

Investigation 3.2: Modeling the Water Cycle on Earth

Procedure

Day 1

1. Split the students into groups of four students. Reserve a space in the classroom where the lamp/container setups will not be disturbed for 24 hours. Assign each group an area in the reserved space where they can assemble their lamps. Have students look at Student Guide Figure 3, and review how to clamp the lamp to two bookends to provide a stable heat source.

2. Review with students the method of using a balance to find mass. Remind students that the balance should be set at zero before any objects are placed on the pan.

3. Instruct students to find the mass of the measuring cup with the water inside. Then, have them record the mass in Table 1 on Student Sheet 3.2.

4–5. Have students repeat the procedure they used in Step 3 to find the mass of the measuring cup with ice inside it. Remind them to record all their measurements in the table.

6–8. After students add together the two masses and place the measuring cups inside the large plastic container, remind them to press the lid down firmly so that the container is sealed.

9–10. Check to make sure that groups have positioned their containers so that the lamp shines directly and equally on both measuring cups. Remind students not to disturb their containers after they have been positioned in front of the lamp.

Day 2

1–2. After 24 hours under the lamps, instruct students to look carefully at the containers and record their observations in their science notebooks both before and after they open the containers.

3–4. Urge caution to avoid spills as students remove the measuring cups

from the container and take the mass of the cups and their contents. Remind students to record their data in Table 1 on Student Sheet 3.2.

5–7. Review with students how to zero the balance. After students collect the water from the plastic container in the third measuring cup, discuss why it was important to zero



Investigation 3.2

Modeling the Water Cycle on Earth

Materials

For you

- Science notebook
- Student Sheet 3.2: *Modeling the Water Cycle*

For your group

- 3 Plastic measuring cups
- 2 Bookends
- 1 Balance
- 1 Clamp lamp
- 1 Plastic container with lid
- Access to electricity

For the class

- Blue water
- Crushed ice

Procedure

Day 1

- 1.** Set up the lamp by clamping it to two bookends, as shown in Figure 3.3.
- 2.** Place 20 mL of blue water in a measuring cup.
- 3.** Find the mass of the water and measuring cup. Record this in Table 1 on Student Sheet 3.2.
- 4.** Fill a second measuring cup with ice.
- 5.** Find the mass of the ice and measuring cup. Record this in the table.
- 6.** Add the mass of the measuring cup with water to the mass of the measuring cup with ice and record the total in the table.
- 7.** Place the measuring cups containing the water and ice inside the large (16-oz) plastic container.
- 8.** Place the lid on the large container. Press down firmly to secure the lid.
- 9.** Make detailed observations of the container. Think about all the places in the container where water might be. Record these on Student Sheet 3.2.
- 10.** Carefully place the container under a light source, as directed by your teacher.
- 11.** Allow the container to remain exposed to the light for 24 hours.



Figure 3.3
Setting up the lamp
PHOTO: © Carolina Biological Supply Company

The Water Cycle, Cloud Formation, and Air Masses

the balance prior to measuring the mass of the water in this third cup. Lead students to understand that they want only the mass of the water that collected in the container. By zeroing the balance when the empty cup was in place on the pan, they have effectively removed the mass of the cup from any subsequent readings they take. Remind students as necessary to record their measurements of the mass of the

collected water in Table 1.

8. Students should find that the total amount of water at the end of Day 2 is virtually the same as the amount calculated on Day 1. Discuss any discrepancies that students find in the mass of water, cups, and ice before and after the 24-hour period. Encourage the class to make a list of reasons for variations, such as not being able to remove all of the water from the container. Ask: How

might we make sure that all water is accounted for? Students might suggest adding a paper towel to the balance with the empty measuring cup when the balance was zeroed, using the paper towel to wipe the container dry after most of the water was poured into the measuring cup, and then massing both the cup with water and the damp paper towel to make sure all of the water was accounted for.

9. Instruct students to read Building Your Knowledge: *The Water Cycle: From the Sky to the Land and Back Again*. Sample answers to questions follow:

- a.** The formation of clouds and falling precipitation are parts of the water cycle that have an effect on local weather.
- b.** Sources of surface water that can evaporate and become water vapor in the atmosphere include oceans, lakes, rivers, glaciers and other forms of surface ice, moist soil, animal respiration, and transpiration in plants.
- c.** Students' answers will vary. Students should recognize that their model shows some of the processes that occur in the water cycle such as evaporation, condensation, and precipitation.
- d.** Answers will vary. Students should recognize that not all aspects of the water cycle are included in this model. Students may note that the model does not include transpiration, deposition, freezing, or groundwater. They may note that while they see precipitation, they don't truly see cloud formation. They may also note that they only see one type of precipitation.

Day 2

- 1.** Make detailed observations of the container. Think about all the places in the container where water might be. Record these on Student Sheet 3.2.
- 2.** Take the lid off the large plastic container.
- 3.** Remove the measuring cups from the container.
- 4.** Find the mass of each measuring cup and its contents. Record this in Table 1 on Student Sheet 3.2.
- 5.** Place another measuring cup on the balance and zero the balance.
- 6.** Remove the measuring cup from the balance and pour the water that was in the large plastic container into the empty measuring cup.
- 7.** Place the measuring cup back on the balance. Record the mass of the water in the table.
- 8.** Add the masses of the two measuring cups and their contents to the mass of water. Record the total in the table. How does this value compare to the total mass calculated on Day 1?
- 9.** Read Building Your Knowledge: *The Water Cycle: From the Sky to the Land and Back Again*. Then answer the following questions in your science notebook:
 - a.** In what ways does the water cycle affect local weather?
 - b.** What sources supply water vapor to the air?
 - c.** How was your model similar to the water cycle?
 - d.** What limitations exist with your model? How is it not like the water cycle?