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MCEN 4151 - 001

Team First Report

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Figure 1: Final image used in post

The purpose of this assignment was for students to take pictures of different types of fluid flow which corresponded to the theme that their team chose. My team chose fire as the theme for our images, so I decided to take an image of a pile of charcoal burning. I decided on charcoal because it burns for a long time and at a high enough intensity to get a lot of different shapes in the flames. Additionally, flames from charcoal typically burn blue at the base and then transition to yellow and orange near the top, which I thought would be cool to see.

In order to prepare this image, I initially positioned my setup on a concrete floor so as to not burn anything, but there was not that much wind interacting with the flame and I was not

very pleased with the photos that I was getting. I then decided to move my setup to a spot in more direct wind, and placed the charcoal on a table in my backyard. I deemed the table a safe spot to place the charcoals as they burned because, for a while, the charcoals only burn from the top half up, which left the bottom side untouched by the flame and safe to place or even hold. However, this is only true for a while, because as I found out, the flames eventually creep lower and lower and caused the spot directly under the charcoal to get burnt.

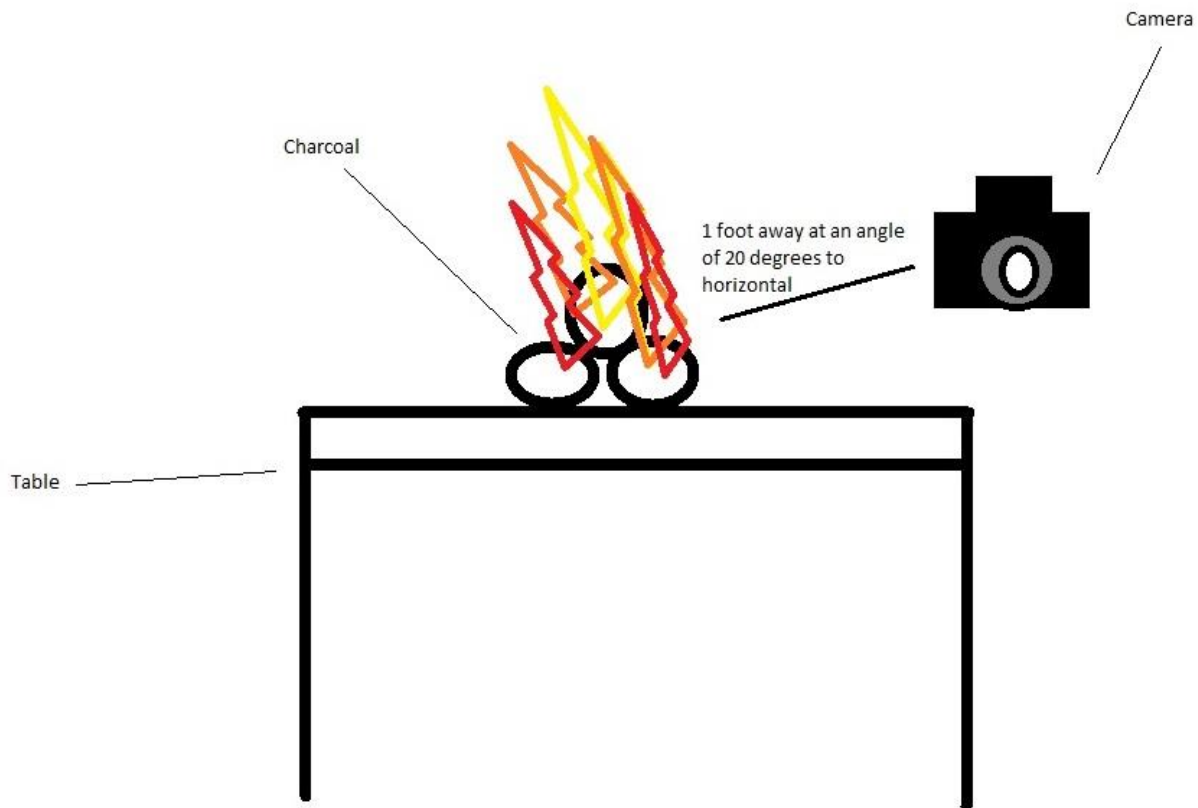


Figure 2: Setup of experiment

In the case of a pile of charcoal burning, there is enough energy condensed within it that the flame intensity is relatively high for the size of the fuel source. Because of this higher flame intensity, the flame has a higher velocity than a match or candle flame, which causes it to have a relatively high Reynold's number (i.e. greater than 2300) [1]. Because its Reynold's number is greater than 2300, the flame is considered turbulent, which is apparent from its tumultuous appearance in the image. Additionally, since the flame is exposed to wind, the flow of the flame is disrupted by the air moving around it and is even more turbulent than it would be if it were in an insulated area.

In terms of visualization techniques used, I wanted this to be a relatively simple photo to replicate, so I used a regular type of charcoal that is easy to find in any grocery store or other store where charcoal is carried. I didn't set any sort of lighting up and only used the light emitted from the flame itself, and environmental factors played a big role in the image because, as I intended, the setup was fully exposed to the wind.

When taking the photo, I used a Panasonic Lumix DMC-GF1 mirrorless camera set on the manual setting with the ISO set to 640, aperture at f/9, and shutter speed at 4000. The only editing I did for the final photo was to slightly increase the brightness so as to make the flame brighter, increase the sharpness slightly to highlight the smoothness of the flame, and then increase the shadows very slightly so that the attention would be brought to the flame itself and not the charcoal.

The thing that I liked most about this image was how the shape of the flame resembled a woman crouching behind the charcoal. I thought this was very intriguing and the fact that flames can create such unpredictable shapes was fascinating to me. I definitely believe that I accomplished my goal of taking a photo of an interestingly shaped flame because it ended up creating a shape that actually looks like a human. One thing I would've changed is to maybe adjust the color so as to bring out more of the blue flames because I think it would've added an extra feature to the image that was interesting. One question that I did have was how much of a role does the energy density of the fuel source play on the turbulence of the flame versus whether or not that flame's fuel source has velocity (e.g. liquid rocket fuel from a jet versus a campfire)? In the future, I think that I could set the charcoal on a different surface so as to not burn it as well as editing the photo differently once I have more skill.

References

[1] Engineering ToolBox, (2004). Laminar, Transitional or Turbulent Flow. [online] Available at: https://www.engineeringtoolbox.com/laminar-transitional-turbulent-flow-d_577.html [Accessed 2 Oct., 2019].