Abstract: In this lab, we set out to determine whether the function determining drag was linear or quadratic. We chose to do this by comparing the terminal velocity of several sets of filters with their respective masses, and observing the resulting curve. We used sets of nested coffee filters, which had the same drag coefficient but variable mass (the number of filters in the stack). The data set produced a linear graph, indicating that drag coefficient of an object is determined by a linear function.

Equipment/ Procedure:

Equipment:

15 coffee filters (1,2,3,4, and 5 filters per object),
Duct tape,
LabQuest,
UMD,
Scale
TI-84 Plus calculator

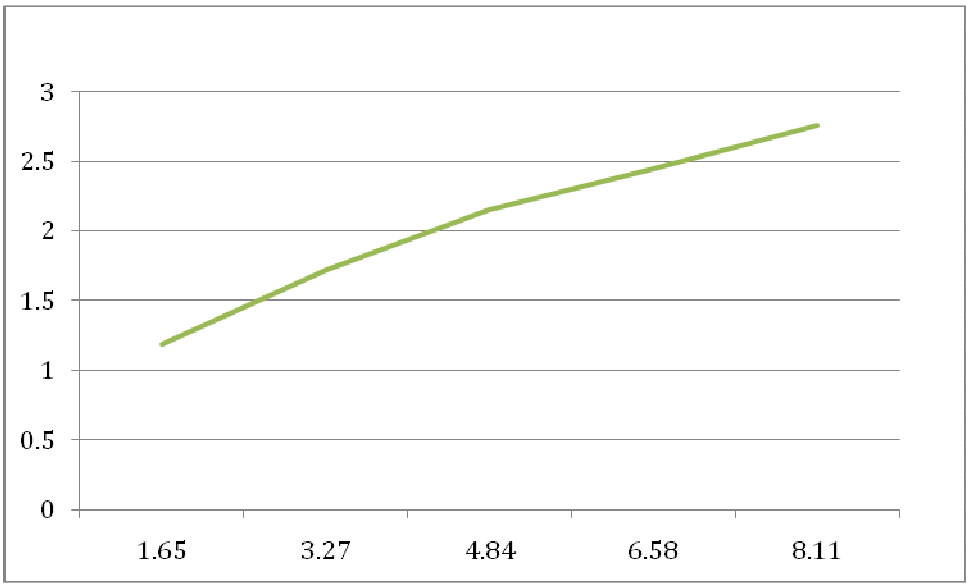
Procedure:

- We set up the coffee filters, making groups of 1,2,3,4 and 5 filters per object.
- We measured and recorded the mass of each of the 5 objects.
- We set up the UMD taped to the ceiling pointing downward, with the cord taped out of the way.
- We set up the LabQuest, with a data point collection rate of 15 samples per second, and a recording time of 5 seconds.
- We dropped the one object at a time vertically from directly below the UMD as it recorded position and extrapolated velocity data.
- We recorded the maximum velocities of the objects.
- We plotted the mass (independent variable) vs. the terminal velocity (dependent variable).
- We examined the data, confirming that the sample followed a linear trend.

Data/Analysis:

Number of Filters	Mass (g)	Avg Time (s)	T1 (s)	T2 (s)	T3 (s)
1	1.65	1.19	1.14	1.26	1.16
2	3.27	1.72	1.75	1.74	1.68
3	4.84	2.15	2.15	2.15	2.16
4	6.58	2.45	2.48	2.46	2.42
5	8.11	2.76	2.82	2.73	2.74

Mass of Filter(s) vs. Terminal Velocity



Conclusion:

The purpose of the lab was to determine whether the function for determining drag was linear or quadratic (based on v or v^2). The force of drag is $F_d = -bv$, where b is a constant of proportionality. If the function were quadratic, it would be equal to $-bv^2$. Let's say the function is linear; for a falling object, $F_{NET} = mg - bv$. So the terminal velocity should be $v = mg/b$, as opposed to $v = (mg/b)^{\wedge}(1/2)$. Since g and b are constants, the only variable of interest is m. Plotting m versus v for the five sets of trials for various masses results in a linear graph, showing that the function is, in fact, linear.