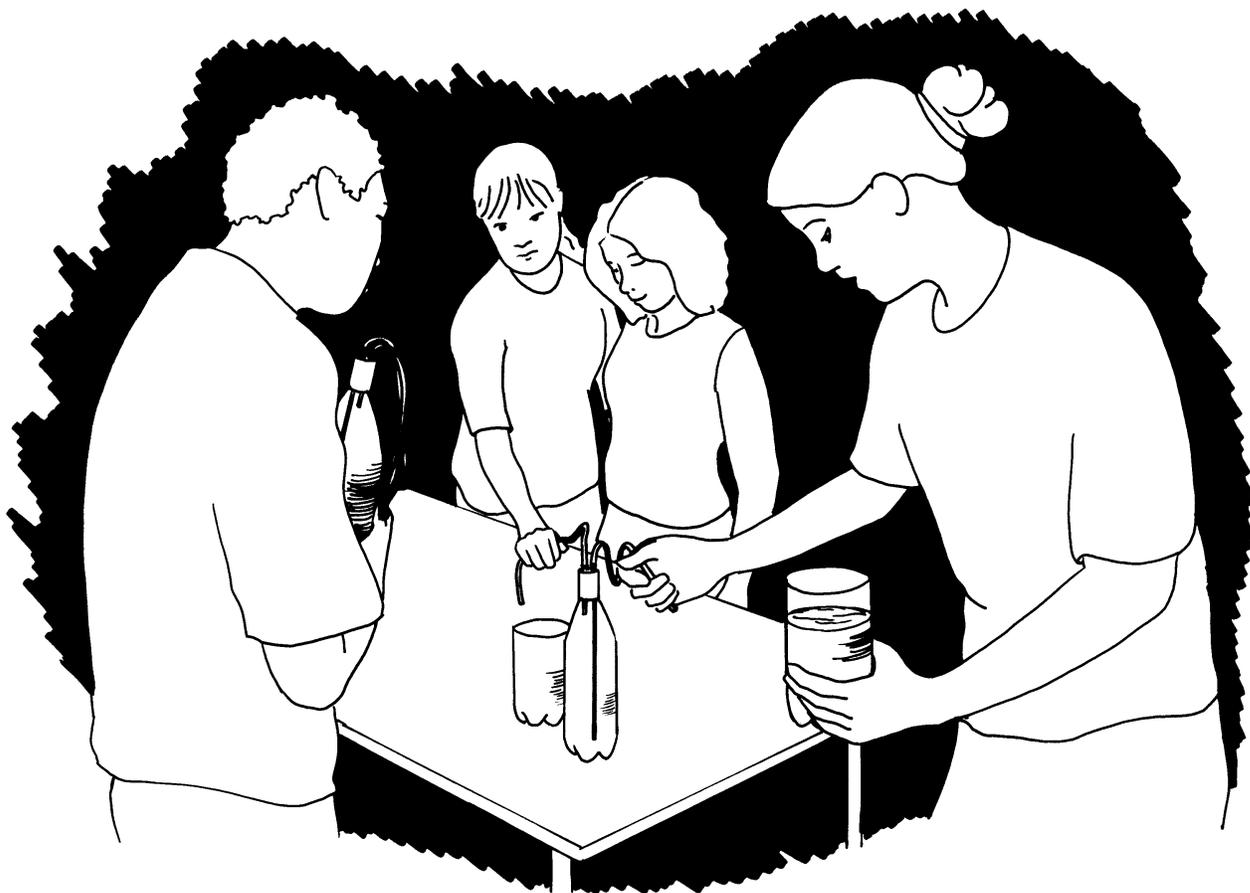


Explore It!

SCIENCE INVESTIGATIONS
IN OUT-OF-SCHOOL PROGRAMS



Siphon Systems

EDC
CENTER FOR *Science Education*



Siphon Systems

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ONE BOTTLE

EXPLORATION 1

Discovery Questions

How can you get water to move by itself from the open reservoir bottle to the siphon bottle?

How can you get the water to move by itself from the siphon bottle back to the reservoir bottle?

PART 1 Exploring Siphon Bottles

WHAT TO DO

1. Designate 1 member of your team to suck or blow into the tubing to get water to move in and out of the bottle. **Make sure only 1 person is doing this.** How can you get water flowing from the open 2-liter bottle into the siphon bottle with the 2 pieces of tubing?
2. Once the water is coming into the siphon bottle, can you keep it coming in without sucking?
3. Can you get the water to go out of the siphon bottle without blowing?
4. Can you get the water to go into the siphon bottle when it is upside down?

WHAT TO THINK ABOUT

- How can the water flow by itself from one container to another?
- If you start the water flowing into the siphon bottle, will it continue to flow until the siphon bottle is all filled up?

PART 2 More Exploring with Siphon Bottles

WHAT TO DO

Continue to explore the siphon bottle. Here are some ways to find out more about the arrangement. Watch carefully, and write down what you think is happening. After water starts flowing into the siphon bottle, do not suck or squeeze the bottle. What happens to the water levels in the 2 bottles?

ONE BOTTLE

EXPLORATION 1

1. Place the siphon bottle as far below the water reservoir as possible (Figure 2). What happens to the water flow?

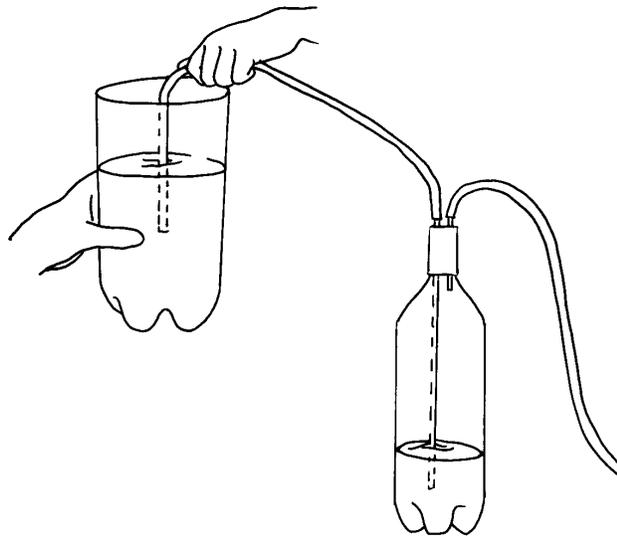


Figure 2
The siphon bottle should be lower than the water reservoir.

2. When the water is flowing into the siphon bottle, put your finger on the end of the other piece of flexible tubing coming from the siphon bottle (Figure 3). What happens?

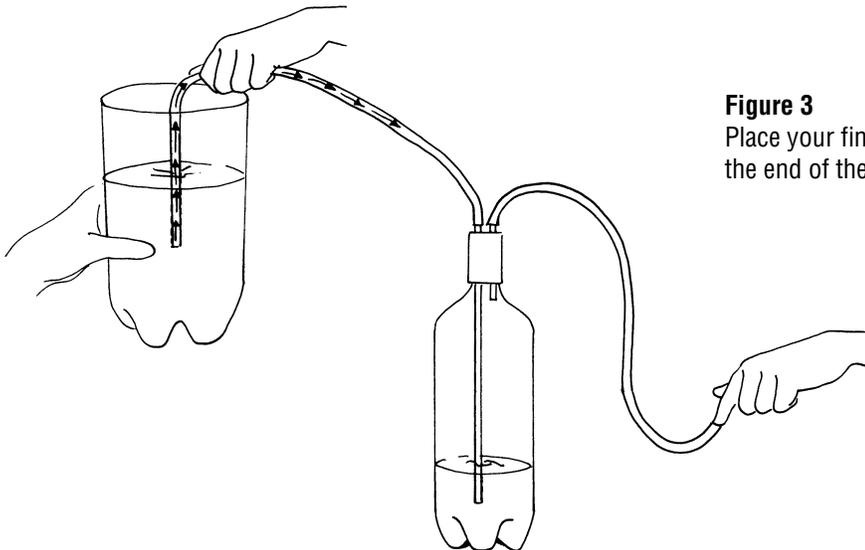


Figure 3
Place your finger on the end of the tubing.

3. When the water is flowing into the siphon bottle, put the second piece of flexible tubing into the water reservoir. What happens? Does the water continue to flow?

WHAT TO THINK ABOUT

- Why does the water in the 2 bottles end up at the same level?
- Is the space inside the siphon bottle completely empty?
- Have you seen other devices that work like a siphon bottle?

ONE BOTTLE

EXPLORATION 1

MATERIALS

For Each Team of 2 students

- 1 special siphon bottle top setup, including:
 - 1 Hero’s Fountain connector set*
 - OR
 - 1 2-holed rubber stopper (size #2)
 - 3 short pieces of rigid plastic tubing that fit snugly into the holes of the stopper (1/4-inch outside diameter [OD])
 - instant or epoxy glue
- 1 1-liter soda bottle
- approximately 5 feet of flexible, transparent tubing that fits snugly onto the rigid hollow tubes of the Hero’s Fountain connector or rubber stopper (5/16-inch inner diameter [ID] x 7/16-inch OD, with a 1/16-inch wall)*
- 1 2-liter soda bottle with top cut off, to be used as a water reservoir
- 2 rubber bands that fit around the empty 1-liter and 2-liter soda bottles
- 1 tray* (cat litter box or aluminum turkey-roasting pan)
- 1 Explorers’ Sheet

Shared

- several large sponges
- newspaper
- 1 sponge mop
- several large buckets (if a sink is not available)

For the Program Leader

- dishwashing soap
- 1 1-liter soda bottle, with siphon top (Hero’s Fountain connector or rubber stopper with rigid tubes) and flexible tubing
- 2 2-liter soda bottles with tops cut off, to be used as water reservoirs
- 2 rubber bands that fit around empty 1-liter and 2-liter soda bottles

**Additional information is available under Special Notes About Materials (page xv) for those materials noted with an asterisk.*

ONE BOTTLE

EXPLORATION 1

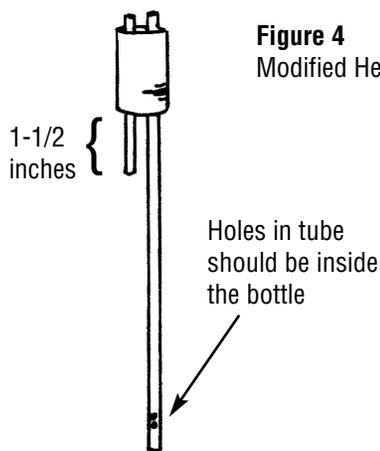
PREPARING FOR THE EXPLORATION

- Make siphon arrangements for each team. Directions follow.

Using a Hero's Fountain Connector for the Siphon Bottle Top

You will need to modify the Hero's Fountain connector to make it more suitable for all the explorations. (If you are unable to obtain Hero's Fountain connectors, you can use two-holed rubber stoppers; see Using a Rubber Stopper for the Siphon Bottle Top).

1. As the package shows, the two long rigid tubes need to be slid through the two holes in the connector. Before you carry out this operation, cut one of the tubes so that it is only three inches long (measuring from the end that does not have any holes).
2. Slide this 3-inch section of rigid tube into one of the holes of the Hero's Fountain connector until there is about 1-1/2 inches showing at the bottom end of the connector.
3. Slide the other (uncut) rigid tube into the second hole in the connector (Figure 4). Be sure to place the end of the tube that has holes in it inside the bottle.



NOTE: Do not cut the tubes of all your Hero's Fountain connector sets. Leave at least one set unmodified so that you can use it for the fountain demonstration in Exploration 6. Also, make sure to hold onto the caps to the 1-liter bottles for use in Exploration 5.

4. When using the Hero's Fountain connector, it is strongly recommended that you glue the two rigid tubes in place to close up any air holes between the tubing and the connector. The caps vary in width; some have holes that result in air easily getting by the rigid tubing. You can use either instant or epoxy glue to seal up air holes. Both types of glue should be used with great care.

ONE BOTTLE

EXPLORATION 1

- Instant glue can be dropped into the area around the tubing in the hole. Add enough glue so that the whole joint is covered. Be very careful that the glue does not get on your fingers, other parts of your body, or your clothing. Read the package directions thoroughly.
 - Epoxy glue is made by mixing two tubes of ingredients together. As you place it around the joint, be careful to keep this glue off your skin and clothing. Again, read the package directions carefully.
5. Cut the flexible tubing into two 2-1/2-foot segments and one 2-1/2-inch segment. After the glue has dried, insert the rigid tubing of the Hero's Fountain connector into these pieces of flexible tubing. Insert the small piece of flexible tubing over the end of the long piece of rigid tubing that will go inside the soda bottle. This addition will extend the long tube to near the bottom of the bottle. Screw the Hero's Fountain connector tightly onto the 1-liter bottle.

NOTE: When inserting this piece of tubing over the rigid tube, make sure to cover the holes at the end of the rigid tube (Figure 5).

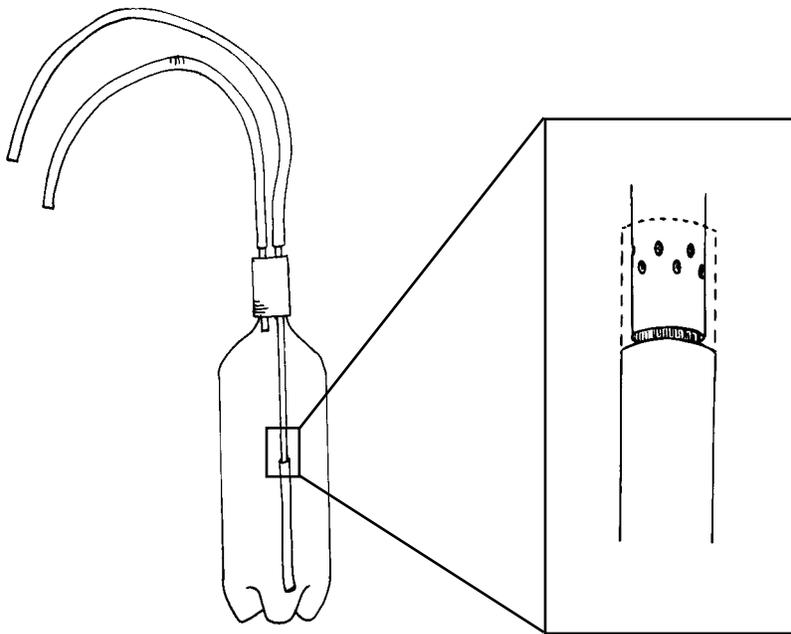


Figure 5

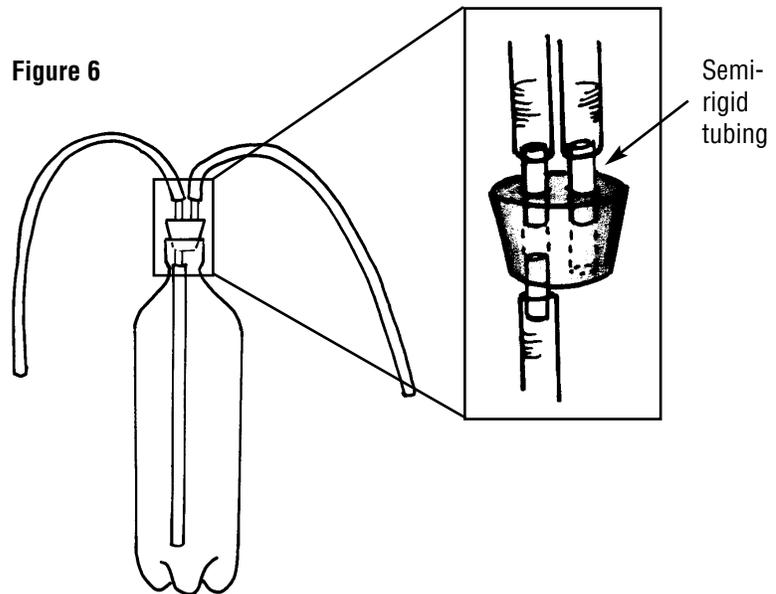
Extend the tubing inside the bottle, being sure to cover the holes on the bottom of the rigid tubing.

ONE BOTTLE

EXPLORATION 1

Using a Rubber Stopper for the Siphon Bottle Top

1. Insert three one-inch long pieces of rigid tubing segments into the stopper. One hole should have a rigid tube extending from the top and from the bottom of the stopper. The second hole should only have a tube extending out the top.
2. Cut the flexible tubing into two 2-foot segments and one 10-inch segment. Attach these three pieces of flexible tubing to the three pieces of rigid tubing in the rubber stopper (Figure 6, inset). The short piece (approx. 10 inches) should be placed on the tube sticking out the bottom of the stopper. When the stopper is placed on the 1-liter bottle, this tube should be inside the bottle and reach as close to the bottom as can be managed.



- Cut the tops off the 2-liter soda bottles (Figure 7) so they can be used as water reservoirs.
- Place the bottle arrangements and trays or newspaper in a central location that children can reach easily.

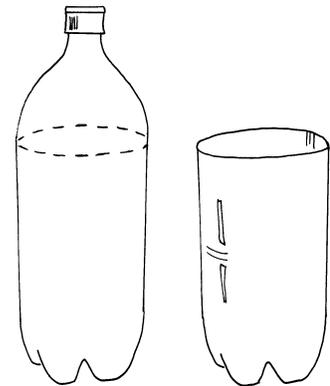


Figure 7
Cut the tops off the 2-liter bottles, as shown.

ONE BOTTLE

EXPLORATION 1

- Practice getting water to move back and forth between the reservoir and the siphon bottle. Carefully read the Exploratory Demonstration and practice it. Observe what happens and think about the questions you will ask during this section.
- If you do not have ready access to a sink when doing the explorations, have extra containers ready. Some should be filled with water, others should be empty so that the children can discard their water in them at the end of the exploration, and one can be used to wash the tubing at the end of the session.
- Children like to help with these kinds of preparations. So, set up a system for them to collect water at the beginning of each session and assign one or two to wash the tubing at the end of the session. Also, have children store their siphon bottles in such a way that they can air dry before the next session.
- Establish a routine for cleaning up. See notes under Space and Storage on page xii. Keep the following in mind:
 - Big sponges can pick up spilled water on tables.
 - A sponge mop can pick up water on the floor. Some children like to use the mop, so you can assign the task of mopping the floor to one child during each session.
 - Alternatively, you can put several sheets of newspaper under each tray. Any stray water can be absorbed by these sheets, making the final cleanup a little easier.
- Make one copy of the Explorers' Sheet for each team. However, wait to pass them out until after you have explained the task at hand.



SAFETY: Be sure to carefully wash the ends of all the tubing, where children will be placing their mouths. For each exploration, you should set up a container of dishwashing soap solution. Dip the ends of the tubing in this solution. Scrub the ends, rinse, and let dry. Even if you use mouthpieces, which can be stuck into the ends of the flexible tubing, you should still wash the mouthpieces and the flexible tubing at the end of each session.

NOTE: Some of the materials used in this exploration can be recycled for use in later explorations.

ONE BOTTLE

EXPLORATION 1

PART 1

INTRODUCING THE EXPLORATION

One way to begin the “Siphon Systems” project is to ask children what they know about how water gets to their houses. Where does the water come from, and how does it get to all the houses in a city or housing development? Then ask them: How is the water distributed among and through the houses?

After they have offered some ideas, show them the following pictures (Figures 8 and 9). Then remind them that water has pressure when it flows out of the spigot inside the house. This happens even for water on the second or third floor of a house or apartment building, as well as in very tall buildings. Why does water still come out of spigots with some pressure on higher floors?

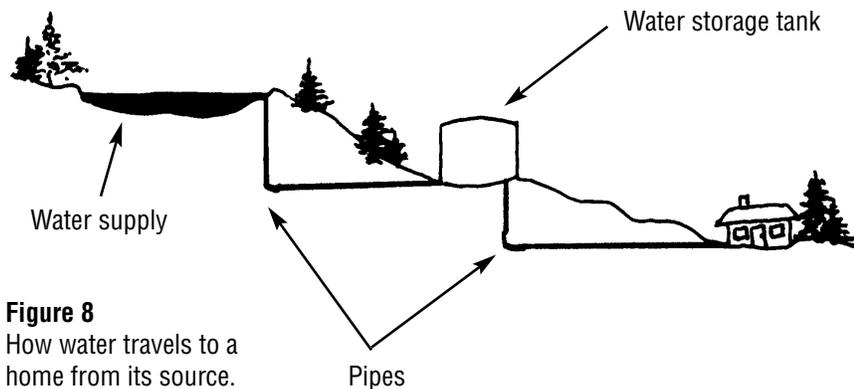
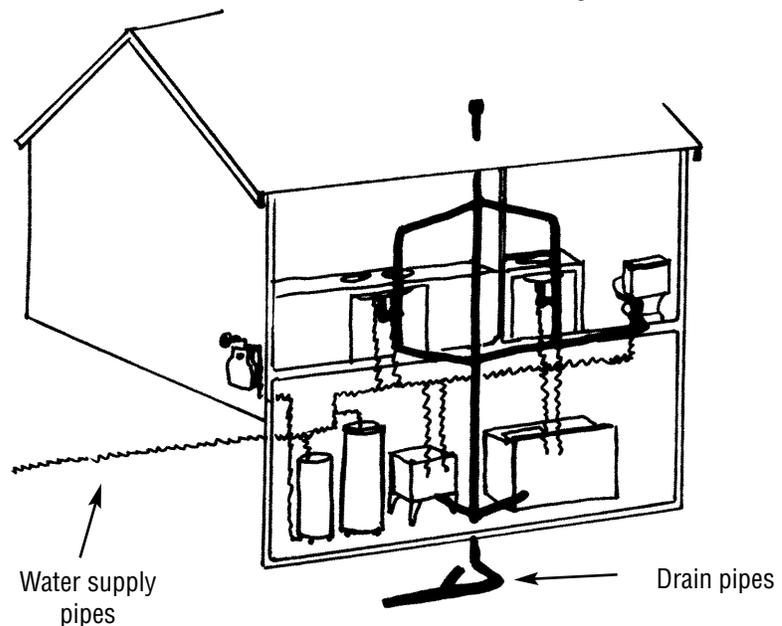


Figure 8
How water travels to a home from its source.

Figure 9
How water travels throughout a home.



ONE BOTTLE

EXPLORATION 1

Accept any explanations children offer. Tell them that they are going to be exploring how water moves through a much smaller system of tubes and bottles. This can help them understand that water has pressure when it comes out of the spigot. They will return to this question after a few explorations to see whether they can better answer it.

To introduce the siphon bottles, start by asking if anyone has ever attempted to get a liquid from one container to another, such as in changing the water of a fish aquarium. Ask what they had to do to get the liquid moving through the tube and to keep it flowing.

Show them the equipment they will be using:

- The modified 2-liter soda bottle, filled almost to the top with water and sitting in a tray.
- The siphon bottle with the siphon top and the tubing outside the bottle. Point out that one tube goes down nearly to the bottom of the bottle while the other ends just pass the siphon top.
- Point out that trays are being provided. These are to catch any accidental spillage that might happen. Therefore, they should always keep the bottle inside the tray or above the tray.

Explain that this arrangement allows for many different kinds of explorations. For now, it will be used to move water from one container to another. For this first exploration, children must figure out how to get water to flow in and out of the bottles. Refer to the Discovery Questions on the Explorers' Sheet. Can they get water to flow in and out of the bottle by itself?

Arrange children in teams of two (or three at the most).¹

One person should be designated as the one who will suck or blow into the tubing. The other team member should not be doing this during this session. When one child is sucking or blowing, the other can assist by holding both bottles, especially the one containing the water. This person can suggest to the other what kind of actions to perform with the tubing.² This person will have a chance to do the sucking or blowing at the next session. Tell all the teams that they will take turns acting as the sucker or blower from one session to the next.

LEADING THE EXPLORATION

To keep some order while getting started, have all the teams sit down. Tell one person from each team to come to the main supply station to get the special siphon bottle and the tray or sheets of newspaper. Then tell the second person on each team to fill the 2-liter soda bottle almost to the top with water. (To facilitate this process, you can have the children fill these bottles before the session.)

Let the children try all the ways they can think of for getting the water to come into the empty bottle. Most likely, they will suck on

¹ Forming teams of more than two children in this first exploration may lead to problems. In this kind of exploration, everyone wants to be sucking or blowing and handling the equipment. With only one siphon bottle, there are only enough tasks to be carried out by two children. The larger the team, the more likely it is that children will lose interest, because they will be merely observers.

² Emphasize that the person not doing the sucking, blowing, or other manipulations also performs a very important function. He or she should be watching what happens to the water in both bottles. This child can make sure the tubing does not slip out of the water reservoir and can also change the height of the reservoir. Making sure all parts of the siphon bottle are working correctly will allow the investigations to proceed as planned, thereby helping both children gain a better understanding of what is going on.

ONE BOTTLE

EXPLORATION 1

GUIDING THE EXPLORATION

one of the ends of the tubing and pull water into the bottle. They may start doing this with the wrong tubing and end up with water in their mouths. Children should *not* swallow this water; nor should they spit it back into the bottle. Instead, have them spit it into the sink or a bucket designated for that purpose.

Let the children play around for a while, sending the water back and forth by sucking and blowing. They may have a tendency to suck too hard and collapse the 1-liter bottle. Tell them to try not to suck with too much force, because it will result in permanent dents in the bottle, which are very hard to remove. If they continue to dent the bottle, it will have to be replaced.

Some teams may manage to get water flowing into the siphon bottle by squeezing the 1-liter bottle. Here, also, tell them to take care not to permanently crush the 1-liter bottle.

When they have moved water in and out of the bottle several times, tell them that there is a way to get the water to flow by itself after sucking on the tube and just barely starting the water flow. Can they maneuver the bottles to get this to happen? (This can be done by lowering the siphon bottle in relation to the water reservoir. Do not show them this technique until they have made some attempts to discover it on their own.)

To keep track of the water level in the two bottles, they can place a rubber band around each bottle at the level of the water, before they attempt to move the water back and forth.

After they have had ample time to work with the siphon bottle, and depending on the teams' progress and level of interest, challenge them to see whether they can get water into the siphon bottle when it is upside down.

Cleanup Routine for Every Session

At the end of the session, tell everyone to stop their investigations. Introduce the following routine for cleaning up the area.

1. One person on each team should drain any water from the 1-liter siphon bottle into the water reservoir (2-liter bottle with top cut off).
2. The other team member should carefully carry the tray and the 2-liter bottle to a sink or bucket to dump the water out.
3. The team member not carrying the tray should unscrew the siphon top from the 1-liter siphon bottle and take the tubing to the container filled with soapy water. He or she should drop the tubing into the soapy water (to be washed by you or a designated child) and then put the 1-liter bottle at a designated spot.

While children are cleaning up, get ready for a discussion. In a tray or on sheets of newspaper, set up one siphon bottle and two 2-liter bottles with the tops cut off and two large rubber bands. Fill one of the 2-liter bottles with water.

ONE BOTTLE

EXPLORATION 1

LEADING THE DISCUSSION

Tell the children to gather quietly around the siphon bottle setup so they can all see the bottles. After they have settled down, review the exploration, mentioning that it appears sucking and blowing is one way to get water to go into and out of the siphon bottle. If some children discovered that holding the siphon bottle lower than the water reservoir got water flowing into the siphon bottle without sucking, call on those teams to report on this operation. Then carry out the following Exploratory Demonstration.

Exploratory Demonstration

One Kind of Mystery Occurrence

1. Ask children: In your investigations, did you notice whether all the water went from the 2-liter bottle into the siphon bottle? What usually seemed to happen?
2. Place a rubber band around each bottle to help show how the water level changes (Figure 10).

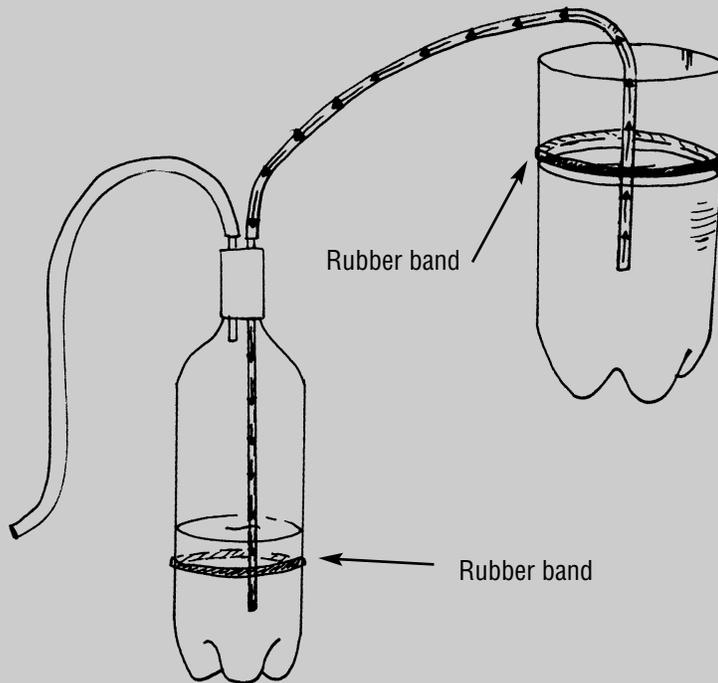


Figure 10

Put a rubber band around each bottle to keep track of changing water levels.

ONE BOTTLE

EXPLORATION 1

GUIDING THE EXPLORATION

3. Start water going into the siphon bottle, either by sucking or by squeezing the 1-liter bottle.
4. Just get it started; do not continue to suck or squeeze the bottle. Adjust the rubber bands so that they line up with where the water levels are as you stop sucking. Make sure that all the water is transferring from the 2-liter bottle to the 1-liter bottle.
5. Then ask the children what will happen next. Will all the water from the 2-liter bottle flow into the siphon bottle?
6. As you wait, have some children come close and report to the whole group what they observe. The water levels in both bottles should be changing. After a while, the water levels should be very close or the same in the two bottles. Ask the group why the water has stopped flowing and why it stopped at those particular levels. Accept any explanations. The goal at this point is to get them (1) to realize that this happens and (2) to think about why it is happening.

Children will puzzle over this discovery throughout the remaining explorations. At this time, it is also useful to point out necessary conditions or discoveries that they should keep in mind each time they want to start water moving back and forth.

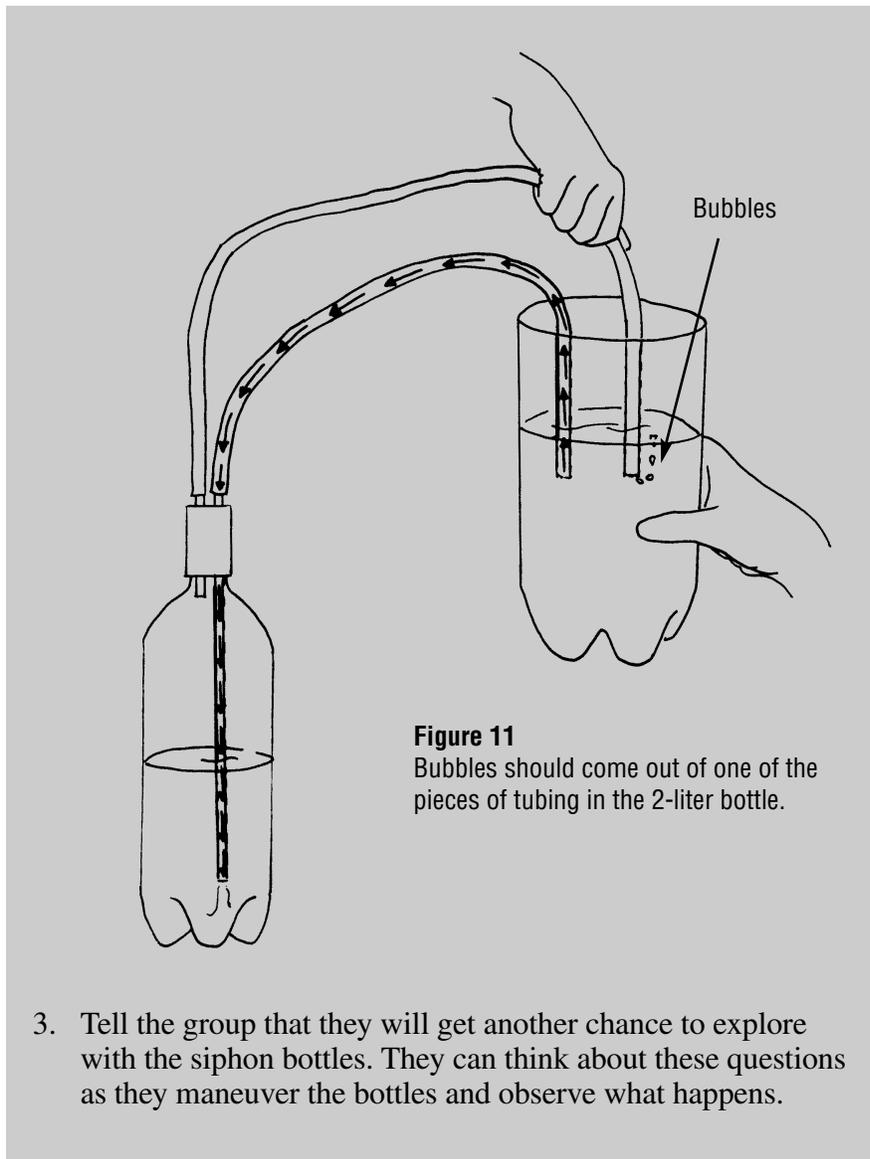
Another Kind of Mysterious Occurrence

1. Empty the siphon bottle of water. Start water flowing again from the 2-liter bottle. Then ask the group what will happen if you place your finger on the end of the other piece of flexible tubing that is not transferring water. If you have made a good seal with glue around the two pieces of rigid tubing where they enter the siphon top, the water will stop flowing into the siphon bottle. Ask the group why this might be happening. Accept any explanations, but, at this point, let it remain an open question.
2. Start over again with an empty siphon bottle. Start water flowing into the siphon bottle from the 2-liter water reservoir. Place the other flexible tube into the water reservoir, holding the tubing so that the end is only 1 or 2 inches below the water surface.

Air bubbles should come out (Figure 11). Ask the whole group why they think this is happening. Then place the end of the air tubing down to the bottom of the 2-liter bottle. (Water may stop flowing into the siphon bottle.)

ONE BOTTLE

EXPLORATION 1



PART 2

To give children time to explore, this part could take place in a separate session.

INTRODUCING THE EXPLORATION

Review what happened in Part 1 of this exploration. Have the children recall the questions that came up during the demonstration and some of the answers they presented. Tell them that they can play with the bottles and see whether they can arrive at some better answers to the questions you introduced at the end of Part 1.

ONE BOTTLE

EXPLORATION 1

GUIDING THE EXPLORATION

Review the questions on Part 2 of the Explorers' Sheet under What to Do. These are the same questions brought up in the demonstration. Tell the children that they can play around with the heights of the bottles and the different ways they can bend the tubing to see what happens to the flow of the water. The goal is to better understand what is happening with the system.

LEADING THE EXPLORATION

Check in with each team to see whether they are being systematic about the explorations. Are they taking time to watch what is happening to the flow of water into or out of the siphon bottle? Or are they just randomly sucking or blowing on the tubing or moving the bottles?

If they are not taking time to watch what is happening, repeat one of the questions on the Explorers' Sheet and ask them whether they have tried the manipulation outlined there. Encourage each team to use rubber bands on the bottles to keep track of the changing water levels.

When a team is watching the flow, look at the piece of flexible tubing coming from the siphon bottle that does not have water flowing through it. Sometimes there may be some water in it. Point this out. Ask the children whether this other water has any effect on the way the siphon bottle fills up.

Some teams might quickly get water flowing into the siphon bottle and feel that they are finished. Spend a little time with them and encourage them to try alternative ways of moving the water back and forth, such as holding the siphon bottle upside down.

All the teams should try the tasks mentioned in the questions on the Explorers' Sheet. Finding the answers to these questions will help them develop good procedures that are important to follow in subsequent explorations.

Cleanup Routine

Follow the cleanup procedures suggested in Part 1. During cleanup, set up a place where you have one siphon bottle, two reservoirs of water, and a tray to use for the discussion.

LEADING THE DISCUSSION

Ask whether any teams made discoveries that they would like to report to the whole group. Have them come up to the front of the whole group and show what they did and what happened. During reporting, again review each of the questions in Part 2 of the Explorers' Sheet:

1. When there is a big difference in height between the bottles, children should notice that water flows faster between the two containers.

ONE BOTTLE

EXPLORATION 1

2. Putting a finger on the one piece of flexible tubing should stop the flow. However, if there is an air leak somewhere in the system, this may not happen.
3. When both pieces of flexible tubing are in the 2-liter bottle, the water should stop flowing, because air cannot get out of the siphon bottle to allow the water to flow in.

Now that they have had another chance to watch the siphons work, can children find words to explain what they think is happening in this system when water is flowing from one container to another? First, have them discuss this with their partners and with several others near them. Then have them offer their explanations to the whole group.³

In this first exploration, children should begin to develop the habit of reporting what they have discovered and asking any questions they have. Give children the alternative of writing their discoveries and questions on a sheet of chart paper. This makes their questions more public and offers recognition that their contributions are valuable. These sheets can also be referred to as the group moves through each exploration.

³ The purpose of asking children to give explanations at this point is to get them thinking about what they observe and to encourage them to come up with their own questions.

ONE BOTTLE

EXPLORATION 1

RATIONALE

Playing around with water is a highly appealing exploration for most children. Getting water to move from one container to another offers multiple possibilities for investigation using the arrangement suggested here. In this first exploration, the main goal is to allow the children to explore what can be done with a single siphon bottle. Although the arrangement seems simple, the water flow is not readily understandable. What is often forgotten is that air takes up space and exerts pressure. Water also exerts pressure. Because children have most likely never siphoned water before, Part 1 of Exploration 1 is mainly about procedures: What do you do to get the water moving, and how can you keep it going?

Part 2 is about getting children to look closely at what is happening. They may not be able to find the words to explain what they observe, but it is important to get them into the habit of generating questions and attempting to find ways answer them.

Children should figure out two subtle procedures in this exploration that can make a big difference in the results:

- If the siphon top is not screwed on tightly, sucking and blowing to get the water flowing becomes harder. The air just escapes around the cap.
- If the cap is screwed on tightly but there is water in the piece of flexible tubing that is not in the reservoir bottle (Figure 12), it may affect whether the water continues to flow.

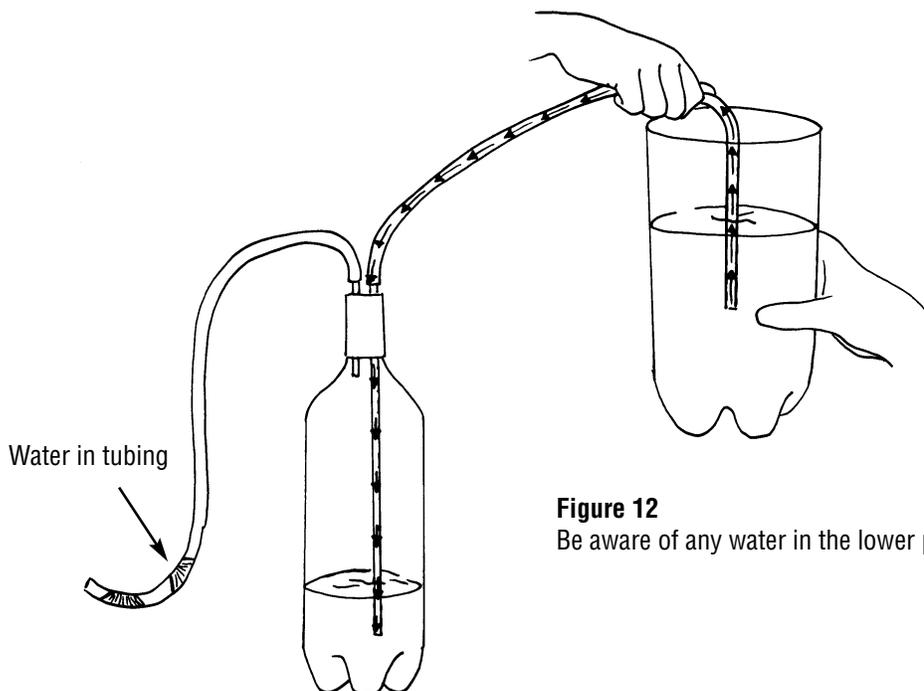


Figure 12

Be aware of any water in the lower piece of tubing.

SCIENCE/TECHNOLOGY BACKGROUND

After this first exploration, try to clarify for children a standard procedure for getting the water flowing from the reservoir bottle. In later explorations, the systems will be more complicated, so children must know, at a minimum, how to get the water flowing into one of the siphon bottles. Here are things they need to know:

ONE BOTTLE

EXPLORATION 1

1. The tubing that goes from the siphon bottle to the water reservoir needs to be completely filled with water (Figure 13), either from squeezing the bottle and letting go or from sucking on the other tubing. With this diameter of tubing, water sometimes trickles into the tubing, not filling it completely. Unless the whole tube is filled with water, the flow will not be continuous.

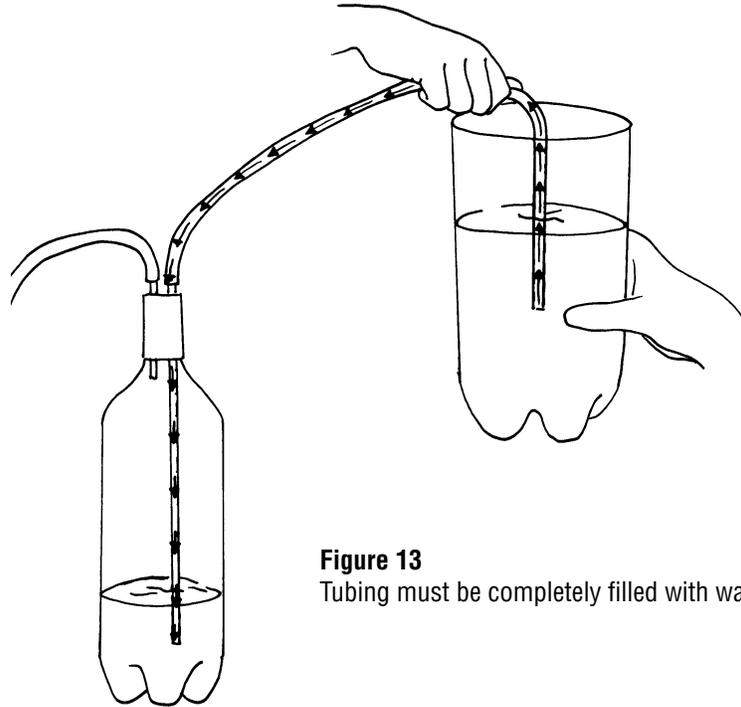


Figure 13
Tubing must be completely filled with water.

2. After the water starts flowing, it will continue until the water levels in the two bottles are equal.
3. Changing the height of either the siphon bottle or the reservoir bottle can change the rate of flow.
4. If there is any water in the other piece of tubing that is not connected to the reservoir bottle, it can affect the flow of water into the siphon bottle. A little bit of water can block the air that must come out of the siphon bottle if water is to flow into the siphon bottle.

The simplest way to siphon water from one container to another is through one tube placed into two containers. To get the water flowing, suck on one end of the tube. Then quickly place this end into another container. To keep the water flowing, the second container should be placed lower than the first container. After the water is flowing continuously, the second container can be put back at the same level as the first. The water will continue to flow until the water levels are even (Figure 14).

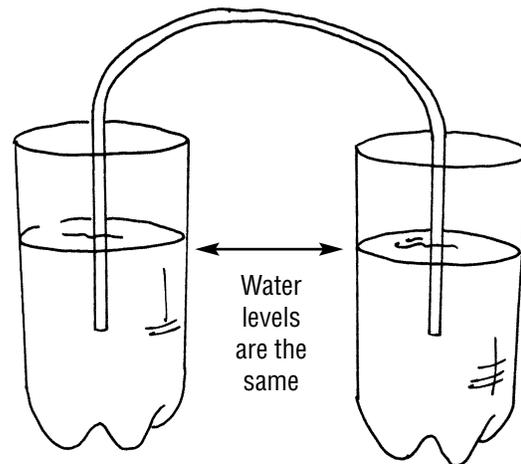


Figure 14
A simple siphon.

ONE BOTTLE

EXPLORATION 1

One advantage of using a siphon bottle instead of this simpler method is that you can suck to start the water flowing without getting liquid in your mouth. However, the major difference between the two systems is that a siphon bottle is a closed system, meaning that when you use it, air has to be pushed out of the bottle for the water to continue to flow (as shown in the demonstration on page 13 [Figure 11]). If you closed off the air-exit tube, water would not flow. Because a simple siphon system is open to the air, however, water can continue to flow easily without air being noticeably removed from the bottle.

As seen in the demonstration, air bubbles will come out of the second piece of flexible tubing if it is immersed in water. And, as you immerse this end deeper and deeper in the water, the flow of water into the siphon bottle slows down or stops completely. This is because there is not enough water pressure from the reservoir part of the system to overcome the increased water pressure pushing on the end of the air-exit tubing. However, if you raise the reservoir bottle higher, you increase the water pressure from the reservoir part of the system and the water can start flowing again.

The fact that water flows from one container to another involves several factors:

- **Water flows only when the water-exit end of the flexible tubing is lower than the water level in the reservoir bottle.** To increase water flow, the water-exit end of the tubing should be moved even lower compared with the water-entrance end of the tubing. This can be done by increasing the vertical distance between the two bottles.
- **The water flow stops when the water levels in the two containers are the same.** You can think of the water in the flexible tubing as a continuous system. Compare the amount of water in the sections of the tubing. The segment of water from Figure 15, A to B is shorter than the segment of water from B to C. The weight of the water in segment B to C is greater than the weight of the water from A to B. Therefore, the water flows from A to C. It is important to know also that water has cohesiveness; it prefers to stay together rather than break apart. This property arises because of the strong mutual attraction of water molecules and helps prevent the segment of water in the tubing from breaking apart.

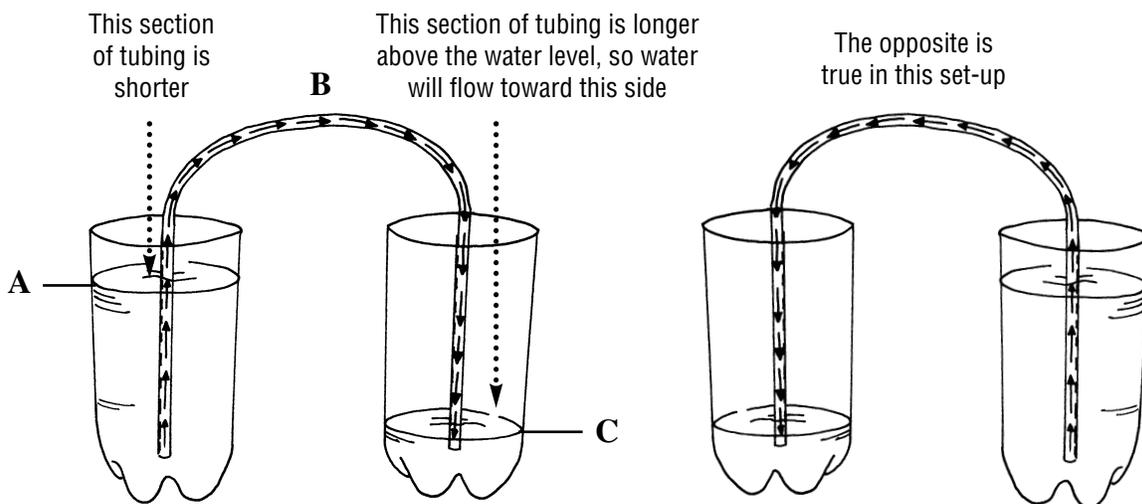


Figure 15

Water is heavier in the longer pieces of tubing, making it flow in a particular direction.

ONE BOTTLE

EXPLORATION 1

The length of water in the shorter side of the tubing cannot overcome the force from the water in the longer side of the tubing. So the water in the longer tubing is heavier and will fall out of the tubing, pulling the water in the tubing with it (and lowering the water in the other container) until the levels are again equal. The water in the shorter segment is “pulled” into the longer tube because of its cohesive force.

- **Blowing into the tubing increases the air pressure inside the siphon bottle.**
This force acts against the water pressure.
- **Sucking on the tubing decreases the air pressure inside the siphon bottle.**
This changes the relationship between the two sections of tubing connecting the water reservoir to the siphon. The column of water in the section of tubing in the reservoir bottle now exerts a greater force compared with the column of water in the section of tubing in the siphon bottle. Water then flows into the siphon bottle.

OBSERVING PROGRESS

Some children are very curious and will spend an extended period of time manipulating the system in a variety of ways. Others may either give up easily after making a few attempts to get the water flowing or, having accomplished this, wait for additional suggestions. You will have to judge to what extent each child needs encouragement, reassurance, or small hints to stay interested in the work.

During Manipulation of Materials

- Do the children pay attention to which tubing they insert into the water reservoir bottle?
- If they find they are not getting the results they expect, do they trace the arrangement of the tubing?
- Do they hold the siphon bottle or the reservoir bottle at different heights to see what will happen?
- Working in a team, even of only two people, can be challenging for some children. Is one member of any team dominating the exploration?

During Discussion

- Do the children point to a specific part of the system to make clear what part they are referring to?
- Are their attempted explanations reasonable, even if they are unscientific? Children should talk about forces acting in the system even if they locate the forces in the wrong place or give them the wrong direction.

In this first exploration, children are just getting acquainted with procedures and with the overall system. Take note of children who are already observing some of the finer details of what is happening in the system, and also get a sense of those who see overwhelmed or confused. Give the latter some attention in the following explorations. Also, use your observation of all children’s skills and comments in this first exploration as a reference point for the progress they make by Exploration 6.