Drag Force

Equipment
- LoggerPro
- Motion Detector
- Optional: Cart, friction pad, track and Force Probe

Objective
Data collection
- Set up appropriate experiment to measure position of a falling object

Data analysis
- Graph position and velocity as a function of time.
- Determine terminal velocity from a line fit
- Determine the dependence of drag force on velocity

Physics Concepts
- Terminal velocity (also called terminal speed)
- Drag force

Conceptual (C-Level)
You and a friend are tossing an object back and forth.
- Draw a schematic diagram with the forces labeled
  - right after the object is thrown
  - when the object is at the top of it trajectory
  - right before the object is caught

Drop a (new) coffee filter and another that is wadded into a tight ball.
- Draw the velocity vs time graph for both coffee filters.
- Describe in words and pictures the terminal velocity of the coffee filter.

Basic Lab (B-level)
Setup the motion detector to collect the position of a coffee filter falling straight down. Determine the power dependence of the drag force to the velocity. So given $F_d = b|v|^n$ determine n.

- Change the mass of the filter (without changing its surface area) and determine the drag force.
- Graph the drag force as a function of terminal velocity and determine the power dependence.

> NOTE: Be careful not to drop anything massive on a motion detector. You might be able to mount the detector on the ceiling.

Advanced/Extended Lab Ideas (A-level)
NOTE: Just pick one advanced lab idea and complete a quantitative experiment.

- Create a function that fits the acceleration vs time graph using the correct drag force.
- Repeat your experiment for an object you expect has a different drag force dependence.
- Determine the static and kinetic coefficients of friction for an object on a surface
- What might you be curious to investigate about frictional forces?