Falling Motion
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Introduction

When objects fall subject to the force of gravity alone, they experience constant acceleration. On Earth, this value is about 9.8 m/s². In most cases that we are capable of experiencing on an Earthbound lab, other forces, such as air resistance will be acting. Neglecting such other forces, one should predict that the position of a falling object , y, as a function of time, t, is given by:

1) $\quad y = y_o + v_o t + \frac{1}{2} a t^2$

where y_o is the object's initial position, v_o is the object's initial velocity, and a is the object's acceleration. The object's velocity with respect to time is:
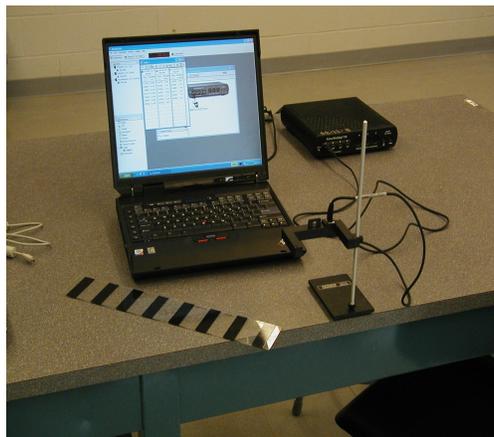
2) $\quad v = v_o + at$

and the object's acceleration with respect to time should be constant as noted above.

3) $\quad a = 9.8 \, m/s^2$

In this lab you will attempt to validate equation 3) by dropping a picket fence through a photogate and comparing acceleration data with theoretical value.

Procedure

Set up your apparatus as indicated by your instructor selecting "Photogate & Picket Fence" as the sensor, and selecting the "Table" as your display type. Attach the table to the acceleration data on the upper left of the screen. Record values calculated by Data Studio in the table below.

Trial	a_1	a_2	a_3	a_4	a_5	a_6	*<a>*
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
					Ensemble Average		
					Ensemble STDEV		

Briefly discuss the characteristics of your data in your writeup. Is there anything unexpected?

Analysis

Calculate the average acceleration value for each trial, and then do an ensemble average to determine your best estimate of the value of g. You will probably see some variation in your data. What causes this? Be specific as to the sources of this variation and any other uncertainties you may encounter. Is your result the same as the theoretical value of g within experimental uncertainty? Why or why not? Be thorough in your discussion leaving no stone unturned.