

Laboratory #1
Acceleration Due to Gravity

Arrange yourselves in groups of about four students. Think about what you are doing before you actually do it.

Stand by the wall and drop a ball from a height of two meters. Time how long it takes to hit the ground. The best way to do this is for one person to drop the ball and also to do the timing. Practice it a few times until you can get reproducible results. Then make about five measurements for recording, and have a second student make five further measurements. Then take the average of all 10 to find the one value for the time at this height.

Now repeat this same procedure for different heights. You might should try 0.5 m intervals up to 2.5 m. To do the last point requires standing on the front demonstration bench.

It is important to have at least two students repeat the timing for each height so that systematic effects caused by reaction times can be controlled.

You should collect the data of height and time in a table. Now add an extra column which is the time squared (t^2), do this just for the average value of t for each height.

Now plot the height (vertical axis) as a function of t^2 (horizontal axis), and make it plenty **big**. You may want to use 10 squares per meter, vertically, and 5 squares for every 0.1 sec² horizontally. The data should be close to a straight line because the ball ought to fall with constant acceleration. Eyeball a line through the data which also goes through the origin of the graph (after all it would take 0.0s to fall 0.0m). Measure the slope of this line,

$$\text{slope} = \Delta d / \Delta(t^2).$$

And the acceleration due to gravity, g , is just twice the slope,

$$g = 2 \times \text{slope}.$$

So, what is your estimate of g ? Does it seem reasonable? (A parenthetical note on my personal style and philosophy: I really don't think it is important just how close your value of g is to the expected value. What is important here is that you understand what g is, that you see how easy it is to measure, and that you end up with an estimate of g that is "reasonable".)