NOVEMBER/DECEMBER 1995
VOLUME 18, NUMBER 6

GIFTED CHILD Today Magazine™

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Gifted Child Today
Magazine
November/December 1995

pages 26 and 27

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Always Blowing Bubbles

Why is it that bubbles are so fascinating to both children and adults? Is it because of the rainbow of color that appears on its outer surface? Is it because of a bubble's shape or the reflection a person can see in its mirror surface? Maybe it's because bubbles are fleeting and can't be caught. Whatever the reason, bubbles offer a world of questions that can be answered through observation, experimentation, and discovery.

Have you ever blown through a straw into a glass of milk or soda? Did you ever wonder why it makes bubbles? These bubbles are the result of forces of air acting on a film in the liquid. We call this surface tension. The film's function is similar to that of the skin on a small balloon with air on the outside pushing in and air on the inside pushing out. This causes the molecules of the soap to adhere to each other producing what appears to be a film stretching, creating a bubble. As a child, I remember playing with a container of bubbles. I never thought of it as soap or film; I just thought of it as fun. That container, however, did contain soapy water with a drop of food coloring. The soap makes a great film which can turn into bubbles. As you blew through the ring, which had been previously dipped in bubble solution, the film across the ring stretched. Air went into the stretched film. Soon a bubble popped off. The bubble formed a perfect sphere. Why did the bubble take this shape, a child might ask? In a square, if you move away from the center of the square toward the walls and corners of the square you find that the distance to the walls is shorter than the distance to the corners. In a sphere the distance from the center to the outer edge is always the same. Forces acting on a bubble push from the inside of the bubble and from the outside of the bubble. This causes the forces acting on the bubble to be equal. Forces in a square or cube are not equal because the distances from the center to the outer edges are not equal. In nature most things will move towards the equalization of forces, including bubbles. Therefore, the logical shape for a bubble is spherical, where forces are equal.

One experiment students may want to try is to see if all bubbles form spheres, and if different bubble wands will create bubbles of various shapes. You may wish to give children straight wire and have them bend the wire to design their own bubble wands. Remember that the wand must be a closed loop. Wands may be round, square, or even amorphous in shape; however, students will find that they all give a spherical bubble. In another experiment, have your students create two-dimensional and then three-dimensional geometric shapes using toothpicks and plasticine clay (this type of clay does not

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dissolve in water). Attach a piece of thread onto these geo-panes and submerge them into bubble liquid. What shapes do you think will be created between the toothpicks by the stretching (surface tension) soap film? As you lift the bubble geo-panes out of the liquid, have your students describe and then draw the shapes they see. Have the children predict the type of bubble that will form when you blow on the geo-pane. Have your students draw a diagram showing the forces they think are acting on the bubble liquid causing the stretching. Ask your students if there is a difference between two-dimensional and three-dimensional shapes. How are the shapes created by the bubble liquid different when your students use two-dimensional and three-dimensional shapes?

Soap films are extremely thin, and burst easily. Dryness helps to pop a bubble even faster. As water evaporates, it will cause a bubble to pull apart and burst. If you touch a bubble with a dry hand it will burst. What if you touch a bubble when your hands are wet? Most children play with bubbles on nice sunny days, but would the bubbles last longer on rainy days? And how can you make the skin of a bubble last longer? Students can devise experiments to find answers. One experiment they can do is to begin with a standard bubble solution. Then the students can be given various liquids that help prevent things from becoming dry. Try hand creams and glycerin. Students may also wish to try to make different kinds of bubble solutions from various kinds of dry or liquid soap and water.

Much experimentation can be done with bubbles. Students can try to make the smallest bubble or the largest bubble. Bubbles can even be placed inside other bubbles. Columns of bubbles can be created or bubbles could be placed next to each other, creating geometric shapes that can be used in a math or science exercise. Whatever type of experimentation is done with bubbles, you will find a room full of fun and excitement with a great deal of learning going on.

For the Teacher

Bubble liquid can be made by adding 15 ml of liquid dishwashing soap (I prefer Dawn brand) to one liter of water. Bubbles can be strengthened by adding 5 ml of glycerin or one packet of sugar to this mixture.

If your class needs another activity to help it understand surface tension, try completely filling a glass with water. Have your children place nails, paper clips, washers or stones in the filled glass of water. Instead of the water immediately overflowing, the water level rises within the glass. Now have your students stand in a large circle. Alternate students facing into and out of the circle. Have everyone hold hands and spread out. On a count of three, have the students facing into the circle lean in while the students facing out lean outward. As long as all hands are together, no one falls. This will help them understand how molecules adhere to each other and how the bubble forms and eventually breaks.❦