Experiment: Ivory soap

Materials: Bar of Ivory soap - Deep bowl of water -Dinner plate - Microwave oven

- **Ivory Soap's Unique Property**: Ivory soap is distinctive for its ability to float in water, attributed to the air whipped into it during the manufacturing process.
- **Density and Air Pockets**: Breaking the soap into pieces reveals no large air pockets, indicating its lower density than water. The presence of tiny air pockets is observable when the soap is broken.

- **Microwave Expansion**: When Ivory soap is microwaved, a similar process to popcorn popping or marshmallow expansion occurs. The heat causes water molecules in the air bubbles and soap matrix to vaporize, leading to the trapped air's expansion.

- **Charles's Law Demonstration**: The soap's expansion in the microwave demonstrates Charles's Law, stating that as the temperature of a gas increases, so does its volume. The heat causes the air molecules to move apart, resulting in the soap puffing up.
- **Unique Microwave Outcome**: Unlike other soap brands without whipped air, Ivory soap expands rather than melting in the microwave.
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Info: Accidental Discovery in 1890: The discovery of air-filled soap was accidental in 1890 when a Procter & Gamble employee left the mixing machine on during a lunch break, causing the soap to double in size. This led to the marketing of Ivory soap as "The Soap that Floats!"

Experiment: Bouncing Bubble - Square bubble

Materials: Water - Dish soap – Glycerin - Cotton gloves – Pipette – Materials you need with the square.

- **Prepare bubble solution**: using 3 parts water, 1part dish soap and 1 part glycerin and rest for 24 hours for best results.
- Choose high-quality water with low iron and mineral content for the bubble solution



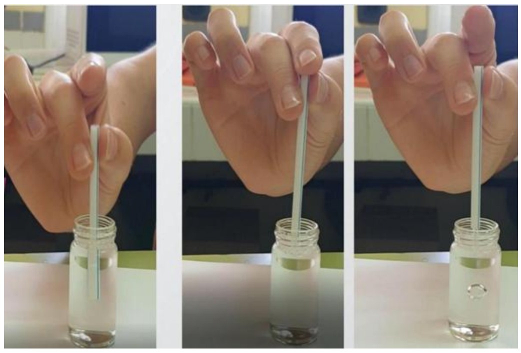

- Bubbles form due to reduced surface tension in water in the presence of soap, where hydrogen and oxygen atoms exhibit cohesion, attracting and clinging to each other. Soap molecules intervene, making the water more flexible by reducing the force of attraction. Additionally, soap, along with glycerin, decreases water molecule evaporation, prolonging individual bubble lifespans and strengthening the soap film.
- The round shape of bubbles is explained by physicists as the minimum surface area needed to enclose the trapped air volume. However, as a cube is dipped into the bubble solution, the film stretches between edges, clinging to the cube's sides (adhesion), resulting in square or cubic bubbles. Despite this, bubbles tend to favor a spherical shape, as evident when blowing into the center causes the bubble to bulge slightly on its sides.

- A bubble's colors result from the reflection and refraction of light waves on its surfaces, similar to the way we perceive colors in a rainbow. Despite its incredibly thin wall, a bubble doesn't have intrinsic color but reflects its surroundings.

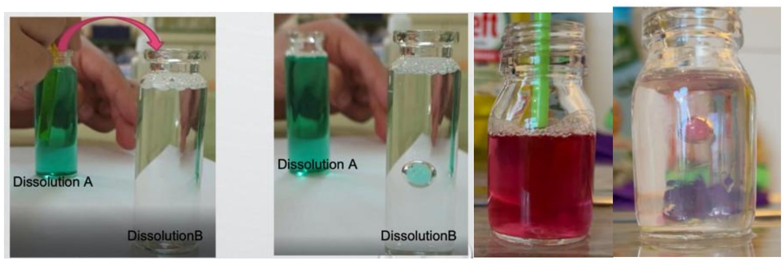
Experiment: Anti-bubble

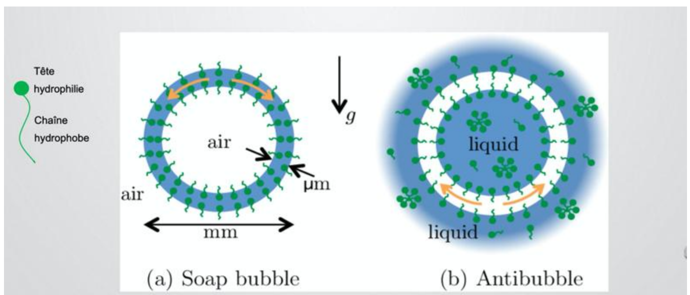
To create the anti-bubble, we use the following steps:

- Begin by preparing a 20 ml container and a straw with a diameter of 3 mm or 4 mm. Place the straw into the solution inside the soapy liquid (composed of water and two drops of detergent). Submerge the straw about 2 cm into the solution, and seal the top of the straw with your finger.
- While keeping the straw sealed with your finger at the top, lift the straw slightly above the surface of the liquid, and release your finger. This action will cause the solution to drop into the container, creating the anti-bubble.



- We created anti-bubbles filled with various substances: food coloring, wine, cabbage juice with mica, fluorescent pigments, etc. The process involves two identical soap solutions, A and B. In solution A, a few drops of the substance to be encapsulated are added. Using a straw, extract solution A and introduce it into solution B. This step results in obtaining the anti-bubble encapsulating the desired substance.





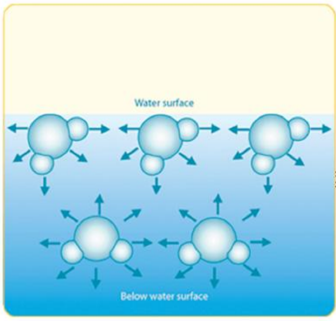
Ref. Provecto STEAM, Alumando de 2e ESO, Prof. Marisa Prolongo

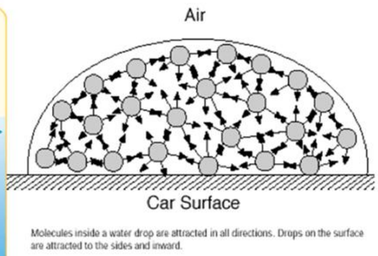
Experiment: Soaps and surface tension

Various experiments to observe the effects of detergents and soaps on the surface tension of purified and hard water

A. Drops on a Penny

Gently place drops of water onto the flat surface of the penny. Keep a count as you add the drops one by one until the water overflows from the penny.





B. Credit Card in Balance

Begin by filling a glass with water to the brim. Then, partially submerge a credit card or another smooth card into the glass. Add a few coins or other objects. Finally, experiment by adding three drops of detergent into the water and observe the outcome. Observe the results?

C. Magic milk

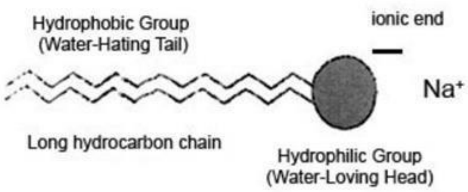
Witness intriguing interactions by combining a small amount of milk, a splash of food coloring, and a single drop of liquid soap.
Now, let's delve into the scientific mysteries concealed within the properties of soap.

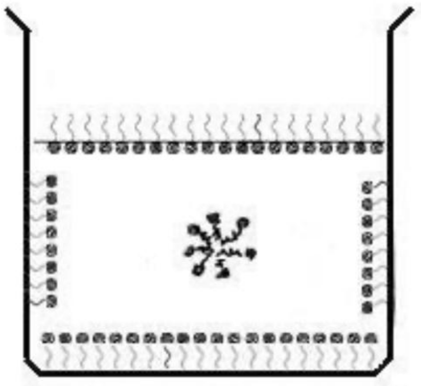
D. Water Suspension

When turning a water-filled bottle upside down, the water doesn't fall. Why?
Consider atmospheric pressure, cohesion, and surface tension

Surface tension

Detergents and soaps typically have long hydrocarbon molecules with a negative charge at one end. This negative charge is balanced by a positively charged ion, like Na+. The long hydrocarbon chains don't mix well with water; instead, they move to the water-air or water-glass interfaces. This weakens the forces between water molecules, reducing surface tension.





Experiment: Explosive Soap

For the bubble mixture
For the bubble mixture, mix together deionised water, washing-up liquid and glycerol (propane-1,2,3-triol) in a roughly 85:10:5 ratio by volume.

For the production of hydrogen and oxygen
- Source of hydrogen and oxygen, eg gas cylinder/Mattson gas microscale gas preparation kit (see below)
- 3 cm^3 20 vol hydrogen peroxide (irritant)
- 0.05 g potassium iodide
- 3–5 cm^3 of 1 M hydrochloric acid
- 0.05 g magnesium powder (flammable)

For the demonstration
- Bubble mixture
- Syringe of H_2 (extremely flammable)
- Syringe of O_2 (may cause or intensify fire)
- 10 cm^3 syringe
- Syringe cap, sticky tack, or small section of silicone tubing with a Hofmann clamp
- Petri dish or similar
- Wooden splints for lighting
- Eye protection
- Ear plugs/ear defenders

Demonstration:
Connect the syringes of gas one at a time to the 10 cm^3 syringe with tight-fitting silicone tubing and push/pull the plungers to draw in 6 cm^3 of hydrogen and 3 cm^3 of oxygen.
- Slowly bubble approximately 10 cm^3 of pure hydrogen gas into the solution. Ignite the bubbles with the lit splint.
- Sowly bubble the contents of the syringe with a specific mixture into the bubble solution.

Ref. *Journal of education in chemistry*