Period of a Pendulum (Part 1)

Lab Notebook

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Course:	PHYS 13100 2
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A reminder: when completing your lab notebook, it's preferable to answer in short sentences and bullet points rather than long paragraphs. You don't need to use full sentences or any formal format… this record is *for you*, and the TA is just looking for it to be complete.

A note on symbols and equations: Inserting symbols and equations into your notebook is possible, but not always quick and easy (especially if you've never had to do it before). We don't want you to spend a lot of time figuring out formatting when you could be spending that time on physics. So consider the following shortcuts as you fill out your notebook.

-You can insert an equation by selecting "Insert: Equation" from the menu bar
-If you can't find a symbol in the "Insert: Special Characters" menu, then spell then spell the symbol out (for example... pi, delta_x, B_exp, +/-)
-If you need to do a long block of math, it may be quicker to write it out on a piece of paper and take a picture.

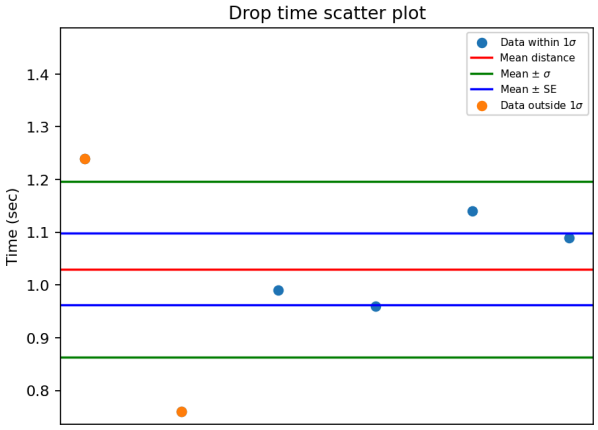
Dropping paper: a quick statistics lesson

Give a short description (1 or 2 sentences) of how you dropped your paper and determined the fall time. Record your data here. What is your answer to "How long does it take for a piece of paper to fall 1 m?"

Table 1: Data for Dropping Paper Experiment

Trials#	*Measurement (s)*
1	*1.24*
2	*0.76*
3	*0.99*
4	*0.96*
5	*1.14*
6	*1.09*
Mean	*1.03 ± 0.24*

We set up the meter stick on a roughly perpendicular surface on top of the table, dropping the paper from the top of the meter stick and then recording the time it takes for the paper to fall onto the table below. We used six trials to determine the mean of the trials to factor in random uncertainties arising from air resistance or the path of the paper.



After the group discussion and after talking to a neighboring group, feel free to revise or add to your answer here. Are you in agreement with the neighboring group? Do you have any ideas for why or why not?

The data we have is not in agreement with neighboring groups. While we got 1.03 s, some groups got 1.32s and 0.63s. This is in a reasonable range since the uncertainty is considerably

big (± 0.24), so as that of the other groups, and the big uncertainty explains the fluctuation of the result.

The period of a pendulum

Record your data, observations, and thoughts here. Include information about your procedure (including pictures), your predicted period, and your values (with uncertainties) for angles $\theta < 10°$.

(Predicted period: 1.23 seconds)

```
# L is the length of your pendulum (in meters)
L = 0.377

# T_predicted is the value of the period predicted from the formula (in seconds)
T_predicted = 2*np.pi*np.sqrt(L/9.81)

print("Predicted Period: T = ", T_predicted, "seconds")
```

```
Predicted Period: T =  1.2317314763581602 seconds
```

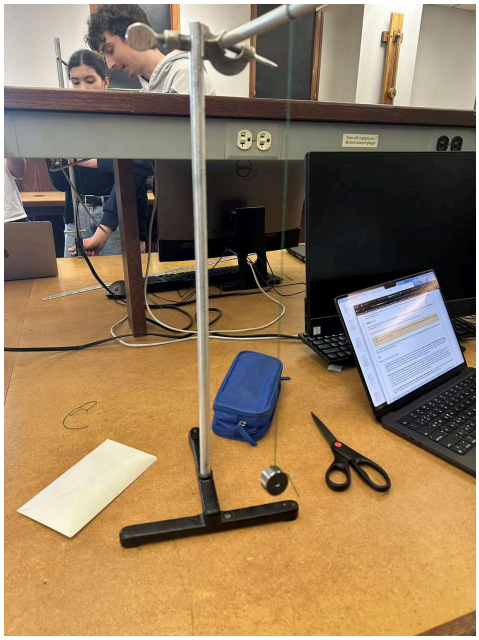
$$T_{predicted} = 2\pi\sqrt{\frac{L}{g}} = 2\pi\sqrt{\frac{0.377}{9.81}} = 1.23\ seconds$$

$$\Delta L = 0.0005$$

$$\Delta T = 2\pi\sqrt{\frac{0.005}{9.81}} = 0.14 \text{ seconds}$$

Table 2: Preparation Data for Pendulum Experiment

Quantity	Measurement
Mass	50.3 ± *0.1 g*
Length	*37.75 ± 0.05 cm*



Procedure:

1. Measure the angle (10, 9, 7, and 5 degrees) from the start of the string using the protractor held against the rod of the pendulum
2. Let go of the weight from the prescribed angle, letting the pendulum oscillate as it is being recorded
3. Using the video, measure the period of the pendulum by using a timestamp to time the recording for one period.

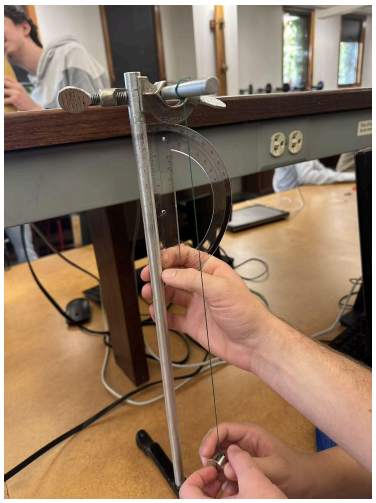


Table 3: Experimental Data for Pendulum Experiment

Angle (° ± 0.5 °)	*Measurements (s ± 0.01s)*	*Means (s ± 0.01s)*
5.0	*1.03*	*1.04*
	1.02	

	1.06	
7.0	*1.09*	*1.03*
	1.01	
	1.00	
9.0	*1.04*	*1.04*
	1.03	
	1.06	
10.0	*1.05*	*1.06*
	1.10	
	1.02	
Mean	*1.04 s ± 0.02s*	

Compare your measured values to the predicted period. Do your periods agree, do they disagree, or is it inconclusive?

$$\frac{A-B}{\sqrt{A^2+B^2}} = \frac{1.23-1.04}{(0^2+0.14^2)^{0.5}} = \frac{0.19}{\sqrt{0.020}} = 1.344$$

It's inconclusive; the difference is probably because there's a force exerted on the pendulum while releasing, causing the period to be shorter than expected.