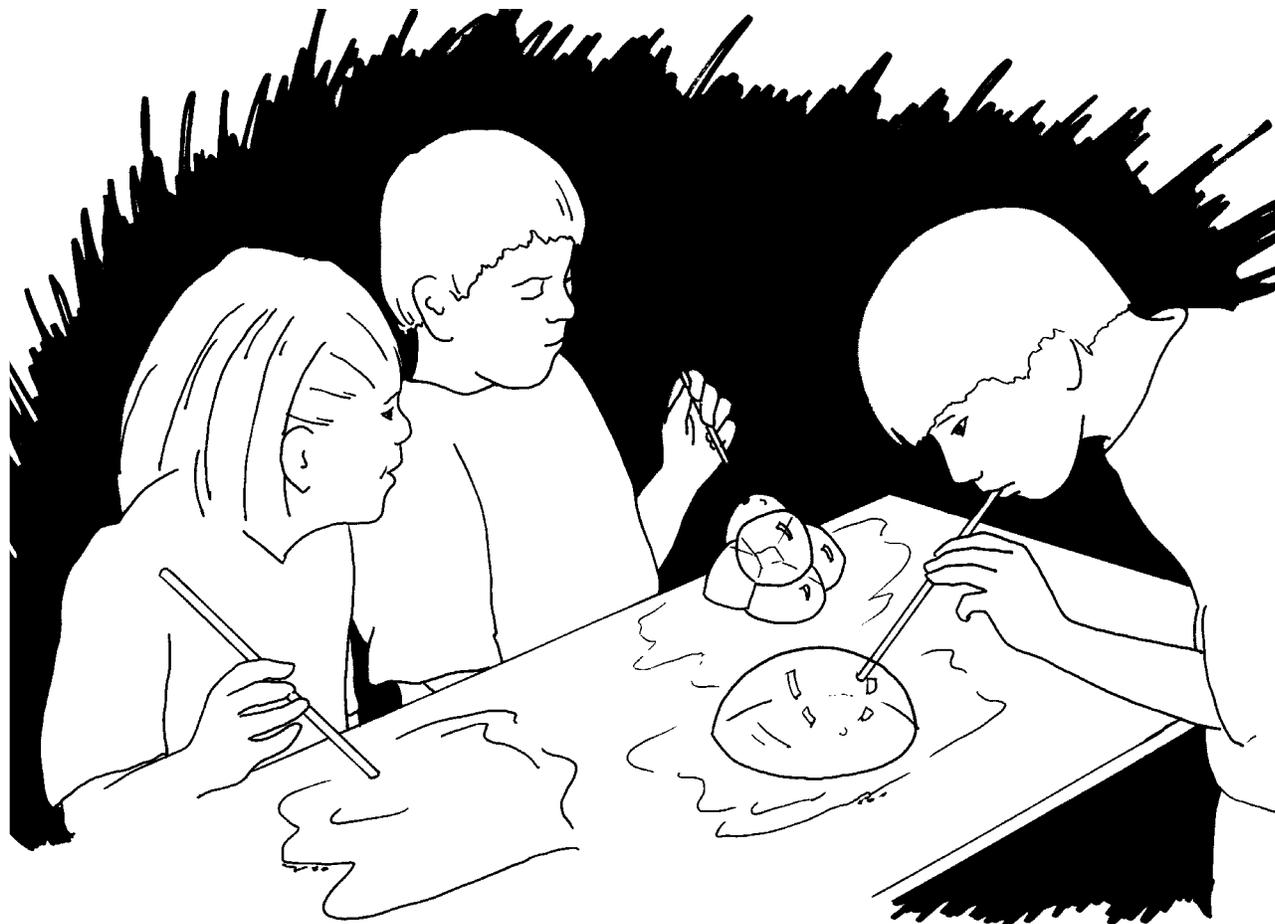


Explore It!

SCIENCE INVESTIGATIONS
IN OUT-OF-SCHOOL PROGRAMS



Bubbles

EDC
CENTER FOR *Science Education*



Bubbles

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BIG FLOATING BUBBLES

EXPLORATION 1

Discovery Question

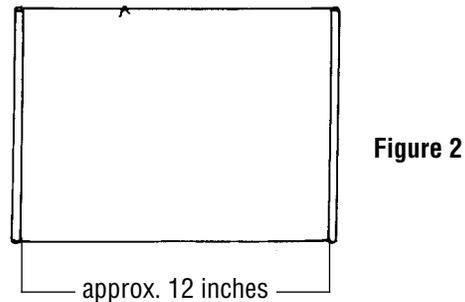
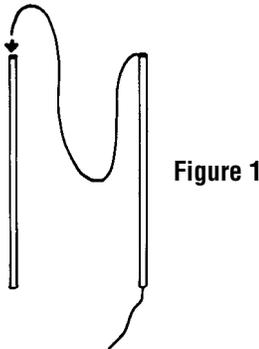
What is the biggest bubble you can launch with a bubble launcher?

WHAT TO DO

Make a bubble launcher:

Put together a bubble launcher out of drinking straws and string. Do not make the string sections longer than 12 inches.

1. Slip the string through both straws (Figure 1).
2. Form a rectangle by tying the two loose ends together (Figure 2).



Launch a bubble:

Try your hand at launching large bubbles with this device.

1. Place the string-and-straw device all the way into the solution. Make sure you get your hands entirely wet with soap solution.
2. Take out the device, holding each straw with one hand (Figure 3).

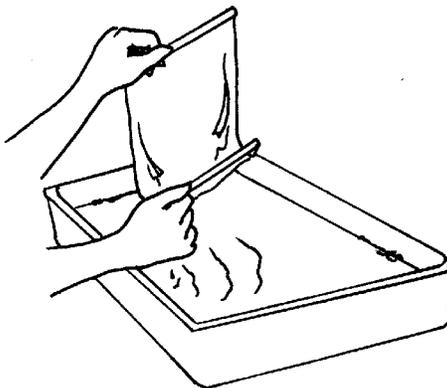


Figure 3

Hold one end higher than the other to let the extra solution drip from the device. Let the device drip a little before raising it to the level just below your waist.

BIG FLOATING BUBBLES

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3. Open it up slowly by pulling the straws away from each other while holding them parallel to the floor (Figure 4, A and B). Move the whole frame up slowly (but not too slowly). You will have to practice to determine what the right speed is to get a large bubble.
4. As you move the frame upward, you get a bulging bubble (Figure 4, C). Close it off by bringing the two straws back together and tilting them and the string away from the bubble so that the bubble peels off of the string (Figure 4, D).

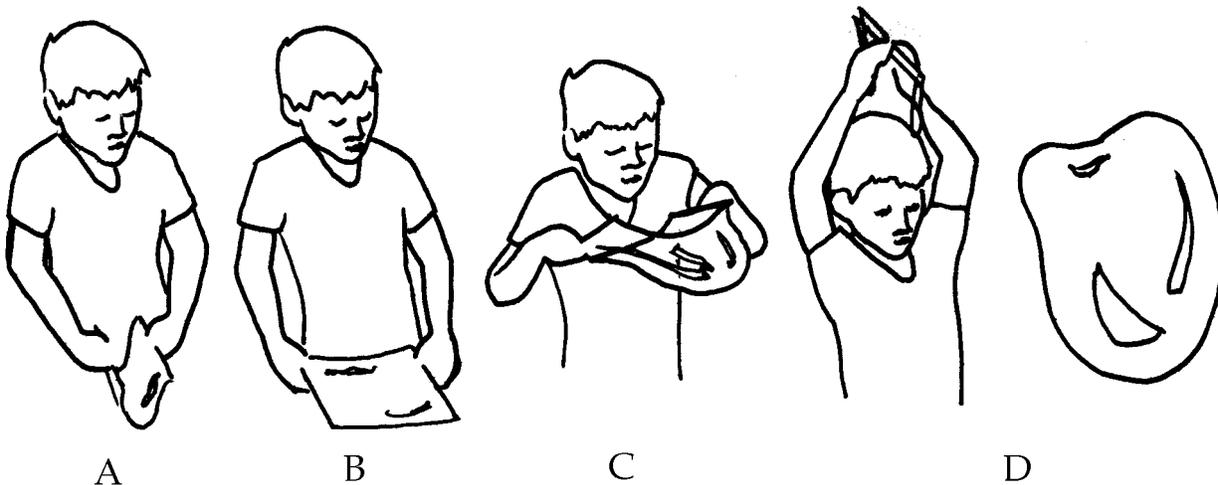


Figure 4
Releasing a bubble.

WHAT TO THINK ABOUT

- What shape are the bubbles when they are first forming on the bubble launcher?
- What shape do the bubbles take when they are free of the frame?
- As the bubbles float around or fall to the ground, do they keep the same shape?
- Is there a limit to the biggest bubble you can make?

BIG FLOATING BUBBLES

EXPLORATION 1

MATERIALS

For Each Team

- 2 drinking straws
- 36 inches of string
- 1 Explorers' Sheet

Shared

- several dipping buckets or trays (preferably flat) (1 per 2 teams)
- several buckets of solution prepared from 3–4 different dishwashing soaps
- yardsticks
- newspapers and/or mops (for cleanup)
- drop cloths for protecting floor (if working indoors)

PREPARING FOR THE EXPLORATION

- Decide where the best place will be to launch the bubbles. If you choose to do it outdoors, make sure there is little or no wind blowing. If there is a wind, find a sheltered area where the wind is not strong.

NOTE: When there is even a gentle wind, it becomes difficult to make complete bubbles and to reach the desired results. If the air blows the soap film too quickly or right after a bubble is launched, the bubbles can become distorted and will often break.

- If you are going to do this activity indoors, find a space large enough for children to launch their bubbles and to observe the shape of the bubbles they make. Areas such as a hallway, cafeteria, or other large room will do.



SAFETY: *Because of the dripping soap film, a large drop cloth can be placed on the floor, but make sure children are careful not to slip and fall down. Having a mop and newspaper handy is helpful for cleaning up the larger spills.*

- Using clean containers, make several soap solutions by placing about 1 cup of liquid dishwashing soap into 1 gallon of water. (If you are making enough solution for several sessions, make sure to follow this basic recipe.)

NOTE: It is important that you use clean containers for making your soap solution. Sometimes residues of other substances remaining on the sides of the bucket can interfere with the effectiveness of the soap.

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- For this first exploration, you will be testing three or four different kinds of soap solutions. Joy and Dawn should definitely be included because they work very well for creating very large bubbles. Although a very inexpensive brand will usually not work as well, you should try one and see if it works. You may even want to try liquid hand soap.



SAFETY: Some kinds of special soap solutions may not be safe to use directly on hands. Check the labels to make sure they can be used safely.

- Following the steps on the Explorers' Sheet, make and practice using a bubble launcher (straw-and-string device). Practicing will allow you to show the children what to do and help them with any obstacles they might face. The most critical step is the final one—the frame *must* be moved away from the forming bubble so the bubble can be released from the launcher. The result is quite exciting and well worth the persistence.
- Make one copy of the Explorers' Sheet for each team. However, wait to pass them out until after you do the Technique Demonstration below.

INTRODUCING THE EXPLORATION

Children will probably have blown bubbles before, possibly even very large bubbles. Ask them to recall these experiences. What do they remember about the bubbles? How big were the bubbles? What shapes were they? What is the biggest bubble they have seen?

Point out that although there are commercial soap solutions for making bubbles, soap solutions around the house can also be used. Do they think that any kind of dishwashing soap can be used to make soap bubbles?

Show the children the three or four soaps that you have used to make solutions. Tell them that they will test the solutions to see if there is a difference. Two teams can share one container of soap solution.

Technique Demonstration

Demonstrate how to launch a big bubble with the string-and-straw bubble launcher using the steps on the Explorers' Sheet. Do this several times, pointing out the critical step of how to release the bubble from the frame. Have one or two children come up and try the procedure. Help by coaching them as they move the frame and release it.

BIG FLOATING BUBBLES

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Now that you have completed the demonstration, ask the children the Discovery Question on the Explorers' Sheet. Then ask them the following to focus their attention:

- What shape do the bubbles take?
- What do you notice about the bottom of the bubbles?

Assign the children to teams of two. Point out that both members will take turns launching the bubbles. While one is launching, the other will observe and coach the launcher, helping that person learn the right technique. This "coach" will also observe the bubbles, making a few sketches of their shapes and any other observations. Have the children decide who will report out during the group discussion.¹

LEADING THE EXPLORATION

Pass out the Explorers' Sheet to each team. Take the whole group outdoors or to the area that you have prepared. Spread out the containers so that there is enough room for each team to move around and launch their bubbles.

Observe how each of the teams launches its bubbles. Some teams will need some coaching to perfect their launching technique. In the beginning, some children may have a tendency to break each other's bubbles. This should be stopped immediately.

After most teams have been able to launch some bubbles, visit each team and make sure that those who are in the role of observer are watching the bubbles closely and sketching what they see. Ask the children to look closely at the bottom of the bubbles. What do they see? Do they notice that some bubbles have solution dripping from the bottom?

Depending on the length of your session, you should allow some time for cleanup, some reporting of what was observed, and a discussion.

If doing this activity indoors, have children wipe up the solution from the tables and floor with newspapers.²

***NOTE:** Make sure children use their hands and not their shoes when cleaning the floor. When newspaper is rubbed against the floor with shoes, the ink tends to be ground into the floor, leaving marks.*

¹ For more information about teamwork, see the *Implementation Guide to Explore It! Projects*.

² Cleaning up indoors for this activity can be chaotic. You will need to establish a routine for how this will happen.

- Assign roles to some children. A few can collect the materials and all the trays/buckets, placing them in one location.
- One or two can hand out sheets of newspaper to the rest of the children for wiping up the solution.
- Two or three can collect the wet newspaper and place it in a barrel.

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When children are describing the shape of the bubbles, encourage them to use their hands and arms to demonstrate what they saw, outlining the different shapes. Also, call upon a few children to draw on a large sheet of chart paper what they observed. These drawings do not have to be very accurate, but should suggest the overall shape of the bubbles.

Try to get the children talking about whether these kinds of bubbles really float. You can point out that although the soap film is very, very thin, it still has some weight. Continue to return to the observation that soap film is dripping from the bottom. When the air currents are strong enough, these bubbles will stay in the air. In fact, you can blow on them to keep them in the air and moving. But, generally, they start to sink to the floor as soon as they are released. This indicates that they are heavier than air.

The Exploratory Demonstration is suggested as a way of drawing attention to an important property of soap film—the tendency of soap film to shrink and pull itself together. This demonstration can help children think beyond the activity they just completed to consider more about the properties of soap film and bubbles.

LEADING THE DISCUSSION

Keep one container of soap solution and a straw-and-string bubble launcher available for use during the discussion. Gather the children together into a large group away from the materials. Ask each team to report what they observed with the bubbles. Record their comments on large sheets of paper. To help with the discussion, you can ask the following questions:

- Which soap solutions gave the best results? (If one solution was made with an inexpensive brand, this answer will be obvious. The other, more expensive solutions may give varying results.)
- What shapes did you see?
- Were any of the bubbles spherical (round) in shape?
- What did the surface of the bubbles look like?
- How did the bubbles move? Did they float and move with the air currents or sink immediately to the ground?
- What did you notice about the bottom of the bubbles?
- What do you think is inside the bubbles when they are fully formed? Are they empty or is there air in the bubbles?
- What did you notice about the bottom of the bubbles?³

Continue to discuss the children's observations of the bottom of the bubbles. Some bubbles have soap solution dripping off the bottom. Ask the children what this tells them about what is happening to the soap film. Is it getting thinner?⁴

If you decided to have the children use several different soap solutions, have them report on what they observed. Generally, the cheaper soap solution will not work. The solutions made from the more expensive soaps will give the best results.

Ask children if they have any questions about the soap bubbles. Record these on a separate large sheet of paper, titled "Questions." Tell them they will come back to these questions in the remaining activities to see if they have come up with some answers. Also, list any discoveries they made that were not covered by the questions already asked.

As a lead-in to the next exploration, challenge the children to come up with a way to make even larger bubbles. Can the string-and-straw bubble launcher be changed or modified so that even larger bubbles are produced? You can take this discussion further by doing the following Exploratory Demonstration.⁵

BIG FLOATING BUBBLES

EXPLORATION 1

Exploratory Demonstration

1. After some discussion about the above observations, show the whole group the string-and-straw bubble launcher.
2. Dip it into the soap solution and pull it out with the two straws next to each other.
3. Move the straws apart to form a vertical rectangle (Figure 5).
4. Ask the children what they think will happen when you move the two straws closer together. What will happen to the two strings?
5. Show them what happens. Both the top and the bottom strings are pulled inward (Figure 6). It makes sense for the top string to sag (because it is heavy with the soap solution), but why does the bottom string pull up? Shouldn't it also sag downward since it is soaked with solution?
6. Dip the device into the soap solution again and make the vertical rectangle. Ask one child to come up to the device. Have the child wet his or her hand and pull on the bottom string and then release it. When the child lets go, the bottom string is pulled upward.
7. Ask the children what they think is happening here. Are there other materials that children have seen that act the same way?
8. Tell them that they will return to this curiosity in the other explorations.

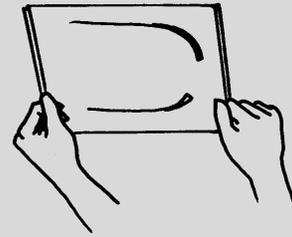


Figure 5

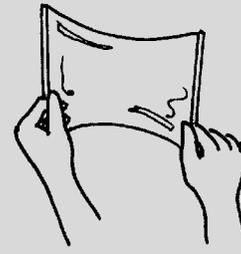


Figure 6

BIG FLOATING BUBBLES

EXPLORATION 1

RATIONALE

Launching soap bubbles with a string-and-straw frame is a very exciting activity. Even if some children have done this before, they will find it irresistible. This exploration provides a beginning to the whole project. It allows children to get their whole bodies involved, and in doing so, gives them a direct sensual feeling for the way soap film shapes arise. The great excitement generated in this exploration can also act as a way of stirring children's curiosity and getting them to wonder about the nature of soap bubbles.

The large bubbles that are obtained from this kind of launching are usually non-spherical in shape. They tend to sag at the bottom and, if a wind is blowing, they get distorted into all kinds of appealing shapes. These shapes are in contrast to the large and small bubble domes the children will make in later explorations, which are almost perfect spheres and hemispheres. So, part of the reason for doing this exploration is for children to see that under some conditions, soap bubbles are not spherical.

It is important for children to begin thinking about what kind of soap solutions are best to use for making soap bubbles. The least expensive dishwashing soaps usually will not work well, if at all. Children need to realize that not all soaps are equal in their effectiveness.

OBSERVING PROGRESS

There are three behaviors to observe that are indicators of how well children are succeeding in this first activity: launching the bubbles, observing the bubbles, and talking about the bubbles.

During Manipulation of Materials

- Did each child reach a point where he or she could successfully launch a big bubble?
- Were there some children who had no success?
- Did children give any attention to bubble properties, reporting on their shapes and the way they moved?

During Discussion

- Did children show the shapes of the balloons with movement of their hands or a quick sketch?
- Did they notice the colors in the soap film and the reflections on the surface?
- Did they come up with their own questions?

FURTHER EXPLORATION

- There are many kinds of dishwashing soaps, hand soaps, and other kinds of soaps that can be purchased in a supermarket. Have children test some of these to see how well they perform.
- Have children think of a way of measuring the stretchiness of soap film. Ask:
 - How much can you stretch soap film?
 - What are the longest shapes you can make before the soap film breaks?