Lab #6

Pendulum

Mayer Adelman

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Purpose

1. To calculate the length of a pendulum that would be a perfect time piece
2. To determine the acceleration due to gravity using the period of a pendulum.

Theory

If you give the pendulum a greater arc, even though there is more distance to cover, still it should take the same amount of time for 20 swings because it obtains more speed.

The period squared of a pendulum is proportional to the length

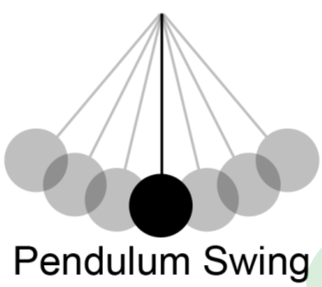
Materials

1. Pendulum
2. Timer
3. Ruler

Procedure

1. Set up the pendulum.
2. Calculate the time for 20 swings using the values of the lengths.
3. Calculate the value of T^2 (the period^2) using the measured time for 20 swings

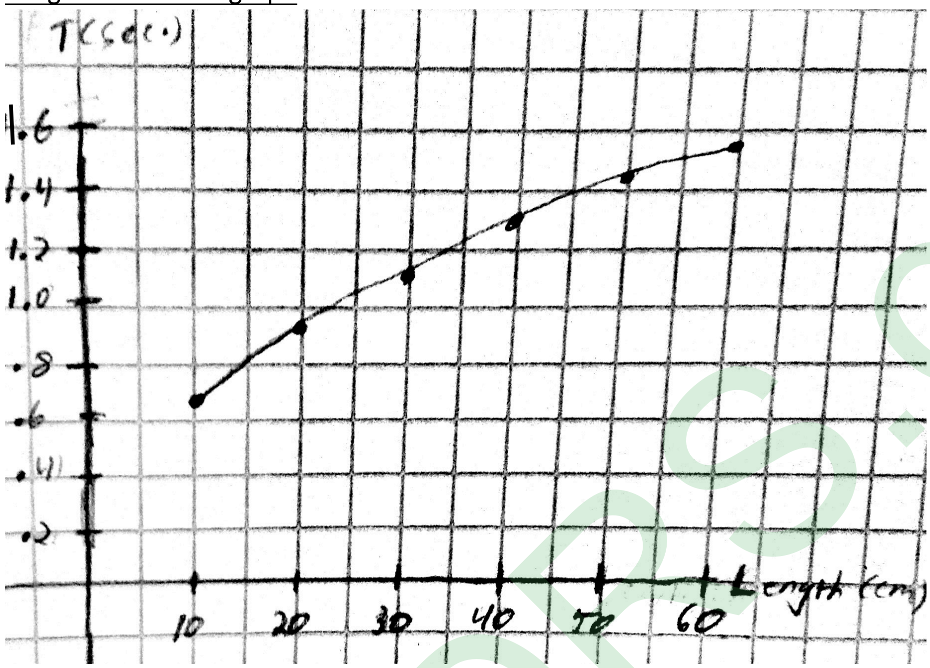
Diagram



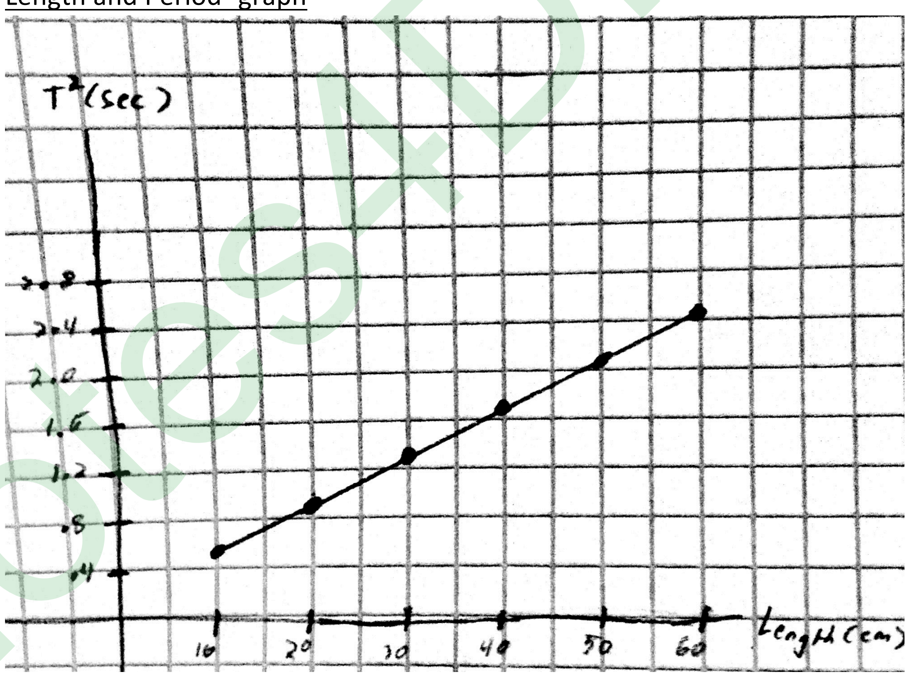
Data

Length (in cm)	Time for 20 swings (in seconds)	T (Time for 20 swings divided by 20)	T^2
10 cm	13.55 s	0.68 s	0.46 s
20 cm	18.30 s	0.92 s	0.84 s
30 cm	22.54 s	1.13 s	1.27 s
40 cm	26.11 s	1.31 s	1.70 s
50 cm	28.53 s	1.43 s	2.03 s
60 cm	31.37 s	1.57 s	2.46 s

- The time value for the 40cm rope is roughly double the time value of the 10 cm rope so it must be that it is square rooted. We balance that out by squaring the T value
- Length and Period graph



- Length and Period² graph



- So based on the Length and T graph a pendulum which is a perfect time piece (i.e. one that takes a second per swing) is around 23 centimeters
- A longer pendulum takes more time, it just isn't directly proportional to time; it is directly proportional to T^2

- g=981 cm/sec
- $T = 2\pi\sqrt{\frac{L}{g}}$
- $T^2 = \frac{4\pi^2 L}{g}$
- $g = \frac{4\pi^2 L}{T^2}$=$\frac{4\pi^2(60)}{(1.57)^2}$=963 cm/sec
- Percent Error: $\frac{981-963}{981}$=1.8%

Conclusions and Discussion of Results

We determined what the value of the acceleration due to gravity on earth using the period of a pendulum.