Lab Report Scoring Rubric

RR03

Lab Report Research Question

What impacts the period of a pendulum?

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Partners:

File Name: RR03_Ryan Keshock - Lab Report 1 Physics 2001030 14SS PROMPT

Total: 57 (out of 72)

Scientific Ability	Score (0-3)	Comments
Title and Abstract		
Is able to write an appropriate and descriptive title.	3	
Is able to write an abstract of 150 words or less.	3	
Is able to write a coherent abstract (with all 4 elements: problem, method, results, conclusions).	2	Not covering all the points
Experimental Design	2	
Is able to identify **hypothesis** tested in the experiment.		Missing Hypothesis
Is able to identify **independent** and **dependent variables**	2	Missing Hypothesis
Is able to identify **control variables** and actual values for which they were held constant if known	2	Missing Hypothesis
Results	2	
Is able to present pertinent data in appropriately labeled data tables.		Data tables are missing
Is able to estimate and include measurement uncertainties in the data table.	3	
Is able to describe process for estimating uncertainties.	3	
Is able to present data in a meaningful way through appropriately labeled graphs (if applicable).	2	Plots are missing
Is able to include error bars on graphs (if applicable).	3	
Discussion and Conclusion	2	

Is able to restate hypothesis for reader clarity.		Missing Hypothesis
Is able to make an ***accurate* and *sufficient* claim** addressing hypothesis. (Makes sense based on results.)	2	Missing Claim
Is able to provide ***genuine* and *sufficient* evidence** that supports claim. (Data is authentic and collection is valid and indisputable.)	2	Missing Claim
Is able to provide adequate ***reasoning*** *or* ***justification*** for *how* evidence supports claim.	2	Missing Claim
Is able to identify random errors and discuss how these were **actively reduced** *during* data collection and/or analysis (or could be reduced next time).	3	
Is able to describe ***how*** random errors may have impacted results.	3	
Is able to identify **systematic errors** (conditions in the physical system or biases in the observational method which shift the results in one direction away from the true value) and discuss ***how*** they may have impacted results (state if none identified).	3	
Is able to identify ***assumptions*** and discuss how these may have impacted claim(s) made.	2	Not suffcient
Is able to identify ***constraints*** or ***limitations*** and discuss how these may have impacted claim(s) made.	3	
Is able to correctly state whether hypothesis was **supported** or **refuted;** and, if applicable, identify new hypothesis to test in future investigations.	2	Mathematical model not justified
References/Grammatical Considerations	0	
Properly cited references are included (if applicable).		References may include other group members readings
Report is organized into clear sections.	3	
Proper use of spelling, grammar, punctuation.	3	

Ryan Keshock

Physics 2001L

Section 030

2/7/2014

The Effect of String Length on the Period of a Pendulum

I. Abstract

There are several factors which affect the period of a pendulum. In our research we studied these factors to discern which caused noticeable change, with a particular focus on the relationship between the length of the pendulum's string and the pendulum's period. To test this relationship we performed a multitude of tests where string length was varied and the length of the period was measured. The results from these tests show that as the length of the string increases, the period also increases. The data also shows an exponential trend in the relationship between string length and period. Therefore, our results support the conclusion that as the length of the pendulum's string increases, the period increases exponentially.

II. Experimental Design

Set 1

Hypothesis:	The period of the pendulum is affected by the length of the string supporting it.
Independent Variable:	Length of String
Dependent Variable:	Period of Pendulum
Control Variables:	Mass of Pendulum (50g) Release Angle (40° Off Vertical)

Set 2

Hypothesis:	The period of the pendulum is affected by the length of the string supporting it.
Independent Variable:	Length of String
Dependent Variable:	Period of Pendulum
Control Variables:	Mass of Pendulum (110g) Release Angle (10° Off Vertical)

III. Results

Collected Data

Dataset 1

Length of String (cm)	**Period of Pendulum (s)**
9 ± 0.2	0.85 ± 0.131
14 ± 0.2	0.99 ± 0.131
19 ± 0.2	1.09 ± 0.131
60 ± 0.2	1.70 ± 0.131
111 ± 0.2	2.22 ± 0.131

52 ± 0.2	1.446 ± 0.131
66 ± 0.2	1.633 ± 0.131
13.5 ± 0.2	0.731 ± 0.131
35.5 ± 0.2	1.2 ± 0.131
88 ± 0.2	1.9 ± 0.131
173.5 ± 0.2	2.653 ± 0.131
200 ± 0.2	2.842 ± 0.131
158.5 ± 0.2	2.533 ± 0.131

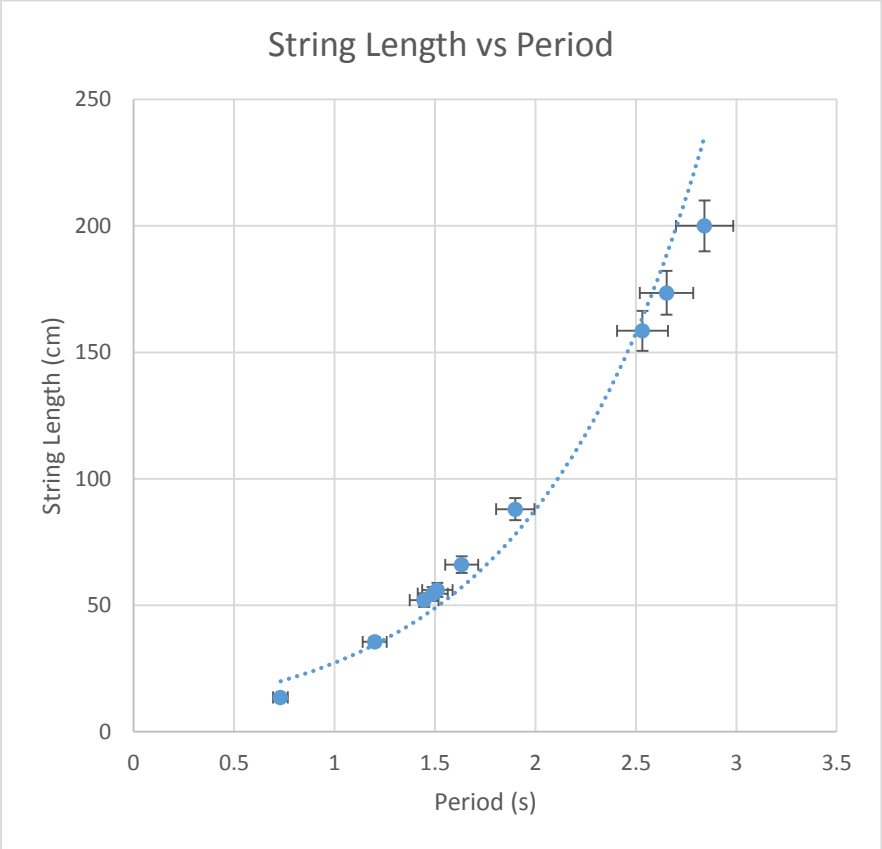
Dataset 2

String Length (cm)	**Period (s)**
56 ± 0.2	1.512 ± 0.131
54.5 ± 0.2	1.489 ± 0.131

Uncertainty of string length is estimated to account for use of a meter stick

Uncertainty of time is standard error calculated from five trials with four measurements per trial

Graph of Data from Set 2



IV. Conclusion and Discussion

When beginning testing, we hypothesized that the period of the pendulum is affected by the length of the string supporting it. Through testing, the conclusion was reached that the period of the pendulum is directly proportional to the length of the string and that it follows an exponential model. The data supports this claim in every way – our recorded data shows that there is a clear trend between the increase of the length and the increase of the period. This trend was evident every time the experiment was done, with no trials showing the opposite to be true. We can postulate that the

relationship between these values is exponential in nature by graphing recorded data and fitting a trendline to the resulting data points. Doing this shows a reasonably clear relationship without significant outliers, and as such it is reasonable to believe that data taken far outside either boundary would agree with this relationship.

The results given could be a victim to random error, and as such be slightly offset in either direction. This random error could be a result of the measurements taken with stopwatches, as any visual measurement is bound to be off at least a small amount. The random error in the second set of data is significantly less, as the period was measured by a sensor instead of people. The random error of this experiment does not affect the results much, as it does not result in any significant outliers and does not alter the trend.

When doing tests we did run into a small amount of systematic error where the length of the string in dataset 2 was measured to the top of the pendulum instead of to its center of mass. To account for this we increased all the measured lengths by 8.5 cm. This measurement error would have made all the periods be longer than they should have been with the given data. This does not affect our claim because although the periods may not match the string lengths exactly, the general trend of each variable to increase is preserved.

Our results may have been colored by the assumption that the pendulum's mass was marked accurately, but this should not affect our results as the mass of a pendulum has no bearing on its period.

Constraints that may have presented issues to our setup are that we could not use lengths over roughly 200 cm, and could not reliably measure the period for extremely short lengths. This means that although our model can be extrapolated to these extreme values, we cannot say with 100% accuracy that the model will be followed at these lengths.

In conclusion, the data obtained through experimentation supports our initial hypothesis that period increases as string length increases.