

Hot vs Cold

MCEN4151: Flow Visualization

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The purpose of this image was to display the difference in the motion between hot and cold water in a side-by-side comparison. Both the left and the right are water, with different colored food dye. The only difference is the temperature of the water; the water on the left with the blue is cold, while the water on the right with the red dye is hot. The image shows that the hot water has much more energy, due to the temperature, than the cold water.

The dye travels down into the fluid about the same amount in each case, but the blue dye has a relatively narrow path, while the red dye is dramatically more diffused. This difference is due to the difference in temperature and thus the difference in energy between the hot and cold water. The higher temperature means that there is more energy in the hot water, which means there is more motion on the molecular level; the cold water has less energy, and thus less movement. The greater energy in the hot water can be seen in the dye. Looking at the image, there is clearly a lot more motion in the red dye than in the blue dye, a direct effect of the temperature difference.

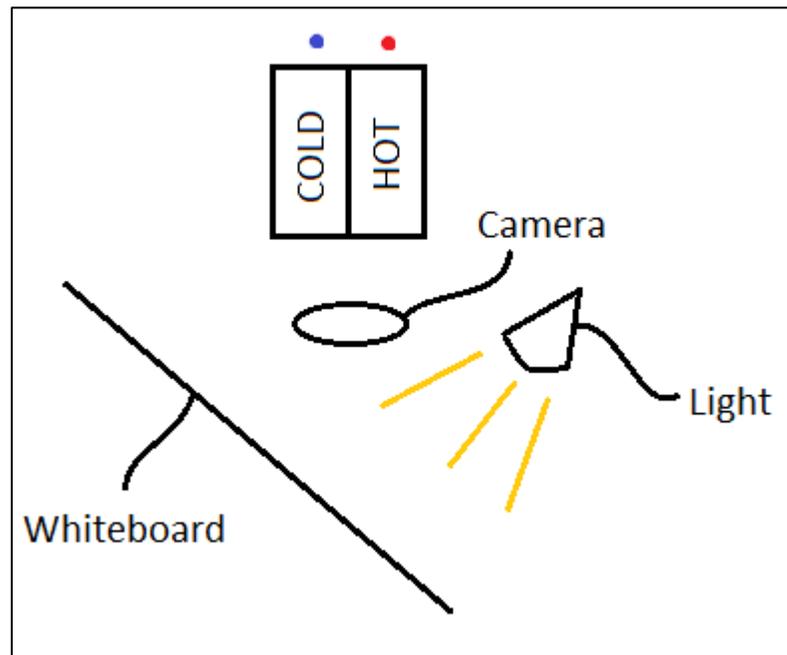


Figure 1: Image Setup

This image was created by taking cold water from the refrigerator, approximately 35°F, and hot water from the microwave, approximately 170°F. A drop of food dye was dropped in each glass at the same time from about 2 inches above the surface of the water—red in the hot water, blue in the cold water. The photo was taken approximately 3 seconds after the food dye was dropped. A blank white sheet of paper was used for the background. Light, from halogen shop lamps, was reflected off of a white board to provide a diffused light source.

A Nikon Coolpix S9 digital point and shoot camera was used, with an exposure time of 1/30 second, an f-stop of f/3.5, and a focal length of 6 mm. The width of field for the image is approximately 8

inches. Macro mode was on because the lens was so close to the flow. No flash was used because there was a tendency of the flash to distort the colors, and the setup had ample lighting. In Photoshop, the image was cropped, very slightly correcting for perspective effects, and the contrast was slightly increased.

Overall, this image turned out pretty good. The background could have been a little brighter white. Also, there were some problems with distracting reflections, which could have been fixed had the image been taken in the photo tent. On the whole though, the image effectively shows the difference in the energy stored in hot water compared to the energy stored in cold water in a beautiful way. Overall, the colors look very nice, and the flow is represented well.