

## Modeling a Closed System

You know that you share the world around you with many other organisms, but have you ever had a close-up view of those neighbors in action? We tend to think of ecosystems as enormous areas like deserts and beaches, where plants, animals, and other organisms are seen from a broad perspective. But ecosystems don't have to be large, and the relationships of organisms to each other and to the environment can be fascinating to watch on a small scale. In this lab, you will create your own closed ecosystem and monitor its activity over several weeks.

### OBJECTIVES

**Identify** components to be included in a small, closed ecological system.

**Describe** changes within the system over time, and interactions among the components.

**Compare** the closed system to Earth.

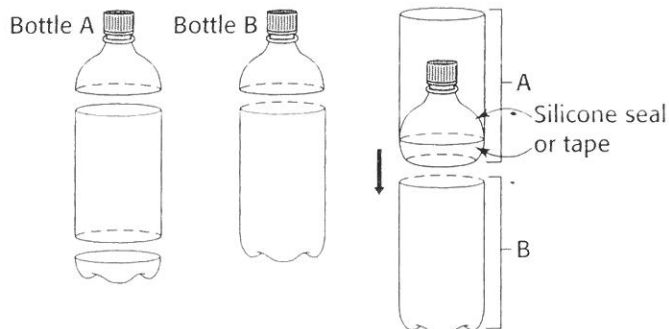
### MATERIALS

- clear silicone sealant
- journal or logbook for recording observations
- knife or sharp scissors for cutting the bottles
- plastic soda bottles, 2-liter, identical, with labels removed (2)
- pointed tool for poking air holes into the bottles
- selection of “ingredients” that will fit in the ecosystem: soil, soil nutrients, water, grass, compost, insects, snails, etc.



**Modeling a Closed System** *continued***Procedure**

1. Inspect the bottles to be sure they are clean. Cut base off of one bottle (Bottle A), about 1 cm below where it tapers downward. Cut the top off of the same bottle, about 1 cm below where it flares outward.



2. Cut the top off the second bottle (Bottle B), at the same spot where you cut the top off Bottle A.
3. Slide the top of Bottle A, cap side up, down into the lower portion of Bottle A.
4. If you want your ecosystem to hold water, seal with silicone the joint where the top of Bottle A now meets the sides of the lower portion.
5. Poke drainage/air holes all the way around the top portion of Bottle A.
6. Stack the Bottle A "unit" into Bottle B, to create a two-chambered ecosystem.
7. Determine which habitats you want to create in your chambers by using your choice of the ecosystem "ingredients" supplied. The bottom habitat can be aquatic (water-based) or terrestrial (land-based). Set up the habitats by adding nonliving components (soil, water, etc.) as well as the appropriate organisms.
8. Once you have set up your bottle ecosystem, monitor it for six weeks, noting all observed changes in your logbook.

**Analysis**

1. **Describing Events** Which nonliving components did you include in your ecosystem? Did you include soil nutrients at the start?

---



---



---

**Modeling a Closed System** *continued*

---

**2. Describing Events** Which organisms did you choose to include? How many of each type did you add initially?

---

---

---

**3. Describing Events** In what order did you introduce your organisms?

---

---

---

**4. Describing Events** Did you maintain a specific range of temperatures and light? Was your ecosystem kept on a dark/light cycle that simulated night and day?

---

---

---

---

**5. Explaining Events** How many of each organism did your ecosystem eventually support?

---

---

---

**6. Explaining Events** Did any of the organisms in your ecosystem enter any new phases in their life cycles? If so, describe your observations in detail.

---

---

---

**7. Explaining Events** What changes or interactions within the system did you notice over time?

---

---

**Modeling a Closed System** *continued*

\_\_\_\_\_

\_\_\_\_\_

**8. Explaining Events** Describe the movement of water in your bottle ecosystem. What parts of the water cycle appear to be represented in the bottle?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Conclusions**

**9. Drawing Conclusions** How is Earth similar to the ecosystem that you constructed? Are Earth and your bottle ecosystem truly closed systems?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**10. Drawing Conclusions** Which changes in your ecosystem surprised you the most? What did you learn from observing the changes?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Extension**

**1. Designing Experiments** Alter your bottle ecosystem in one of the following ways, and monitor the results of the changes: add decomposing fruit and breeding fruit flies; add predators above the fruit flies; change the light routine; experiment with different soil types.