Lab 2-3: The Acceleration due to Gravity

Purpose:
1. To determine the acceleration due to gravity on the earth.
2. To determine the acceleration due to gravity on the moon. (Data from class video.)
3. To determine your eye-hand reaction time.

Materials: 1 picket fence 1 photogate 1 stand 1 clamp 1 stopwatch 1 ruler

Procedure:

Part 1: Acceleration due to gravity on the earth

1. Arrange the photogate so that you can drop the plastic "picket fence" through the light beam.
2. Turn on Logger Pro by opening up the file *"Experiments/Probes & Sensors/Photogates/Motion Timer Picket Fence.cmbl."* This file has the spacing information on the picket fence already in so you don't have to measure anything. How convenient!
3. Make sure there is something soft under the picket fence and also make sure that when you drop the picket fence through the photogate it will fall all the way through before hitting the table.
4. Click on "Collect," hold the photogate a little above the photogate and let it go.
5. In the Acceleration graph, add in the statistics by clicking on the "statistics" button.
6. In the Velocity graph, add a regression line by clicking on the "linear fit" button.
7. In the Position graph, add in a quadratic fit by clicking on the "f(x)=" button.
8. Check with your teacher, then print the graphs so that everyone gets one. Make sure to only print the first page! (Make sure you put a title on the graphs.)

Part 2: Acceleration due to gravity on the moon

9. Play the movie clip (AS15_Ham_feath_drop3.mov) from the Apollo 15 mission to familiarize yourself with it.
10. Play it again, and record the time it takes the hammer to fall using a stopwatch.
11. Estimate the height the hammer fell by comparing it to the astronaut.

Part 3: Reaction times (Each person should do this part individually)

12. Hold your hand out with your fingers a few centimeters apart, ready to grab a ruler that is dropped.
13. Have a partner hold the ruler by the top so that the bottom of the ruler is between your fingers. Engage in idle chit-chat, and at some point your partner will drop the ruler.
14. Grab the ruler as soon as you can. Record how many centimeters the ruler fell before you caught it.

Data:

Part 2: Time hammer fell: _____ s Distance hammer fell: _____ m

Part 3: Distance ruler fell: _____ cm

Conclusions:

Part 1

1. Based on the acceleration graph, was the acceleration of the picket fence constant? If so, what was it? How did you know?

2. Based on the velocity graph, was the acceleration of the picket fence constant? If so what was it? How did you know?

3. Based on the position graph, was the acceleration of the picket fence constant? If so what was it? How did you know?

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4. How much of a factor was air resistance in this lab?

Part 2

5. How did you estimate the distance the hammer fell? How reasonable do you think this was?

6. Calculate the acceleration due to gravity on the moon. How accurate do you think your number is?

Part 3

7. How can you determine your reaction time from the distance a ruler fell?

8. Calculate your reaction time.

9. If you are driving down the highway at 60 mph, and the car in front slams on their brakes, how far do you travel before your brakes engage? (Use your reaction time above. In case you don't remember, 1 mile is 1609 meters.)

10. In reality, how do you think your braking reaction time compares to what you calculated above? Why?