Physics 106 – Mini-Lab
Moon Drop and Pendulum

(See http://www.physics.rutgers.edu/ugrad/106/labs.html for lab write-up guidelines.)

Part 1. The goal of this part is to measure the acceleration due to gravity on the surface of the moon. Read https://nssdc.gsfc.nasa.gov/planetary/lunar/apollo_15_feather_drop.html and download the “8.3 Mb Quicktime movie of the demonstration.” Now watch it with a computer that supports Quicktime movies and that allows you to advance a frame at a time. For example, on my Mac laptop, the button indicated below advances a frame at a time. If you don’t have access to a computer with these capabilities, get the help of a friend who does.

Now play the movie through, and then go back and find the part where the hammer and feather drop. Advance a frame at a time, and count how many frames it takes for the objects to drop. Also get the frame rate (frames per second) by counting how many frames are needed to advance the clock by 10 seconds, and divide by 10. From this information, determine the time $t$ that it took for the objects to fall, rounding to the nearest tenth of a second. Also make an estimate of $h$, the dropping distance.

Now use the expression

$$g_{\text{moon}} = \frac{2h}{t^2}$$

to find $g_{\text{m}}$, the acceleration due to gravity on the surface of the Moon.

Part 2. The goal of this part is to measure the acceleration due to gravity on the surface of the earth. Here, an object drops so fast that it is hard to time it, so we use a pendulum method instead.

Bring a calculator with you. At the MSLC desk, ask for a stopwatch and a meter stick (or better yet, a two-meter stick.) Then locate the pendulums hanging near the wall in the MSLC.

Displace the pendulum by about 10 degrees and release it, letting it swing back and forth. Measure the time for each complete two-way swing (the period $T$) and the length
$L$ of the pendulum. For the period $T$, let the pendulum swing about ten complete periods and measure the total time in order to get the average period. For the length $L$, ignore the markings on the wall (they are too approximate); measure from the support point of the string (bottom of the eye-hook) to the center of the metal ball, recording the result to two figures after the decimal point.

Then use

$$g_{\text{earth}} = \frac{4\pi^2 L}{T^2}$$

to obtain the acceleration $g$ due to gravity on the earth’s surface.

Repeat the experiment using both the short and long pendulums. Record your measurements, calculations, results and observations in your notebook.

**Part 3.** How does the acceleration due to gravity compare on the earth and the moon? (Are you comparing two numbers given in the same units?)