

# BOTTLE BIOLOGY



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## Contact Information

Athens-Clarke County Recycling Division  
Program Education Specialist  
706.613.3512  
[www.acc-recycle.org](http://www.acc-recycle.org)

## Grades

6-12

## Objectives

Students will use plastic bottles and other recyclable materials to explore the world of science and our environment. Using materials that would otherwise be “trash”, students will create an ecosystem and observe the changes within this ecosystem to explore the link between land and water.

## Method

By building a Terraqua Column, students will observe the connections between water cycles, land use and water quality, point-source pollution, ecology, soil science, and agriculture.

## Materials

Per student: 2 two-liter plastic bottles, one bottle cap, BOTTLE BIOLOGY TOOL KIT, wicking material, water, soil and plants.

## Vocabulary

Ecosystem, water cycles, land use, water quality, point-source pollution, ecology, soil science, agriculture.

## Procedure

1. Follow step-by-step instructions provided in the BOTTLE BIOLOGY WORKSHOP guide following this section.

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Source: Jacquelyn Walton, Rothschild Middle School

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# BUILD:



## DECOMPOSITION COLUMN

### MATERIALS:

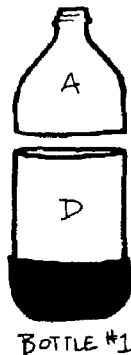
- three 2-liter soda bottles
- Bottle Biology Tool Kit (p. 2)
- kitchen scraps, leaves, newspapers ... you decide!



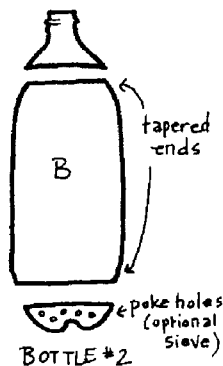
**1.** Remove labels from all 3 bottles. Remove bases from 2 of them if they have bases (see Bottle Basics, p. 3).



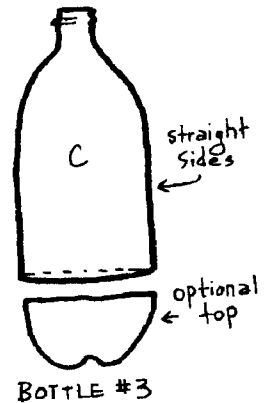
**2.** Cut top off Bottle #1 2 to 3 cm below shoulder so that cylinder has straight sides.



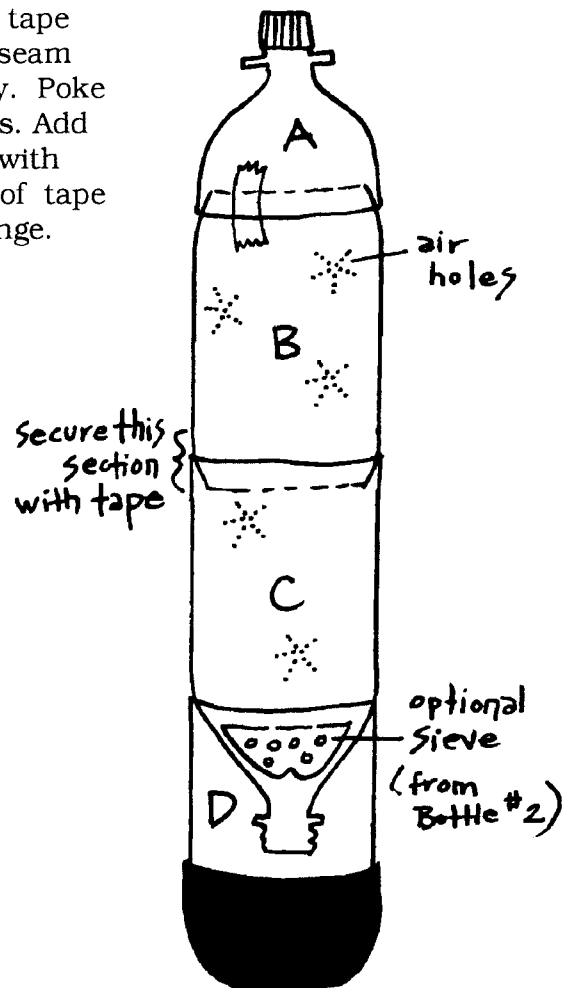
**3.** Cut top off Bottle #2 2 to 3 cm above shoulder. Cut bottom off 2 to 3 cm below hip. The resulting cylinder will have two tapered ends.



**4.** Cut bottom off Bottle #3, 2 to 3 cm above hip, so cylinder has a straight end.

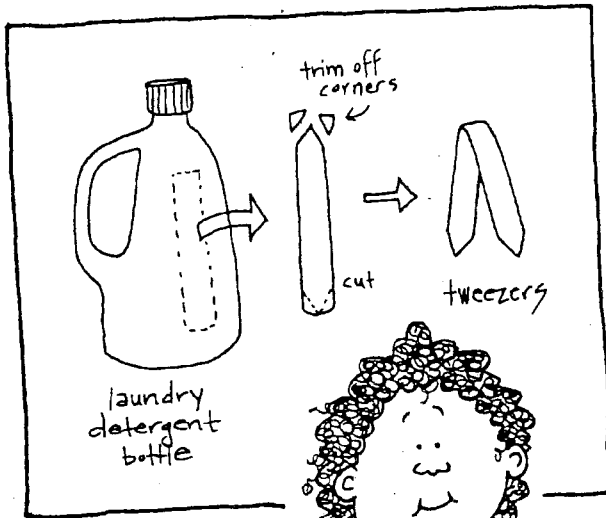


**5.** Invert "C" and stack into base "D". Stack "B" and tape middle seam securely. Poke air holes. Add top "A" with a piece of tape for a hinge.



# More Treasures from Trash

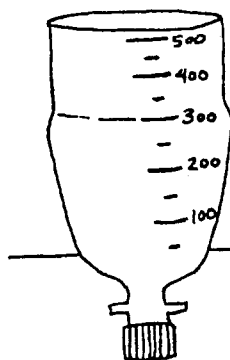
## TWEEZERS



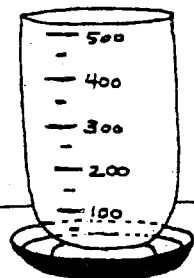
## WATER BOTTLE



## GRADUATED FUNNEL

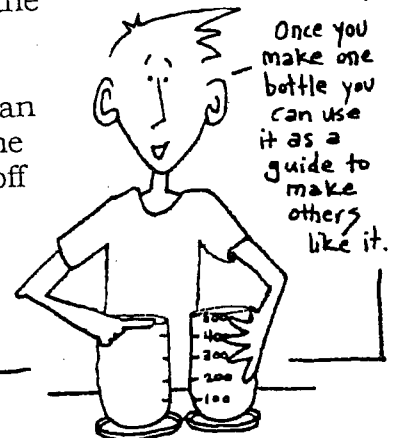


## GRADUATED CYLINDER



A 1-liter bottle has a volume of 1050 mls or ccs. To make a graduated cylinder, add water 50 mls at a time using a premeasured graduated cylinder or another measuring vessel. Mark off each 50 ml increment with a permanent marker to the 500 ml point. Then empty the bottle and cut it about 0.5 cm above the 500 ml level.

The top half of the bottle can be capped, inverted into the bottom half, and marked off by 50 mls as above. Remove the cap and use it as a graduated funnel.



**Bottle Biology Workshop**  
**Snoops Environmental Engineering Corporation**  
**Training Program**  
Presenter: Jacquelyn Walton

**Introduction:**

Bottle Biology uses plastic bottles and other recyclable materials to explore the world of science and our environment. Out of the trash, into the classroom if you combine science with soda bottle, you can create an ecosystem, explore the concept of niche, and model a lakeshore. These hands-on, eyes-on, nose-on, mouths-on and minds on activities will help motivate students to learn more about the world of science and our environment.

**Hands-On Session:**

Participants will be actively involved in constructing a Terraqua Column, which provides a model to explore the link between land and water. The model has three basic components: soil, water and plants. This model shows the connections between water cycles, land use and water quality, point-source pollution, ecology, soil science, and agriculture. Each group will need the following materials to build a Terraqua Column: two-liter bottles, one bottle cap, Bottle Biology Kit, wicking material-fabric interfacing, water, soil, and plants. This activity will help session participants understand how to use Terraqua Column in the classroom.

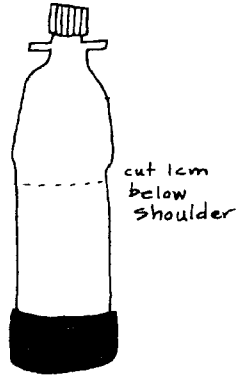
# TERRAQUA BOTTLE

A Terraqua Bottle will allow you to grow larger plants. This is a single bottle version of the Terraqua Column (see p. 62).

## MATERIALS:

- one 1- or 2-liter bottle
- one bottle cap
- wick strip 25 cm x 1 cm
- Bottle Biology Tool Kit (p. 2)

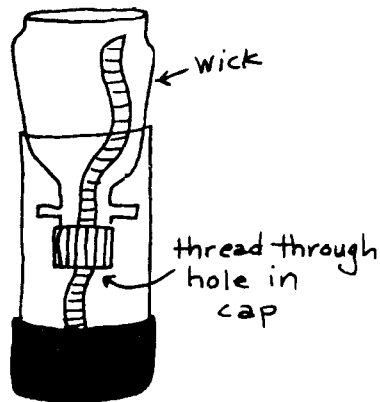
**1.** Remove label and cut 1 cm below shoulder.



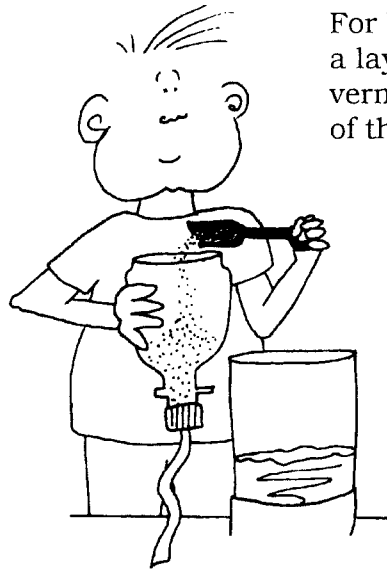
**2.** Poke or drill a 1 cm hole in bottle cap.



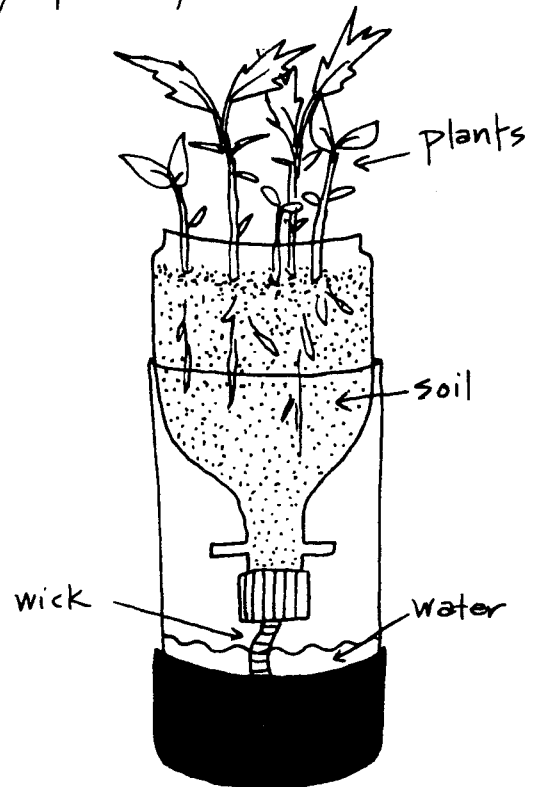
**3.** Thread a thoroughly wet wick strip through bottle top, invert top, and set into base. Wick should reach bottom of reservoir and thread loosely through cap.



**4.** Fill reservoir with water. Add soil and plants to top chamber. To be effective, the wick should run up into soil, not be plastered along a side of the bottle.



For better drainage place a layer of gravel, sand, or vermiculite in the bottom of the soil unit.



## **Bottle Biology Workshop**

### **Key Questions:**

1. What goes on in a TerrAqua Column (TAC)?
2. How do these components interact in a TerrAqua system? (The word **system** indicates you are dealing with a diversity of organisms and the interactions between them.
3. How do land and water interact in your area?
  - a. Does runoff from fertilized lawns or agriculture threaten the quality of streams or groundwater?
  - b. Is salt pollution a problem, from road salt, irrigation, or saltwater intrusion?
  - c. Are landfills affecting local groundwater?

### **TerrAqua Column (TAC) Soil, Water, and Plants**

1. Fill the top unit of you TAC with soil you collect, or with potting soil from a gardening store.
2. Fill lower aquatic unit with tap water, or water from pond, lake, puddle or fish tank.



ou can fill  
our TAC with  
soil you collect  
from our



# Bottle Biology Workshop Expenditure Ledger

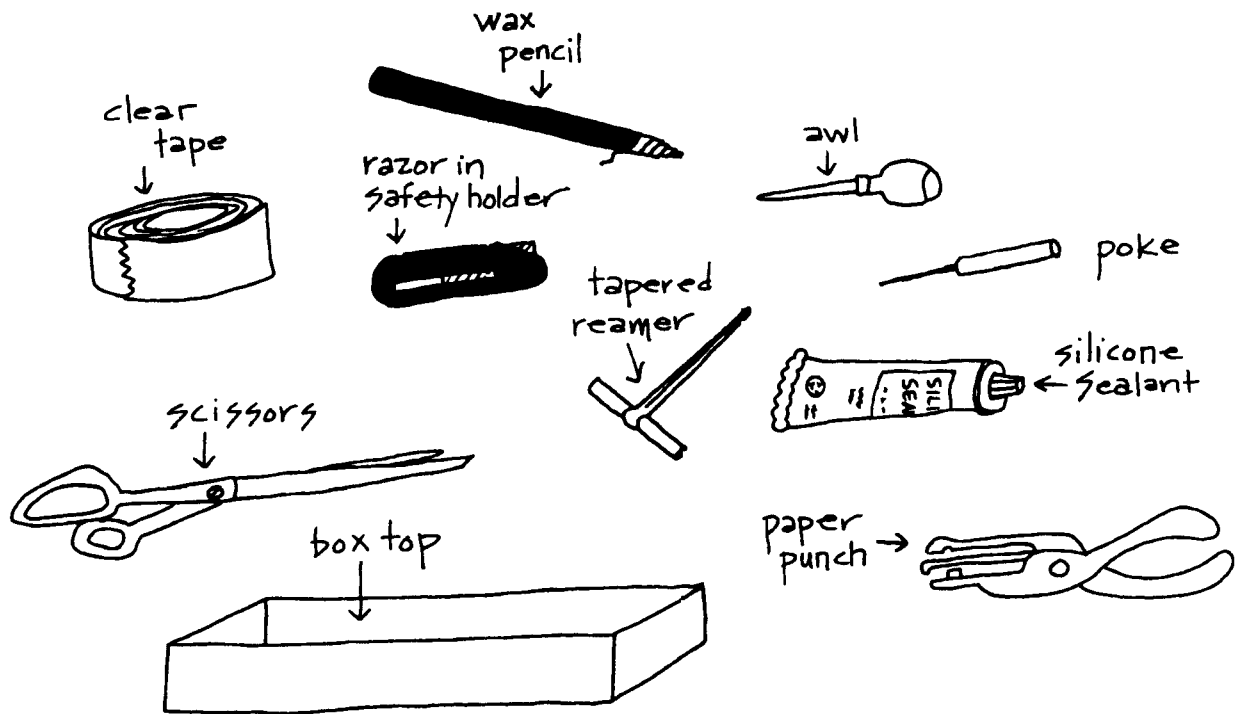
**Beginning Balance: 25,000**

Check number	Date	To whom check is written	Check amount and balance
			amount
			balance
			amount
			balance
			amount
			balance
			amount
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# BOTTLE BIOLOGY TOOL KIT

These tools will enable you to construct any of the columns in this book. Some of these items are not critical – you do not need to use a razor to start bottle cuts, for example, or a tapered reamer to enlarge holes – but they can make construction easier.



- **Box top or drawer** to stabilize bottle while making cutting lines;
- **Wax pencil, marker, or crayon** for drawing cutting lines;
- **Razor in safety holder or sharp pocket knife** to start cut;
- **Scissors** to cut bottle;
- **"Poke," darning needle or diaper pin** to make air holes;
- **Awl** to make holes in bottle caps and film cans;
- **Tapered reamer** for enlarging holes;
- **Paper punch** for making large holes in thin plastic;
- **Clear waterproof postal or bookbinding tape** to join columns;
- **Silicone sealant** to waterproof joints.

# BUILD:



## SEDIMENTATION BOTTLE

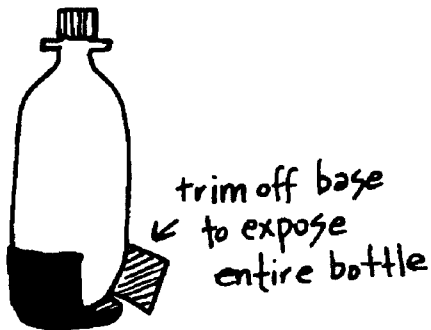
### MATERIALS:

- one 1-liter bottle plus cap
- Bottle Biology Tool Kit (p. 2)
- graduated cylinder or other measured container
- 200 cubic centimeters (ccs) soil
- water

**1.** Remove the label from a 1-liter bottle (see p. 3).



**2.** If your bottle has a base, trim away sides of base to expose entire bottle.



**3.** Using a graduated cylinder, or some other known measured container, add water to the bottle in 100 ml increments, marking your bottle every 100 milliliters (or cubic centimeters) from the bottom to the 1000 ml point.

Use a waterproof pen. You'll notice the spacing between marks changes as the bottle changes shape.

