Finding *g* with a pendulum

Purpose:

 Use the formula for the period of a pendulum to find gravity.

Materials:

* Photogate
* Meter stick w/ holes
* CBL cable and calculator unit
* Stand to hold photogate
* Paper Clip
* C clamp
* Play dough

Procedure:

 C clamp a paper clip to a desk to hang the meter stick on to act as a pendulum. Use the piece of play dough to prevent the meter stick from sliding off. Using the CBL unit measure the period that the meter stick swings at different distances c from the center of mass. Record the data and using a linearization of the pendulum period formula calculate gravity from the slope of the best-fit line.

$$T= 2π√\frac{Ipp}{mgd}$$

$$T^{2}=4π^{2}\frac{Ipp}{mgd}$$

$$Ipp= \frac{1}{12}mL^{2}+md^{2}$$

$$T^{2}=\frac{4π^{2}}{g}\frac{\frac{1}{12}L^{2}+d^{2}}{d}$$

$$L=1$$

$$T^{2}=\frac{4π^{2}}{g}(\frac{\frac{1}{12}+d^{2}}{d})$$

Data:

|  |  |  |  |
| --- | --- | --- | --- |
| Period,T (sec) | d (m) | D | T^2 |
| 1.686 | 0.15 | 0.705556 | 2.842596 |
| 1.538 | 0.25 | 0.583333 | 2.365444 |
| 1.641 | 0.5 | 0.666667 | 2.692881 |

Data Analysis:

$$m= \frac{4π^{2}}{g}$$

$$\frac{4π^{2}}{g}=3.908$$

$$g=10.10$$

Conclusion:

Error Calculation:

$$\frac{10.10-9.81}{9.81}\*100=2.95\%$$

 We found that gravity is 10.10 m/sec^2 with our physical pendulum. Our error is only 2.95%, so the lab was very successful, given the crude set up of the lab.