Coffee Filter Drop

We are going to measure the velocity dependence of air resistance. To do this, we will use the motion sensors from the first lab to measure the terminal velocity of dropped coffee filters.

1. **Plug in the sensor**
   a. Connect the USB cable to the sensor and the laptop
   b. Put the sensor on the floor

2. **Start the software**
   a. Open LoggerPro (the red diamond with a caliper over it)
   b. Refamiliarize yourself with the program

We will be dropping 1, 2, 3, 4, 5, 8 and 10 stacked coffee filters. Each filter has a mass of 1.6 g.

Have the skeptic drop stand over the motion sensor and try to drop one filter straight down onto the sensor. The recorder should start the data taking right before the filter is dropped. After the filter is dropped, step back from the sensor, so it does not pick up stray movements.

The coffee filter will reach terminal velocity before hitting the floor. Find the terminal velocity. (The velocity will not be exactly constant, but it will stop increasing and fluctuate at the terminal velocity.) To help with this, you can adjust the length data taking time (by clicking the button near the top with a clock face) and adjust the axes to make the data easier to see. If the data is noisy, repeat until you can get a reasonable measurement. The button with a vertical line crossing is another useful tool to scan over the data and see the values on the curve.

Record the value on an Excel spreadsheet.

Repeat with 2, then 3, 4, 5, 8 and then 10 stacked filters. You will have to reach high for the 8 and 10 filter trials in order to allow filters to reach terminal velocity. Record the data in Excel.

After taking all the data, plot the mass vs. the terminal velocity in Excel. Use the curve fitting tool to find the best fit relationship between the variables. (Try Linear, Polynomial, and Power.) You can set the intercept to be zero. (Why?)

What is the relationship between air resistance and velocity?

Write answers in Excel file and submit to WebAssign.