Name(s)	**Project Number**
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Project Title
Shape and Surface Texture, What a Drag!

Abstract

Objectives/Goals

I will demonstrate that the more aerodynamically shaped and smother an object's surface is, the lower the object's drag coefficient [C(d)] will be. I will do this by comparing the air velocities (V) required to keep objects of different shapes and surface textures floating in a vertical tube.

By making all the objects' weights (ma) and cross sectional areas (S) the same and assuming air density (p) remains constant, I will make all the variables in the drag force [F(d)] equation constant except the C(d) and V. When the objects floats in the tube, F(d) and the gravitational force [F(g)] are equal.

F(g) = F(d)
ma = 1/2C(d)pSv^2

Since V is inversely proportional to the C(d), any increase in V required to keep an objects floating equals a reduction in the C(d). The lower an objects' C(d), the more aerodynamic the object is said to be.

Results

I was able to rank and compare the objects by their C(d) by comparing the V's required to keep them floating. The smooth tear drop shaped object required the highest V to float which means it had the lowest C(d) (i.e. it was the most aerodynamic). The rough square required the least amount of V which means it had the highest C(d) (i.e. it was the least aerodynamic).

Conclusions/Discussion

I thought that the rough and smooth cubes would have the highest C(d) but the C(d) of the smooth cube turned out to be about medium compared to the other objects. I noticed that both cubes tilted sideways in the tube forming a diamond shape. I believe this happened because the cubes tried to positioned themselves to create the least amount of drag. I also noticed that the balls were rotating at different speeds. I believe that this rotation had some effect on the balls' C(d) but I am not sure how much.

At first, I tried to make the surface areas and the weights of the objects equal. Since some of the object's shapes are complex, this turned out to be too difficult to do so I just made the weight and the largest cross sectional areas of each object equal. Since I formed each object out of clay by hand, I could not make them exactly round, straight or smooth. I am sure this also affected my results but I don't know how much.

Summary Statement
How An Object's Shape And Surface Texture Effects Its Drag Coefficient

Help Received
My dad made the dimmer switch for me.