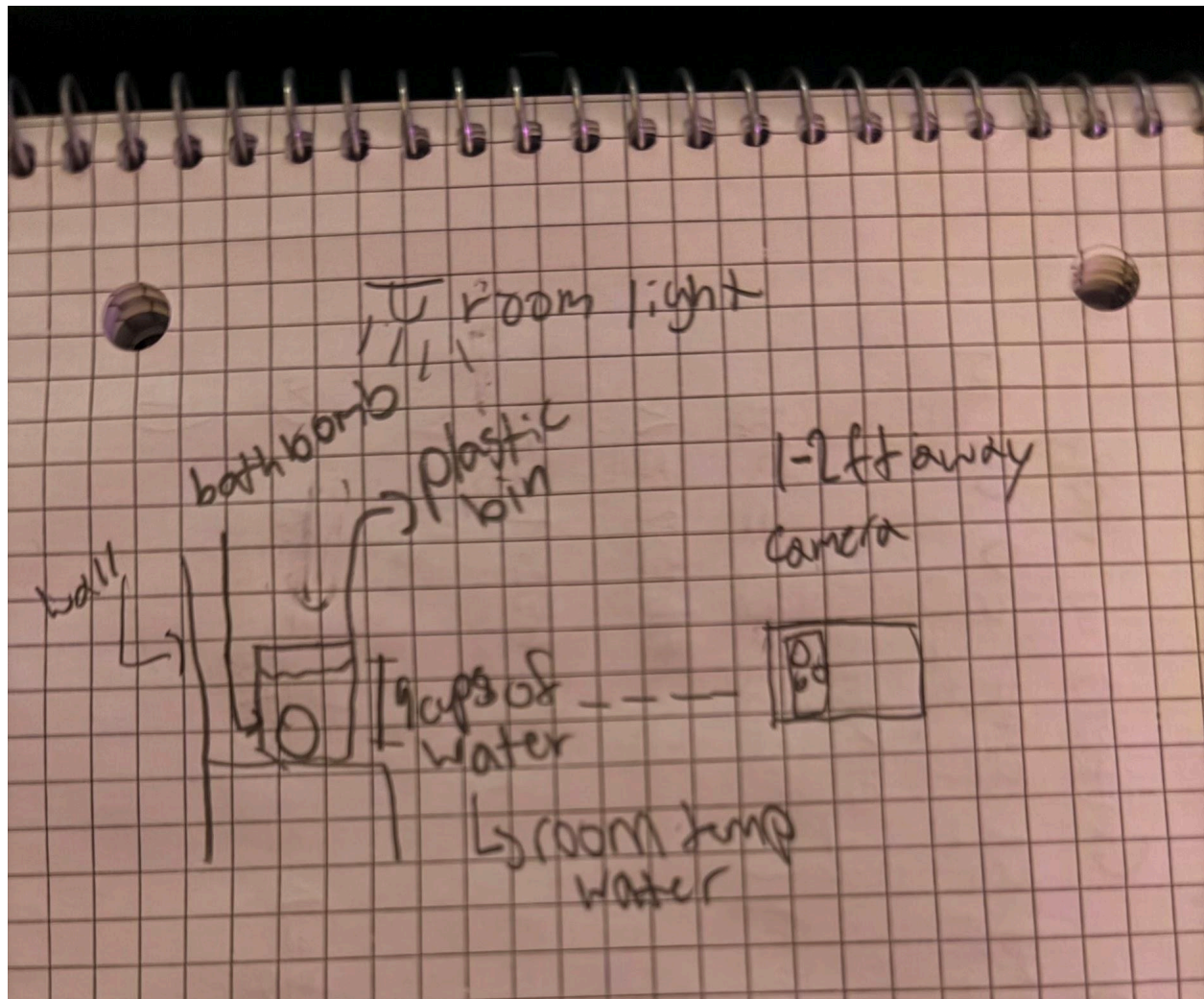


Bath Bomb Flow Visualization
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Flow Visualization
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For this project we wanted to display fluids traveling from a bath bomb. By using a picture of a bath bomb traveling through water we can make a picture that can display these characteristics. Our picture will primarily consist of the bath bomb. Water and the buoyant colors coming off of the bath bomb. We wanted to get a picture that showed most of the dye plume while still being able to see what was going on around it.



This was done with the use of a plastic container used for baths. I used about 9 cups of water and dropped in a lush bath bomb. It had the colors blue, pink and purple. The water was left to sit alone with no outside force applied to create movement in the water. The water began to have movement once the colors started spreading throughout the water. Movement occurred due to the colored water leaving the bath bomb as well as the gases that were produced from the bath bomb. Movement can be seen from the picture with the plume's traveling the color out of the bath bomb. The motion is mainly caused by buoyancy, gravity, change in densities and bubbles moving through the water. When these colored fluids travel through the clear water we see these formations of color. With our given characteristic velocity $U=0.001$ m/s and length $D=0.065$ m we can calculate the Reynolds number by $Re=UD/\nu$. By using $\nu=1.004 \times 10^{-6}$ m²/s for water we can find our Re to be 64.7 or rounded to 65. Our Reynolds number being small means that viscous forces will dominate over our chosen scale of velocity but as you can see there is still motion.

Given in water and u is .001 and d is 6.5cm or 0.065m

$$Re = 1.004 \times 10^{-6} \text{m}^2/\text{s} (0.001 \text{m/s}) (0.065 \text{m}) \quad Re \approx 64.7$$

Our flow tracer was a Lush bath bomb with blue pink and purple colors in it. We used large plastic cups from Walmart to measure about 9 cups worth of water into the bath. The water temperature was normal room temp and there was no other chemical or dye put into the water. Once the bath bomb began to break down it gave us our flow tracer. The color from the bath bomb allowed us to see what the water around it was doing. Our picture was taken using room lighting instead of using the flash on the camera. We wanted to be able to light up the container but did not want the flash to reflect off of anything in our picture.

Using our phone camera we captured this visualization in 4K at 60fps. The camera was set about 1-2ft away from our experiment and we placed the bath bomb almost directly in the middle of the shot to focus on it. Since we wanted to be able to see the flow of the different colors and bubbles we used a higher fps rate. After getting the visualization we chose we cropped the image to show more focus on the middle bath bomb and flow. We also enhanced the colors to show more of the blue pink and purple colors flowing through the water. This was done to better visualize the flow without altering too much of the visualization itself.

This image displays the colored fluid being transported and mixed once the bath bomb begins to dissolve. Because there are multiple colors we can see the movement of fluid quite easily through the clear water. Flow can be best seen around the bath bomb where we are able to see colored fluid and gas bubbles moving up and out from the bath bomb. Once this colored fluid moves farther away from the bath bomb we start to see individual plumes begin to mix in with the water around them. This picture also allows us to see curved structures in the flow which allows us to know the flow is unsteady. I liked how you could focus on the bath bomb while still seeing the colored fluid around it. There were some smaller flows we couldn't see once the dye started to disperse further. My picture met my expectation of being able to see flow but perhaps we could have used more lights or had a different color behind the bath bomb. Another experiment we could try is by changing temperatures of the water or maybe the position of the bath bomb or type of bath bomb used.