ACTIVITY 3

HOW CAN YOU CREATE A GIANT BUBBLE?

EXPERIMENT OBJECTIVES AND CONTENT

The goal of this activity is to teach students about soap bubbles.

ESSENTIAL KNOWLEDGE

Matter
- Changes in matter: physical changes (phase changes); Manufacturing household products

Techniques and instrumentation
- Use of simple measuring instruments

Appropriate language
- Terminology related to an understanding of the material world
- Convention and types of representations specific to the concepts studied: graphs

SUGGESTED MATERIALS

Scientific equipment:
- Scales
- Beakers
- Rulers
- Protractors
- Eye-droppers

Perishable scientific materials:
- Plastic gloves (optional)

Perishable non-scientific materials:
- Vegetable oil
- Vaseline
- Glycerin
- Water
- Food coloring
- Dish soap
- Powdered laundry detergent
- Bar soap

Household materials:
- Glass or plastic jars
- Measuring spoons
- Measuring cups
- Kettles
- Cotton thread
- Large rope
- Wooden sticks at least 30 cm long
- Straws
- Funnels of various sizes
- Flexible metal wire
- Shallow tubs

CONTEXT: SITUATIONAL PROBLEM OR RESEARCH QUESTION

A magic show is taking place in the school and your team—the Super Bubbles—decides to participate. However, while you have seen many magic tricks, you have neither the formula nor the instruments needed to make a super bubble liquid. How will you go about creating your super bubbles?

SUGGESTED PREPARATORY ACTIVITIES (INTRODUCTION)

The teacher begins a discussion on the place of bubbles in everyday life. They may also present an excerpt of a show featuring soap bubbles or else bring up the concept of foam, so that the children see that bubbles can have many different sizes. Then, the teacher introduces various types of soaps and detergents to the students (e.g., floor cleaner, laundry soap) so they can discover the various textures of these products.

INITIAL IDEAS AND HYPOTHESES

Here are a few examples of hypotheses the students might formulate based on their initial ideas:

Example 1
I predict that I can create very large bubbles by using less water in my mixture. I believe this because bubbles are made of soap, not water.

Example 2
I predict I will create larger bubbles if I use a liquid soap. I believe this because liquid dish soap makes bigger bubbles than the bar of soap I use in the shower.

THE STUDENTS MAY BELIEVE THAT ONLY LIQUID SOAP WILL BE ABLE TO MAKE LARGE AND RESISTANT BUBBLES.

Example 3
I predict that by adding corn syrup to the mixture I will be able to make larger and stronger bubbles, while if I add oil, the bubbles will be weaker. I believe this because when I cook with my parents, syrup is sticky, while oil prevents foods from sticking to the pan. (Variants: glycerin, sugar, Vaseline, food coloring, etc.)

Example 4
I predict that I can create larger bubbles by using larger instruments. I believe this because a larger circle will let more air into the bubble.

RECORD ALL YOUR IDEAS AND OBSERVATIONS IN YOUR EXPERIMENT WORKBOOK.

WORK PLAN AND EXPERIMENTATION

Here are a few examples of experiments the students can carry out to verify their hypotheses:

Example A
The students make several mixtures using the same soap but varying the amount of water used. They take note of their observations and determine which recipe gives the best results.

Note: All quantities should be weighed, measured and counted. Students should use an eye-dropper, a graduated cylinder, a scale, and a measuring cup or spoons to correctly take their measurements.

Example B
The students carry out different trials to find the soap or detergent that lets them create the biggest bubble. They can grate different types of bar soap, use laundry detergent or liquid soap. They should also verify whether water temperature has an effect on the mixture.

Example C
The students add various substances to the water-soap mixture in different proportions and observe the results. They may also want to verify which soap reacts the best with such and such substance.

Example D
The students build different bubble-forming instruments. They may design different prototypes. They can use a ring made of metal wire and attach it to a wooden stick, or take two sticks and attach a string to it. They could also thread cotton string through two straws and tie a knot to make a closed circle. The students can form the bubbles by holding a straw in each hand and dipping the thread in the soap solution.

Example E
The students compare instruments of different sizes, such as funnels of various formats, and evaluate which ones create the biggest bubbles.

EXPERIMENTAL FACTORS
To ensure scientific rigor, the students should evaluate the experimental factors that might influence the experimental results.

- Strength of air stream
- Size and nature of instrument used to make the bubbles
- Proportions between soap and water
- Presence of binding agents (e.g. sugar, syrup)
- Presence of water on the hands
- Presence of water on the instrument
- Humidity in ambient air
- Air currents
- Type of thread

DISCUSSION: SUGGESTED INTEGRATION ACTIVITIES (CONSOLIDATION)

The teacher leads a discussion with the class to review the key concepts of the activity: which teams were able to create the biggest bubbles? Did the recipes the students develop allow them to make stronger bubbles? What factors varied the results? After the activity, it is suggested to use fun and amusing posters to create a concept network.

SUGGESTED ACTIVITIES FOR APPLYING KNOWLEDGE (APPLICATION)

The teacher suggests that the students produce a magic show. They could also create soap from the small bits of soap left over from the experiments and verify whether it lathers as much as the original soap. Another suggestion would be to visit an artisanal soap-making workshop.

SCIENTIFIC CONCEPTUAL CONTENT

Contact area between bubbles
Soap bubbles tend to take on a spherical shape, the advantage of which is that it makes them stronger and more stable. This is because spheres are the shapes in nature that present the lowest ratio between an object's surface area and its volume. In addition, soap molecules tend to move toward each other and condense, which contributes to bubbles' forming spheres. When two bubbles come into contact a completely straight wall forms between them. This phenomenon results from the fact that each bubble wants to occupy the space it needs to regain the most stable shape: a sphere.

Soap bubble
Soap bubbles are made of a thin film of soapy water surrounding a quantity of air or some other gas. The water that makes up the outside of the film circulates freely over the bubble's surface.

The difference between bubbles and foam
Foam is a collection of small bubbles of varying sizes.

Why bubbles pop
Bubbles pop for three main reasons: the liquid that makes up the bubble wall is drained away through contact between an object and the bubble's surface (where water circulates freely); the water evaporates when the bubble nears a source of heat, or the bubble is violently penetrated, which tears the film that makes up the bubble wall.

How soap works
A soap molecule looks much like a pin. It has two ends, one of which is attracted to water molecules and the other to grease and dirt. By bonding this way, soap can surround and isolate dirt.

Basic formula for soap bubbles
To make your own bubble soap solution, mix one part soap with ten parts water (warm water helps the solution to mix). To increase the size and strength of the bubbles, increase the amount of soap used. You can also add syrup or sugar to the mixture, which will increase the bubbles' elasticity. In addition, using a larger bubble-forming instrument can help make bigger bubbles.

Types of soap
There are five major types of soap: soft soaps, which use a potassium base; hard soaps, which use a sodium base; liquid soaps, which are based on petroleum derivatives; transparent soaps, to which glycerin or alcohol has been added; and powdered soaps, which have been dried and granulated.

CULTURAL REFERENCES

Ingredients of soap
Soap is made through a chemical reaction called "saponification," which is the reaction of a basic, or alkaline, substance with a fatty acid. Making soap thus requires fat and an alkaline substance. The fats used to make soap come from animal and plant sources (e.g., suet, olive oil, coconut oil, etc.). The main alkaline substances used to make soap are caustic soda (sodium hydroxide), or potash (potassium hydroxide). Perfumes and coloring may also be added to soap to make them more appealing.

History of soap
Scientists have found evidence of soap in Mesopotamia dating back over 2500 years before the modern era. The ancient Gauls were apparently the first people to mix plant ashes with animal fat to create a paste that could make hair shine. The first soap bars (solid soap) appeared in the 13th century. However, it is only in the 18th century that solid soap began to be manufactured industrially and made available to the middle class.

Unusual fact
Some bar soaps float in the bath while others sink. What makes them different? The secret is that to make soap float, you have to mix in air bubbles. This was apparently discovered after an error was made in the manufacture of a very popular brand of soap.

FOR MORE CULTURAL REFERENCES, VISIT THE ÉCLAIRS DE SCIENCES WEBSITE:
www.eclairsdesciences.qc.ca

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PROCESS OF ACTIVE DISCOVERY

GENERAL LEARNING PROCESS IN SCIENCE AND TECHNOLOGY (IN ELEMENTARY SCHOOL)

Context related to everyday life

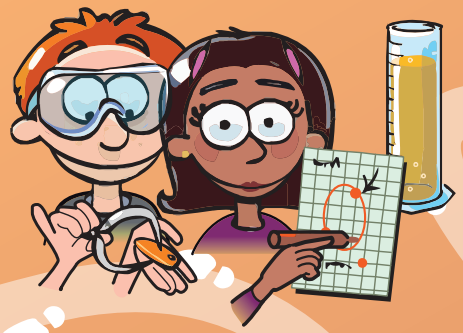
- **Situation problem** or
- **Discovery question** or
- **Need to be fulfilled**
- **Question related to the operation of an object** (how does it work?)

Initial ideas and hypothesis

My initial ideas:
- I share my own ideas.

My hypothesis:
- I predict that... I think that because…
- I imagine my prototype.
- I think it works like this…

Planning and carrying out



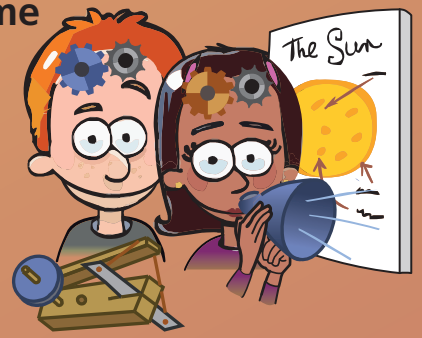
My equipment:
- I observe and handle the equipment.
- How could this equipment be useful to me?
- I choose my equipment and my materials.

Carrying out my process:
- What will the steps be?
- What precautions should I take?

My actions:
- I carry out the steps of my protocol.
- I note or draw what I observe, what I do and what I discover.

My results:
- What is my answer to the problem, question or need?

Outcome



My outcome:
- Do my results confirm my hypothesis or not?
- Are my results similar to those of the other teams?
- Can the other teams' results help me to find answers to my problem, my question or my initial need?
- What could I communicate concerning my discoveries?

New question?

What I learned:
- What do I retain from this activity?
- What could I communicate concerning my results or my discoveries?

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