Caprese

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Get Wet Report
MCEN 4151

September 17, 2026

Figure 1: Balsamic vinegar flowing over a sheet of olive oil

Context and Purpose

For my Get Wet assignment, I wanted to create a visualization involving food to highlight the importance of beauty we place on what we eat. I chose olive oil and balsamic vinegar as the components of my experiment because they are ever-present in Mediterranean cuisine. I knew they would make for a good marked boundary experiment due to their contrasting colors. Furthermore, I could display the concepts of surface tension, buoyancy, and hydrodynamic pressure. My experiment involved inducing flow in the liquids to show the formation of droplet shapes because of these principles. Special thanks to my roommate, Samuel Meyn, for tilting the experiment structure while I photographed.

Flow Apparatus and Physics

The flow apparatus setup was a wide and shallow dinner plate that was tilted at a shallow angle to induce flow. The flow can be described as the flow of droplets on the surface of a medium. The droplets range in diameter from half a centimeter to five centimeters.

The two liquids are separated because of differences in density and chemical polarity. Olive oil has a lower density than vinegar. The equation governing buoyancy is $F = \rho * V * h$ where ρ is density, V is volume, and h is depth. This means that the force of gravity on molecules of balsamic vinegar is greater than that on olive oil, so the vinegar should sink to the bottom.

However, chemical polarity also acts between the liquids. Vinegar molecules are polar while olive oil is nonpolar, so the vinegar molecules are repelled into the droplets seen in the image. The chemical repulsion overcomes the buoyant force and pushes the vinegar droplets to the surface.

Surface tension also plays a role. This is the pulling force molecules exert on all the particles around them. Thus, particles at the surface have a non-zero net force pointing into the liquid. This drives a mass of liquid to minimize its surface area in the shape of a sphere (Purdue).

When the plate is tilted, gravity accelerates the fluids on the plate downward. The droplets of vinegar on the surface are exposed to an induced air flow as they flow down the plate. This creates a distribution of aerodynamic pressure around the surface of the droplet which applies a force on the molecules (USGS). This new force changes the equilibrium shape of the droplet as the forces of aerodynamic drag, buoyancy, gravity, and surface tension balance.

The Reynolds Number is the ratio of inertial to viscous forces in a flow. It can be calculated with the equation $Re = \frac{VL}{\mu}$ where V is the velocity, L is the characteristic length, and μ is the dynamic viscosity. The dynamic viscosity of olive oil is approximately 90 $mPa*s$ (Michael Smith Engineers). The length of the plate is 0.254 meters (ten inches) and the velocity of the flow was 0.127 meters per second (5 in/s). This means the Reynolds Number of the flow was $Re = 0.36$. This means the flow was highly viscous and laminar, which is clear from the undisturbed appearance of the olive oil in the image.

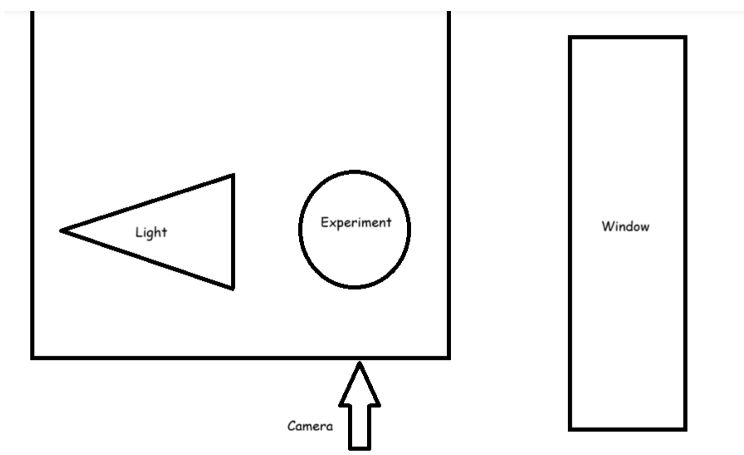

Figure 2: Sketch of the flow apparatus

Visualization Technique

My experiment involved a marked boundary technique where I mixed two fluids with contrasting colors. I used olive oil and balsamic vinegar from King Soopers and a pipette from Michaels. The setup was on my kitchen table next to a window facing north-northeast in the afternoon. I had an LED flashlight diffused with a tissue on top of a water bottle on the opposite side of the experiment. I filled a shallow white ceramic dinner plate with olive oil and used the dropper to place drops of balsamic vinegar on top. My camera was on manual focus with flash on. I was standing to the side normal to the line formed by the flashlight, experiment, and window.

Photographic Technique

My camera is a Canon Rebel T3i DSLR camera. I took pictures from about eight inches away from the experiment. The field of view was about 28.7 degrees diagonally for my camera. The settings of my camera were 55mm focal length, f/8 aperture, 1/200 shutter speed, ISO 400, and compulsory flash. The original image has a size of 5202 x 3464 pixels and the final image was cropped to 4026 x 1698.

The drops moved roughly five inches per second at the instant the photograph. With a shutter speed of 1/200 seconds, the droplets would have moved .025 inches.

The original image is below. I performed a few changes in post-processing. I cropped the image, increased contrast by 25%, saturation by 20%, and brilliance by 10%. The final image can be seen at the start of the report.

Figure 3: Original image before adjustments

Discussion

The image reveals the drops of vinegar that flow over the olive oil. What is most interesting is that some drops maintained their circular shape while the larger ones deformed according to the pressure distribution along their surface. I find the image visually pleasing, but I don't like that it appears a little underexposed and dark around the corners. I personally like that the top and bottom are a little out of focus because it accentuates the part of the image I like best, but it makes the other parts of the image a little unpleasant. The biggest thing I would improve for this experiment is the lighting. I would do it again in a setting with more surfaces to bounce light and perhaps a third light source. It would also be interesting to perform this experiment with a flow driven by some kind of motor instead of gravity.

References

[1] Purdue University. "Surface Tension." Www.Chem.Purdue.Edu, https://www.chem.purdue.edu/gchelp/liquids/tension.html. Accessed 14 Sept. 2026.

[2] "Are Raindrops Shaped Like Teardrops?" USGS, 6 June 2018, https://www.usgs.gov/water-science-school/science/are-raindrops-shaped-teardrops. Accessed 14 Sept. 2026.

[3] Michael Smith Engineers. “Viscosities of Common Liquids by Product Name.” Www.Michael-Smith-Engineers.Co.Uk, https://www.michael-smith-engineers.co.uk/resources/useful-info/approximate-viscosities-of-common-liquids-by-name. Accessed 16 Sept. 2026.