Deneen Get Wet Report

12/8/2017

MCEN 4151

For the get wet assignment in the Flow Visualization class I decided to capture the effect that temperature has on a fluids density. I chose water as my fluid mostly because it was readily available and non-toxic. At first I used a single color in an ice cube to illustrate the phenomenon but had the idea of putting a blue ice cube in a glass that had already been used with a red ice cube in order to depict the warm water and the cool water. As stated above the phenomenon is driven by the temperature differences in the water. Because the blue water melting from the ice cube is cooler than the surrounding red water it is denser and thus sinks to the bottom of the container.

To set up the apparatus I used a placed a blue ice cube in a wine glass of red water. The flow starts at the ice cube and continued down towards the bottom of the glass. The image at the end of document depicts the set up for the image. As the blue ice melts it is much cooler than the surrounding room temperature red water. The room temperature water has a density of about 999.1026 kg/m^3 and the recently melted water has a density of about 99.8395 kg/m^3 (Shapley) Though this difference is small it is enough to drive the flow, and the blue water sinks to the bottom of the glass. The laminar flow would indicate that the Reynolds number would be low because there is no turbulence and the blue fluid does not mix much with the red. The low velocity in combination with a low amount of sheer stress between the flows is most likely the reason for the smooth laminar flow.

In order to capture the effect I decide to use food coloring in the ice cubes. I chose to use a large wine glass because it offered enough volume and clarity to be able to capture a long laminar trail. I put a single drop of red food coloring in an ice cube and two drops of blue in another. I then put the red ice cube in the water and waited for it to melt most of the way before stirring the water to create a uniform color. Then I placed the blue ice cube in the glass. I waited until all of the turbulence caused by putting in the ice cube died down before I started to take photos. The glass as placed outside in direct sunlight and a white background was placed behind the glass. I shot the glass from an angle such that the sunlight was not reflecting off the glass in front of the blue trails.

The field of view for the original photograph was about 4”x6”. It was shot from 4.5 feet away using a 4.5-6.5/55-210 lens. The camera was a Sony alpha 5000. The original photo was 3632 pixels by 5456 pixels. The f-stop was f/8 with an exposure time of 1/640s and an iso of 100. The photo was altered using Olympus Master 2. In the software I cropped the photo to just the part that included the blue stream and pumped up the brightness of the blue stream by adjusting the contrast in the blue spectrum.

The image reviews the laminar flow of cold water from an ice cube making its way to the bottom of a glass. Overall I like the photo. I would have liked to get a somewhat crisper definition on the flow. I really like how it shows the flow forming at the ice cube and how it is unbroken all the way to the bottom of the frame. The physics of the fluid flow are clearly seen and depicted by the sinking blue

stream. In order to improve the image I would use a slightly redder backroad and add more blue to the ice cube in order to further the contrast without the editing.

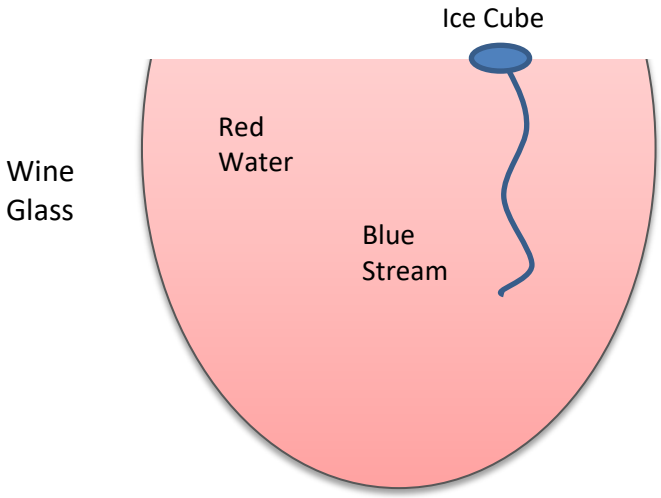

Figure 1: Depiction of Image Setup

Sources

Shapley, Patricia, Professor. "Temperature Effects on Density." Temperature Effects on Density. University of Illinois, 2011. Web. 23 Sept. 2015. <http://butane.chem.uiuc.edu/pshapley/GenChem1/L21/2.html>.