



Lesson Plan
Revised 6/00

Lesson #3 Bubble-ology Grade Level: K-2

Teachers, this is a basic lesson plan that you may modify at your discretion.

Modifications to video: There have been several changes to the lesson plan since the video was made. This lesson plan reflects the latest changes made as a result of suggestions from teachers who have presented the lesson during the daytime program. Please continue to send us your ideas!

Overall educational objective: Students will know the characteristics of bubbles and be able to identify a sphere.

Associated Standard and CORE objective:

- 3010-0101 Observe the characteristics of air.
- 5000-0901 Describe, model, draw, and classify shapes.
- 5000-0902 Investigate and predict the results of combining, subdividing, and changing shapes.
- 5000-0905 Recognize and appreciate geometry in the world.

Materials list:

- dish detergent (Dawn)
- 2 - wash tubs (to fill with soap and water solution)
- 1 each - PVC square, circle, triangle, rectangle (2D)
- 1 each - PVC triangle pyramid, rectangular prism, cube (3D)
- 1 - circular bubble maker with divider string
- 1 - skein of string
- straws & pipe cleaners
- 2 - 8' x 10' tarps
- 1 - tennis ball
- 1 - cube

Teacher Provides:

Rubber gloves, if desired

Lesson activities:

1. Discuss how bubbles are made and popped. Give reasoning.

2. Demonstrate the different, **simple** PVC shapes as bubble makers. Have the students predict what shape the bubble will be each time. Explain at the end that the bubbles will always be spheres because the soap film wants to be as small as possible.
3. As shown in the video, use the circular maker with string; stretch the soap film by pulling the string. Release and show how the film always tries to get smaller. Make a straw/string rectangular blower to demonstrate surface tension.
4. Demonstrate the **complex** PVC shapes and discuss basic shapes.
5. Hands-on activities for each student:
Activity #1 - Cut a 3 1/2 foot length of string; thread the string through two straws; tie a knot in the string, forming a loop; slide the knot into the straw; have the students place their bubble blowers into the soap and water solution to make bubbles. If preferable, make smaller versions with shorter string and straws cut in half.
Activity #2 - Use the pipe cleaners and straws to create different shapes. Thread the pipe cleaners through the straws; twist the pipe cleaner ends together; add the desired number of sides and continue twisting to make the final shape; use scissors to cut off the excess pipe cleaner ends. These constructions can be used to show how sides share surface area, as the students place their shapes into the soap and water solution to form bubbles.
6. Allow time for clean-up. Please clean the soap off the tarps, and if the tarps are saturated, let the Jr. Engineering Rep know. At the end of the day put the materials in module box, list any missing items, tape list to outside of box.

Definition:

Membrane - the “skin” of the bubble: the soap film

Safety precautions: Use caution on behalf of students with allergies or other breathing problems as they may react to the strong smell of the dishwashing liquid. Don’t let the children drink the soap solution or rub their eyes with wet soapy hands. Spread the tarp out to keep water off of the floor.

Teacher tips:

1. Discuss the relationships between the following, using PVC shapes and a tennis ball and cube: circle-sphere, square-cube.
2. Soap films always try to become smaller; they want to be as small as they can. Spheres are the smallest way of holding all the air. The film pushes on the air until it cannot push any more.
3. If you wet your fingers before touching the soap films, they will not break.
4. You may want to ask your custodian to leave a mop bucket in your room to clean up spills that happen during the day, and to keep the tarps from getting slippery.

Extension Activity:

Teachers may want to bring some cookie sheets from home and if time allows, pour a small amount of the soap solution (less than half an inch in the bottom of the cookie sheet) into the cookie sheets, and students can use straws to blow bubbles on the surface of the cookie sheet.

Soap solution:

2/3 cup soap concentrate

1 gallon water (room temperature)

It will take 2 gallons of solution per tub.

Reference:

The Sciences v33, May/June '93, p.32-8 "Bubble, Bubble: Jean Taylor and the Mathematics of Minimal Surfaces" The article talks about how a bubble forms an ideal shape, one that will minimize surface area.

Please make your students aware that this lesson relates to the following:

Career Fields: SCIENCE, SOCIAL-HUMANITARIAN, TECHNICAL

Occupations: Architect: Plan and design the construction for houses, apartments, office buildings, factories, and other buildings. They will also plan and design projects such as parks, airports, and highways. They prepare detailed drawings about the scale and structure of the project, the dimensions of all the parts, and the location of the plumbing and heating units.



Education: Bachelor's Degree

Chemist: These scientists search for and put into practical use knowledge of different chemicals and how they react, while trying to create new products or processes. They also investigate the properties, composition, and structure of matter and the laws that govern the combination and reactions of elements.

Education: Bachelor's Degree

Civil Engineer: Plan, design, and oversee the construction and maintenance of roads, railroads, airports, bridges, harbors, channels, dams, irrigation projects, pipelines, power plants, and water supply and sewage systems. They may work in areas of design, research, construction, or teaching.

Education: Bachelor's Degree

Mathematician: Create new mathematical theories and techniques involving the latest technology and solve economic, scientific, engineering, and business problems using mathematical knowledge and computational tools.

Education: Bachelor's Degree

Teacher: Instruct students in English, mathematics, science, and social sciences. They plan teaching activities, evaluate students' work, record grades, and meet with parents.

Education: Bachelor's Degree

How it relates:

- * Architects, civil engineers, and mathematicians use geometry in understanding advantages and disadvantages in building structures.
- * Chemists study forces that cause materials to attract and repel to one another.

Review Questions:

1. Review various geometric shapes and ask the students what they are.
 2. What is the difference between a circle and a sphere? A square and a cube?
 3. Why do bubbles always pull themselves into spheres?
 4. What prevents a bubble from shrinking even smaller than it does?
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