Lab 2: Measuring the Acceleration of Gravity in Free Fall

Purpose

To measure the acceleration of gravity (g).

Materials

- 2 small differently sized lead weights
- 1 stop watch
- 1 measuring tape
- art room steps

Procedures

1. Measure the mass of each lead weight.
2. Go to Art room steps and measure a distance (in inches) for your first drop height.
3. The "timer" starts the timer when the weight is released and stops it when the weight hits the ground.
4. Take five measurements for each lead weight, and record times in the below table.
5. Measure a second height and repeat.
6. Calculate average of each set. ($AVG = \frac{Total}{Count}$)

Observations

- Try different techniques for measuring the time of the weight drop (stop watch on top vs bottom, stop watch handled by dropper, ball watcher at top or ball watcher at bottom, etc). What seems to affect the accuracy of your measurements? Note any sources of error.
- Record the mass of each weight.
- Mass of lead weight 1: ______________
- Mass of lead weight 2: ______________
- Calculate the acceleration of gravity for each height and weight in $\frac{inches}{seconds^2}$.
- Use $d = \frac{1}{2}at^2$ transformed into $\frac{2d}{t^2} = a$ to calculate the acceleration of gravity.
- Multiply $\frac{inches}{seconds^2}$ by $\frac{1\ meter}{39.37\ inches}$ to convert to $\frac{meters}{second^2}$.
- How do your observed results compare against the "known" value for the acceleration of gravity? Calculate your percentage of error against the known value using the following equations:

$$Percent\ error = \frac{g_{calculated} - g_{known}}{g_{known}} \times 100$$

$$Known\ acceleration\ of\ gravity \approx \frac{9.8\ meters}{second^2}$$

	Height 1		**Height 2**	
Time	**Weight 1**	**Weight 2**	**Weight 1**	**Weight 2**
Time 1				
Time 1				
Time 1				
Time 1				
Time 1				
Avg. Time				
Avg. Time^2				

Lab 2b: Electronically Measure Acceleration of Gravity

Purpose

To measure the value of the acceleration of gravity (g).

Materials

- Vertical stand
- Electronic timer with two sensors
- Two small metal balls or marbles

Procedures

1. Set a ball in the clip.
2. Set one sensor on the vertical stand just below the clip.
3. Set the other sensor at 50 cm ($\frac{1}{2}$ $meter$) lower than the first.
4. Set the timer for "Interval" and "Reset" it.
5. Release the ball five times and record the intervals (in seconds).
6. Calculate the average time for all five drops.
7. Switch to a second ball of a different weight, and repeat.
8. Adjust the vertical stand to a different height, and repeat all steps for each ball.

Observations

1. Record your drop times in the table below.
2. Record the mass of each lead weight.
   1. Mass of ball 1: ____________
   2. Mass of ball 2: ____________
3. Calculate the acceleration of gravity for each height and weight in $\frac{meters}{second^2}$.
4. Use $d = \frac{1}{2}at^2$ transformed into $\frac{2d}{t^2} = a$ to calculate your experimentally derived acceleration of gravity.

	Height 1		**Height 2**	
Time	**Weight 1**	**Weight 2**	**Weight 1**	**Weight 2**
Time 1				
Time 1				
Time 1				
Time 1				
Time 1				
Avg. Time				
Avg. Time^2				