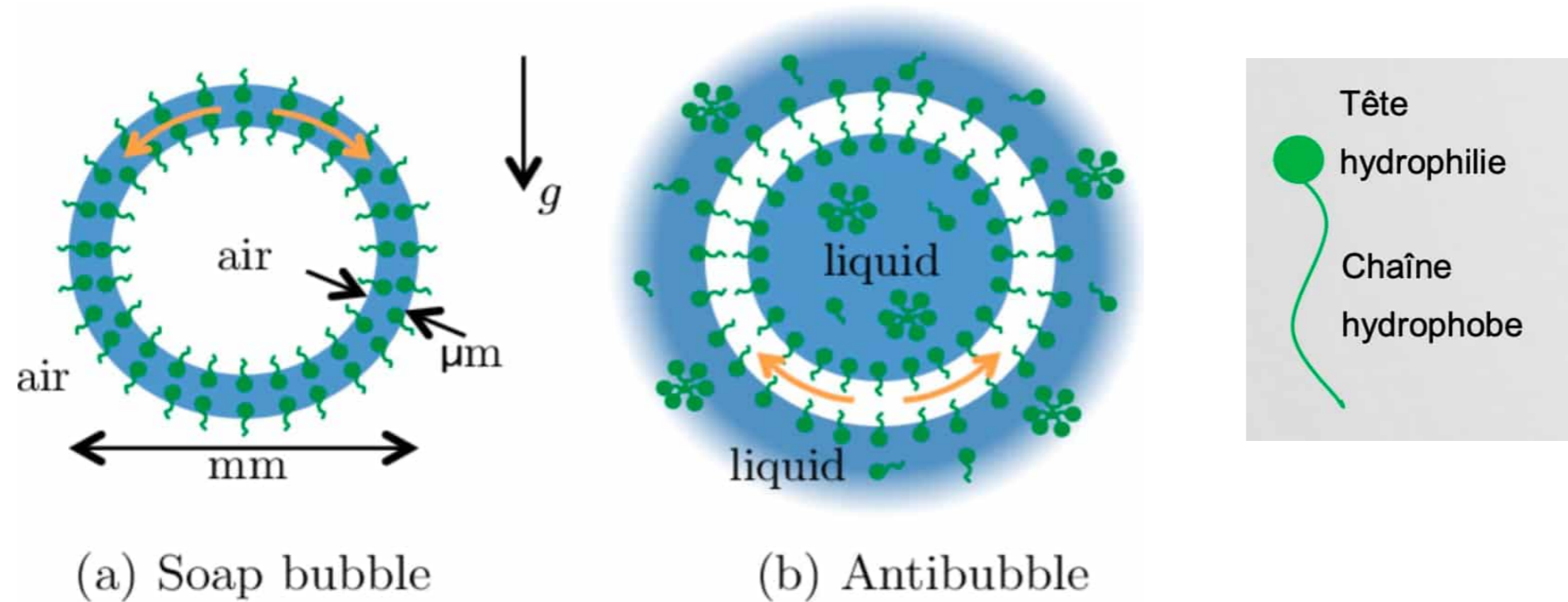


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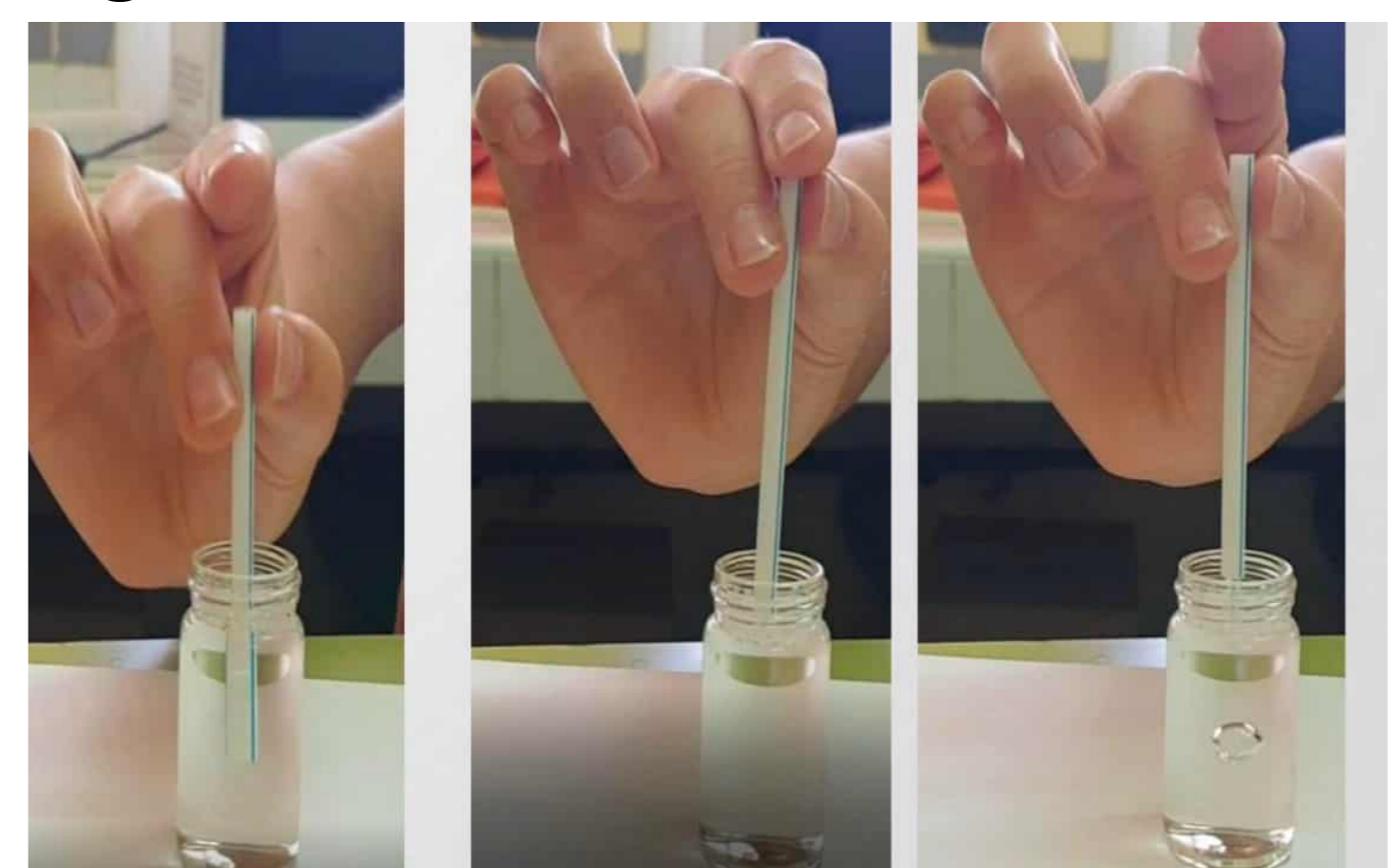
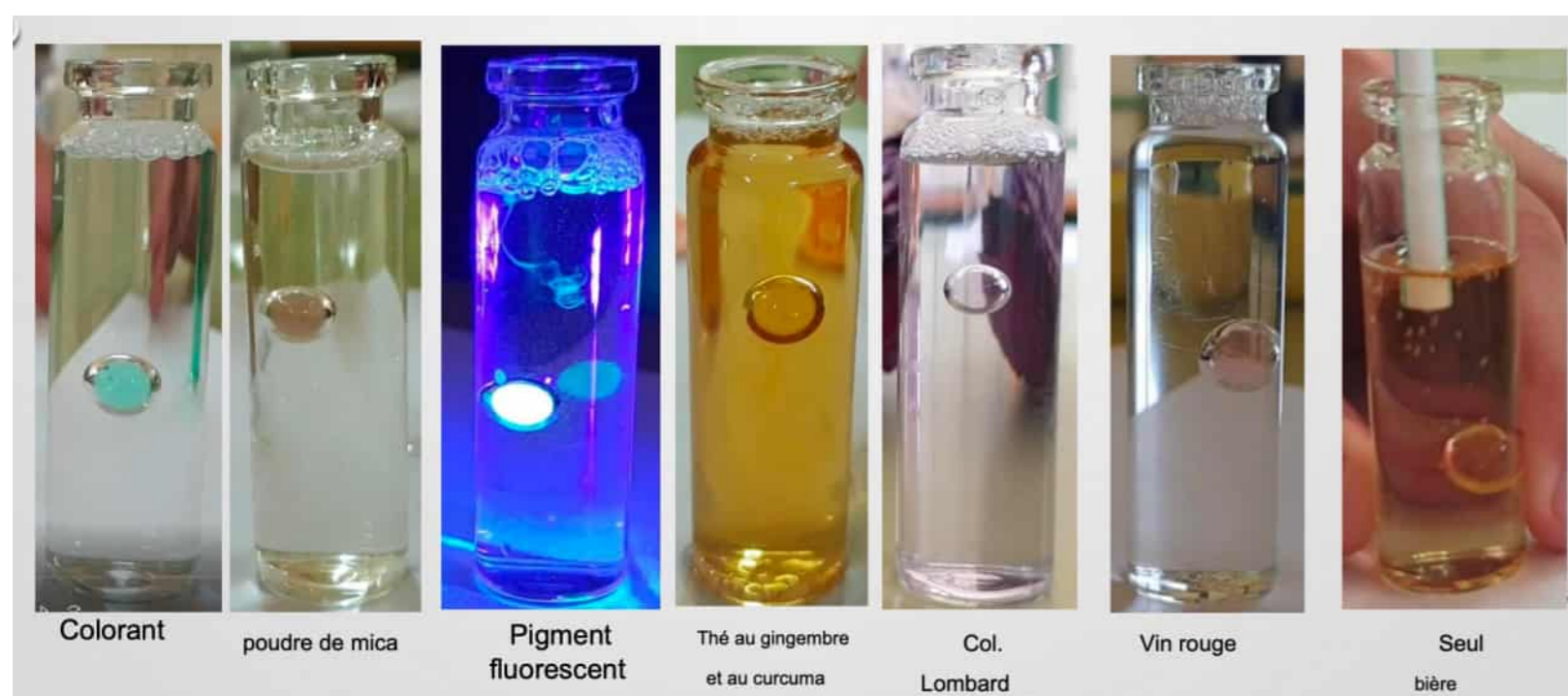
Bubble and Anti-bubble

Explore the fascinating world of soap through affordable experiments that highlight the chemical principles of bubble and anti-bubble formation. These experiments involve encapsulating substances and studying the molecular structures of surfactants. You'll be able to observe and understand how an anti-bubble collapses, delve into its optics, and calculate the apparent air layer thickness. Explore the chemical properties, intriguing reactions, and astonishing mechanisms that make soap an essential element in our daily lives.

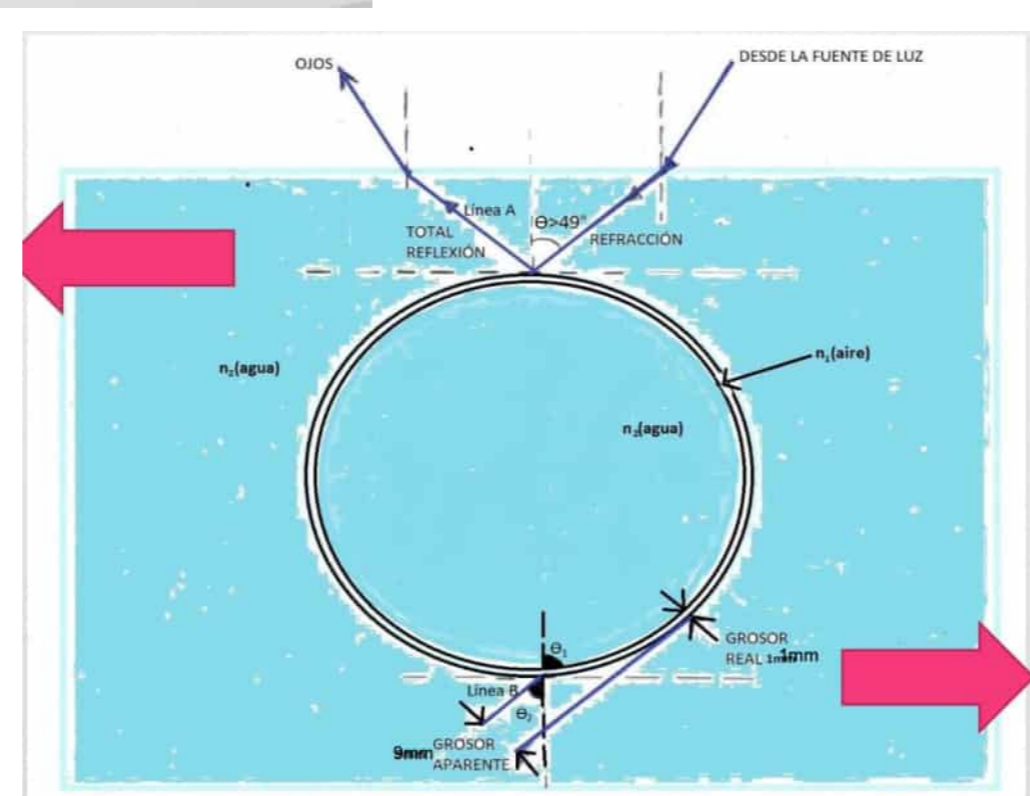


To make the anti-bubble, we first use a 20 ml container and a straw with a diameter of 3 mm or 4 mm, which we place in the soapy liquid solution (composed of water and two drops of detergent). By closing the top of the straw with your finger, you lift the straw slightly above the surface of the liquid and then release your finger, allowing the solution to fall into the container and creating the anti-bubble.

We created anti-bubbles filled with food coloring, wine, red cabbage juice, tea, mica powders, fluorescent pigments, etc.



In the drawing, we observe that with an angle of incidence $> 49^\circ$, there is total reflection; the edge of the bubble acts like a mirror



The thickness of the air layer can be calculated geometrically: it is observed that for a real air layer of 1 mm, there is an apparent air thickness of 9 mm