one experimental system. Repeat the instructions for construction of a second column. The first is the control column and the second is to be used as an experimental column.

Cutting Bottle 1

This bottle needs 2 cuts.

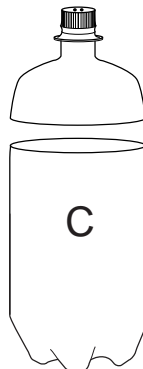
- First, evenly cut the top portion off the bottle, leaving 1–2 in of straight-sided cylinder with the top. This top will become column part A, the terrestrial portion of the TerrAqua column. Your teacher will provide you with a bottle cap having several holes (or you may use a piece of cheesecloth and a rubber band to cap the bottle). Place the cap onto the bottle top to complete column part A.



- Next, cut across the bottom of the bottle, leaving $\frac{3}{4}$ in of the hip on the cylinder (i.e., cut below the curve). The cylinder portion of the bottle will become column part B, the connector.

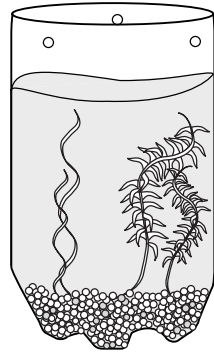
Cutting Bottle 2

Cut across the top of the cylinder, leaving straight sides (i.e., cut below the upper curve). The lower portion of this bottle will become column part C, the aquatic portion of the completed column.



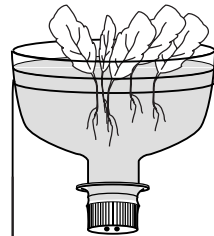
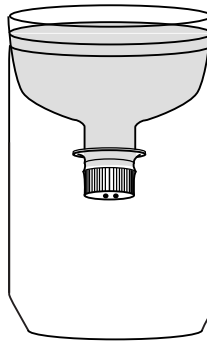
Preparing the Aquatic Portion of the Column

In part C, place conditioned tap water, gravel, and plants, along with 6 snails. Use a hole punch to make 3 holes in the top (above the water line) for aeration.



Combining Bottles to Construct the Terrestrial Portion of the Column

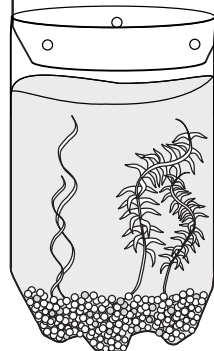
1. Invert part A into the straight end of part B.
2. Fill part A with slightly moistened potting mix to within 1 inch of the top.
3. Plant the seed, lightly cover it, and water.



Final Combination of Column Parts

Place the completed terrestrial portion onto the aquatic portion.

Use some strips of transparent tape to help hold the system together.



Suggested Activities

The TerrAqua Column allows for the study of various aspects of land-water interactions. You have been supplied fertilizer that you can use to investigate effects of different concentrations or application frequencies. Your students may want to create experiments or special columns to investigate topics such as the effects of

- nutrient sources for terrestrial systems.
- nutrient concentrations.
- type and amount of soil in a terrestrial system.
- type of plants in a terrestrial system.
- physical factors (e.g., temperature and light).
- various pesticides or concentrations of pesticides.
- frequency of pesticide application.
- Quantity or characteristics of runoff from different types of soil

Note: Make sure students remember always to use a control column in which the tested variable is not altered. Student groups can work together if they are interested in testing effects of different concentrations of a substance. Each column can be treated a different way, and one can be used as a control for the larger group experiment.

Students may collect materials from their own environment and use the bottle ecosystem concept to construct a mini-model of the ecosystem in which they live. Biological materials for aquatic systems can come from a pond, lake, puddle, or fish tank and can include algae, phytoplankton, zooplankton, aquatic plants, and insects.

To order call:

1-800-334-5551 (US and Canada)

336-584-0381 (International)

For technical help call:

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