# Physics 1D03: Lab 4

CONSERVATION OF ENERGY

Lab Objectives

- Theoretically relate the conservation of energy to objects falling experimentally.

- Using consistent nomenclature with the scientific method.

- Practice labeling graphs correctly and presenting scientific results.

- Empirically examining the effects of air resistance over short distances.

- Exporting data from Capstone and importing data into Excel.

Equipment
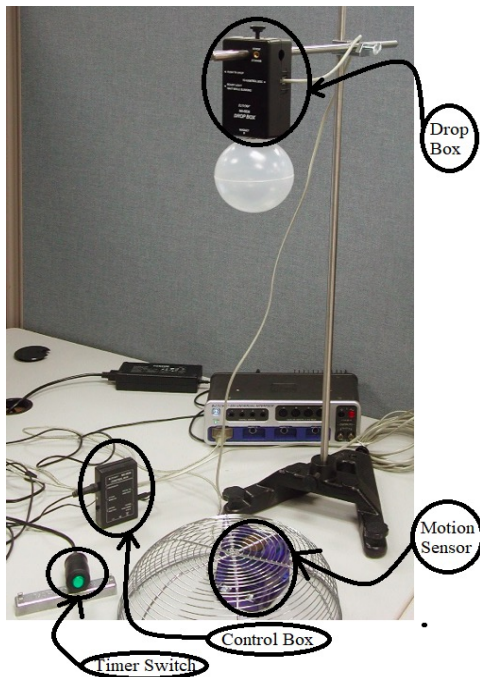
Drop Box Set

Golf/Plastic/Styrofoam ball

Experimental Set Up

Experimental Set Up

- Start by finding the mass each of the droppable balls and record their values in the report
  - Do **_not_** remove any of the cardboard or metallic pieces while doing this
  - Make sure to give each ball a descriptive name which can be used to distinguish between them

- Before continuing, make sure the drop box is properly set up
  - Suspend one of the balls from the box
  - Make sure the sensor is properly covered
  - Use the button to release the ball
 - Repeat with the other two balls

Metallic Piece

Guard

Sensor
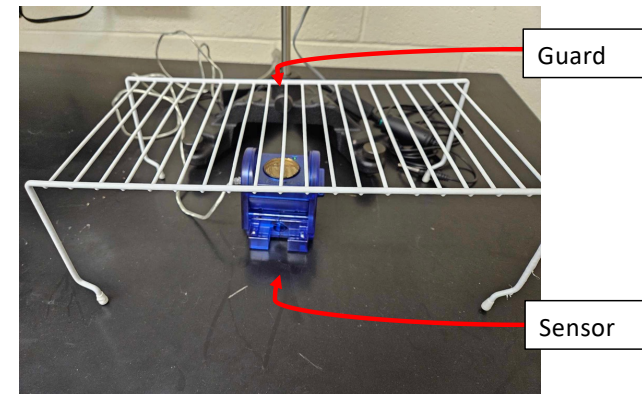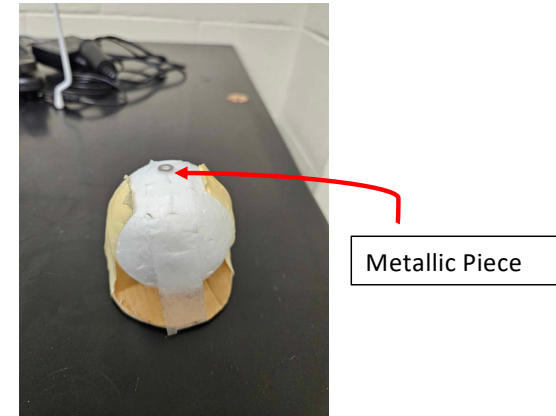
Experimental Set Up

- Start setting up the Capstone file
  - Use Capstone to create position, velocity, and $Energy/Mass$ versus time plots
  - Refer to lab manual on instructions for how to set this up

- Once everything is set up and working, suspend a ball on the drop box
  - Press "**Record**" and make sure the position graph reads 75-90cm
  - Delete previous run, re-record then drop the ball

- Now we want to see if the run was good?
  - If position and velocity curves are smooth, great!
  - If position and velocity curves are jagged and jump around a lot, delete and re-run
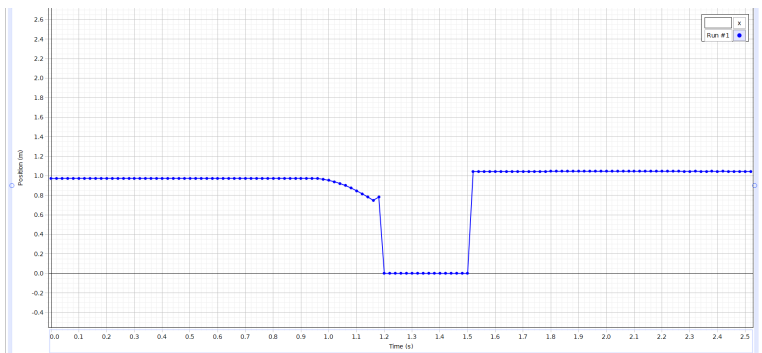 - Ask a TA if you're unsure

Experimental Set Up

■Examples:
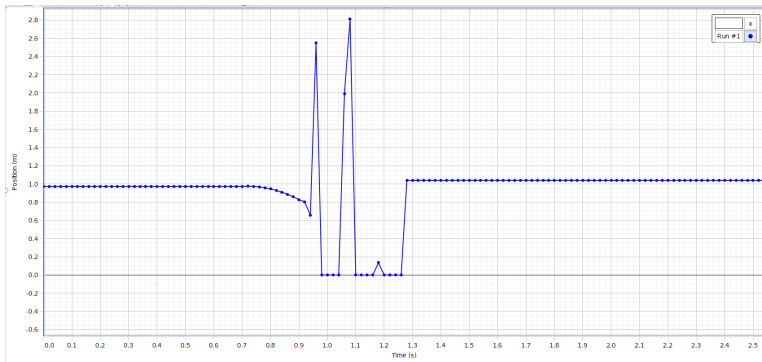
Bad Run:
- Not smooth after the drop
- Large jumps in the data points

Better Run:
- Curve is smooth during the drop phase
- No rapid changes in the data points

Experimental Set Up

- Once you get your first good run, **_check with the TA_**
  - Delete all points _after_ the ball has hit the ground
  - Save the run and name the file with a descriptive title

- Repeat the above steps until you have two good runs for each of the three balls

** Cautionary note **

When selecting 'delete last run', this will delete it from _every_ tab. Only select this button after a run that is bad. If you accidentally delete a run you didn't intend to, you can always undo this by pressing ctrl+z.

Analysis 1

Analysis 1

- Now we want to organize the data in a useable way

- Should have two good runs for each ball
  - Select the best one of the two
  - Delete all points from _before_ the ball fell

- Once done for each ball, **_ask your TA to look over all three graphs_**

- Copy and paste the three graphs into your report

Analysis 2

Analysis 2

- Goal is to now quantify the energy loss of the system

- Examine your graphs and select the one you think best demonstrates air resistance acting on the system

- Mark two points on the energy graph:
  - The first point corresponds to the ball before it was dropped *(record this point in your report)*
  - The second point corresponds to the ball once it hits the ground
  - Copy and paste the graph (with the two pointed marked) to your report

- Transfer the data into Excel and create a scatter plot of the energy difference versus time (ie. Plot $Energy(t - t_{initial})/Mass$ versus t)
  - Copy this plot into the report and make sure it is properly titled and labeled

Good Luck!