# Giant Bubble Wand

## Introduction

Generate students' excitement by enveloping them inside a giant bubble. The Giant Bubble Wand will make the biggest bubbles you've ever seen—big enough for up to two students.

## Concepts

- Properties of matter
- Qualitative and quantitative observation skills

## Materials

Joy® brand liquid detergent, 2.31 L (2.4 qt.)
Water, distilled, 22.57 L (6 gal.)
Wading pool
Power drill with a flat head (slotted) screwdriver bit
PVC pipe, 3/4″ i.d., 1.5 m
Glycerin, 120 mL (4 oz.)
Hula Hoop®
Hacksaw or hand saw
Milk crate
Giant Bubble Wand Apparatus kit

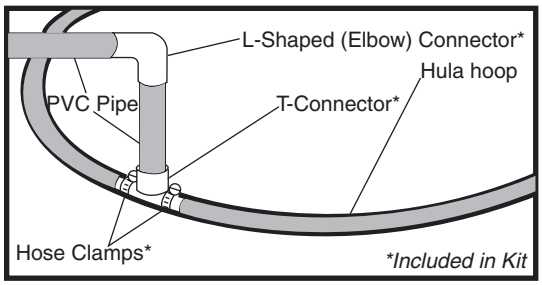
## *Safety Precautions*

*Be certain that students wear goggles when they are in or near the bubble. The soap solution can be irritating to the eyes. Also be sure that the students have help getting on and off the crate. The soap solution will make the area very slippery. When preparing solutions, always wear chemical splash goggles.*

## Preparation

### To build the bubble wand

First, measure and cut the PVC pipe into two pieces, one 15 cm long and the other 135 cm long. Connect the two pieces with the L-shaped connector. Secure the Hula Hoop to the T-shaped connector with the hose clamps. You will have to unscrew the hose clamps completely in order to get them around the Hula Hoop. Tighten the screws firmly with the flat head screwdriver.




Finally, attach the T-connector to the 15 cm long PVC piping and your bubble wand is complete.

### To prepare the bubble solution

Set up the wading pool in the center of the classroom. Cover the floor under and around the wading pool with newspaper (the more paper the better). The soap solution can make tile floors very slippery.

Now pour 22.57 liters of distilled water, 2.31 liters of Joy® and 120 mL of glycerin into the wading pool. Stir gently with the bubble wand. Avoid forming suds as you stir, they will interfere with the soap film's longevity. Allow the soap solution to settle for at least one hour.



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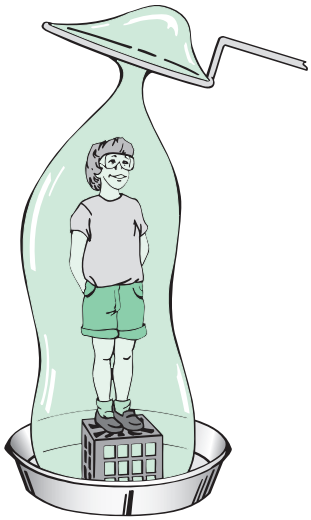
## Procedure



1. Place the milk crate in the center of the wading pool.
2. Place the bubble wand into the solution, surrounding the milk crate.
3. Ask for a student volunteer and have the student put on a pair of goggles.
4. With the help of another student, the volunteer should step onto the milk crate that is in the wading pool.
5. Now, carefully lift the bubble wand up and out of the solution until it is 30 to 40 cm above the student's head. Be careful not to allow the bubble to touch the student (the bubble will pop).
6. To produce a two-person bubble, ask a second student to stand 30 cm from the wading pool, on the newspaper. Then pull the bubble up and over the second student in the shape of an inverted U. Be sure to clear the first student's head by 60 to 80 cm.

## Disposal

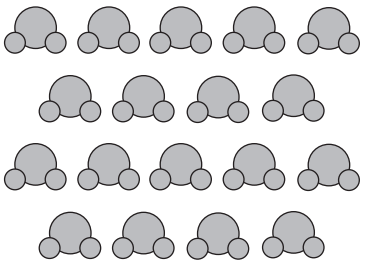
Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Pour soap solution down the drain according to Flinn Suggested Disposal Method #26b.

## Tips

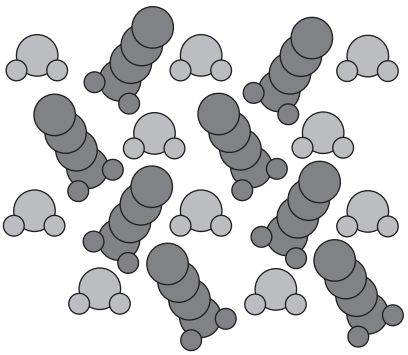
- Give each student a turn to be inside a bubble. The other students should be making observations, both quantitative and qualitative. Use the sample data table on the following page.
- Designate the student who will be in the bubble next as the measurer. This student should measure the height and diameter of each bubble for the class to record.
- Designate the student that was just inside the bubble as the timekeeper. This student will record the length of time elapsed before the bubble collapses.
- You may want your students to prepare the bubble solution on the day prior to the demonstration. To do this, divide the class into lab groups and instruct each group to prepare a portion of the bubble solution. As an example, if you divide your class into 10 lab groups, each lab group would prepare 2.5 liters of bubble solution.
- As the students collect data, they will learn that the larger the bubble, the shorter the time it will last. Ask your students to graph the product of height times diameter ($h \times d$) versus time (t). See the sample graph on the following page.
- Discuss the difference between ***qualitative*** observations such as "The bubble is blue and red" and ***quantitative*** observations such as "The bubble is 160 cm tall." Students should learn that both types of observations are very important.

## Discussion

Your students have seen bubbles hundreds of times but they may want to know what a bubble is and how and why a bubble is formed. A soap bubble is gas enclosed by a thin film of soap solution. It is usually formed when air is forced through a thick film of soap solution.



Water molecules have strong attractive forces for each other.



Detergent molecules seperate the water molecules and reduce the attractive forces between them.

The soap solution is made from detergent and water. The detergent separates the water molecules which have strong attractive forces for each other, thereby reducing the surface tension of the liquid. The lower surface tension allows the liquid to form a thin film. The detergent also lowers the evaporation rate of the liquid; evaporation being one of the arch enemies of the bubble.

The relationship between the surface tension and bubble formation can be understood with the help of an analogy. A plastic sandwich bag and a balloon behave differently when air is forced into each one. The sandwich bag consists of material that is

very inelastic. When air is forced into the bag, it inflates until the bag is full, then it pops. The balloon consists of material that is very elastic. When air is forced into the balloon, it fills with air then stretches into a much larger size. In a similar way, water's high surface tension does not allow it to stretch into a film until the detergent is added to reduce the surface tension and make it more elastic. Without the detergent the water would behave more like the plastic bag.

## Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

***Unifying Concepts and Process: Grades K–12***
Evidence, models, and exploration
***Content Standards: Grades 5–8***
Content Standard B: Physical Science, properties and changes of properties in matter.
***Content Standards: Grades 9–12***
Content Standard B: Physical Science, structure and properties of matter.

## Acknowledgement

Special thanks to Mike I. Shaw and Greg F. Smith of Chestnut Grove Middle School in King, North Carolina for this idea.

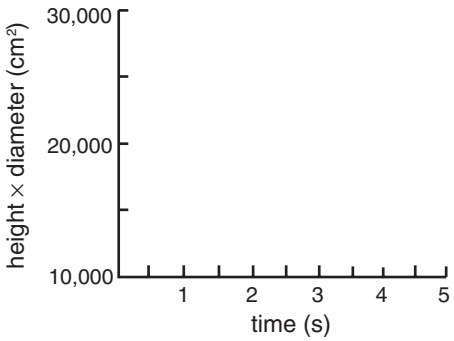
## Reference

Shaw, M. I. and Smith, G. F. ***Science and Children***. 1995, ***33*** (1), 24–27.
Cassidy, J. ***The Unbelievable Bubble Book;*** Kultz: Palo Alto, CA, 1987; pp 43–53.

## Sample Data Table

| Student | Height (cm) | Diameter (cm) | Time (s) | Color | Shape |
|---|---|---|---|---|---|
| Genna | | | | | |
| Andrew | | | | | |
| Stephanie | | | | | |
| Jacob | | | | | |
| Tawanna | | | | | |

## Sample Graph




## Materials for the *Giant Bubble Wand* are available from Flinn Scientific, Inc.

| Catalog No. | Description |
|---|---|
| AP9304 | Giant Bubble Wand Kit |

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.