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Get Wet

The purpose of the Get Wet flow visualization assignment was to make a picture of fluid motion that demonstrates a flow phenomenon and is also astatically pleasing. The idea for my particular image came to me when I was eating a candle lit dinner. When I blew out the candles after dinner, I noticed that when I extinguished the flame, a plume of smoke rose and became turbulent. My goal in taking this image was to capture the turbulence in the smoke as it rose. What causes this motion is the fact that the smoke is much hotter than the surrounding air. This causes it to rise first laminarly, and then as it cools, it mixes with the surrounding air and becomes turbulent. The final photo can be seen in Figure 1.

Figure 1: Candle Smoke

The apparatus for taking this picture was really quite simple. I set up a tripod 39 inches away from six lit candles. After extinguishing the flame the camera was set to take several pictures in quick succession. A sketch of the equipment can be seen in Figure 2.

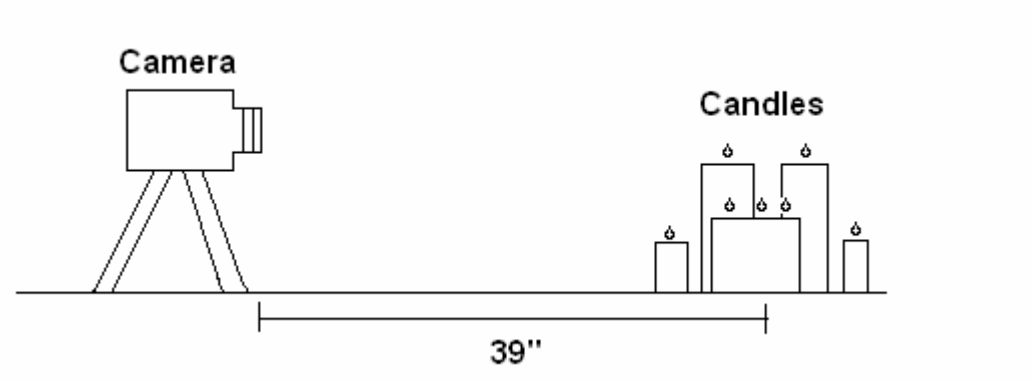

Figure 2: Setup

The approximate Reynolds number can be calculated because we know the field of view and also how much time it took the smoke to pass through that field of view. Equation 1 shows how to find the Reynolds number.

$$R_e = \frac{\rho V D}{\mu}$$

Equation 1: Reynolds Number

V = Free-stream fluid velocity

D = Characteristic distance

ρ = Fluid density

μ = Fluid viscosity (dynamic)

The velocity can be determined from Equation 2.

$$V = \frac{dx}{dt}$$

Equation 2: Velocity Equation

dx = Change in distance

dt = Change in time

Using values from *Principles of Heat Transfer* by Kreith and Bohn, the Reynolds number was found to be ~390.4.

To capture this image of the smoke rising, this picture was taken indoors with overhead track lighting as well as the use of a flash. The original photo can be seen in Figure 3. The angle of the camera lens was parallel with the table.

Figure 3: Original Photo

Photographic Technique:

Camera Type = Digital

Focal plane resolution unit = cm

Make and model = hp photosmart 945

Mega pixels = 5.3

Size of the field of view = 19 inches

Distance from object to lens = 39 inches

Lens focal length = 10.6 mm

Exposure Specs:

Exposure Time = 0.67 sec

Aperture = 3.1

Shutter speed = 0.66 seconds

Several Photoshop manipulations were involved in the final photo. First, the image was cropped to where the most interesting fluid flow was taking place. Next, the color curves were adjusted to make the contrast between darks and light more dramatic. Last, the image was reverted to grayscale.

This image reveals a very interesting view of turbulent fluid flow. I really like the intricate display of turbulence and I feel that the ratio of black to white in the photograph is very effective. I believe it has a very distinctive and drastic look to it. The one thing that I dislike about this image is that the background was distracting to the picture. I took many other photos where the background was either black or white, but unfortunately the picture that turned out the best was the one that did not have the simple background. I was able to remove most of it by use of Photoshop, but there is still a hint of it there. Despite this, I feel that the photo turned out very well and my intent was fulfilled. If I were to try and reproduce this image and make improvements on the photographic technique, I would change the lighting situation and make sure that the background was a solid color. If I were to further develop this idea, it would be very interesting to see how using color filters would affect the image.