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Pendulum Lab

Author:
Team Members:
Date of Experiment:
Date Report Submitted:
Class:

Purpose:
The purpose of this experiment is to determine the factors that influence the period of this pendulum. It is also to learn about how to devise an experiment that only test one variable at a time, how to collect data and how to organize and draw data tables in lab journals.

Background:
A pendulum is a weight suspended from a pivot so that it can move freely. When a pendulum is placed somewhere above resting point, it is subject to a restoring force that will swing it back and forth. In the past, predating the pendulum and drenching rods were employed to discover where water, oil or minerals existed underground. The period of a pendulum is the time (in seconds) that it takes for the pendulum to take one full swing. In the experiment, the pendulum swings five times then the timers stop the timer. After that they calculate the time of one swing. They do this because it allows getting a more accurate and exact time.

This detail belongs in Procedure

This experiment involves using a pendulum to determine the factors that influence the period of this pendulum. A model experiment would be to have someone hold the pendulum at the decided angle on the decided length of string and when the timer announces go, let the pendulum swing five times. After it swings five times, the timer will stop the clock then calculate the time it took the pendulum to swing once. Our groups hypothesis was that the weight of the washers, the length of the string and the starting angle will all affect the outcome of the experiment.

Experimental Procedure:
Equipment and materials used in the experiment were as follows:
Washers (4)
String (1)
Protractor (1)
Table (1)
Ruler (1)
Timer (phone) (1)

The amount of washers being used in the section of the experiment would be tied to the string. In the first part of the experiment, only one washer is used, which is the smallest pendulum mass. The string would be hung down from a ruler that is placed on a table. This prevents the string from moving any way other than swinging from where we dropped

it. The protractor is used to get the correct starting angle for the experiment. The first step is to just to get the period for one washer, with a small string and a small angle. To get a precise time, the person that is holding the washer will count the washers swing and once it has swung five times, they will say stop and the timer will stop the time. Then they can divide that time by five and get the time it takes it to swing once. Then you repeat that three times and average the times that it takes one washer with a small string and a small angle to swing once. Next, you make the string a medium length and keep all of the other variables the same and you repeat the same process to get the average period of the washer swinging once. Then you make the string the large length, still keeping all the other variables the same. You repeat the process of finding the average period again. Next, you go back to a small length of the string, but you change the small starting point angle to the medium staring point angle. Then you test the medium string with the medium angle and the large string with the medium angle. Lastly, you test the small, medium and large string length with the large angle. Then, after all of these results are found and recorded, you will repeat the entire process with two washers, then with four washers.

Results:

In these tables, there are the average times that the washer(s) took to swing once, depending on the stating angle and string length. These tables assist us in interpreting what variables affect the period of the washers.

Table 1. Period for 1 Washer with a Small Starting Angle

Amount of Washers	String Length	Angle of Starting Point	Average Time of One Swing
1	20 Inches	20 Degrees	.800 seconds
1	40 Inches	20 Degrees	1.24 seconds
1	60 Inches	20 Degrees	1.60 seconds

Table 2. Period of Washer with a Medium Starting Angle

Amount of Washers	String Length	Angle of Starting Point	Average Time of One Swing
1	20 Inches	40 Degrees	.990 seconds
1	40 Inches	40 Degrees	1.27 seconds
1	60 Inches	40 Degrees	1.65 seconds

Table 3. Period of Washer with a Large Starting Angle

Amount of Washers	String Length	Angle of Starting Point	Average Time of One Swing
1	20 Inches	60 Degrees	1.20 seconds
1	40 Inches	60 Degrees	1.30 seconds
1	60 Inches	60 Degrees	1.70 seconds

The tables are not well organized, which makes it difficult to compare results.

Table 4. Period of 2 Washers with a Small Starting Angle

Amount of Washers	String Length	Angle of Starting Point	Average Time of One Swing
2	20 Inches	20 Degrees	1.10 seconds
2	40 Inches	20 Degrees	1.30 seconds
2	60 Inches	20 Degrees	1.70 seconds

Table 5. Period of 2 Washers with a Medium Starting Angle

Amount of Washers	String Length	Angle of Starting Point	Average Time of One Swing
2	20 Inches	40 Degrees	1.06 seconds
2	40 Inches	40 Degrees	1.29 seconds
2	60 Inches	40 Degrees	1.79 seconds

Table 6. Period of 2 Washers with a Large Starting Angle

Amount of Washers	String Length	Angle of Starting Point	Average Time of One Swing
2	20 Inches	60 Degrees	1.10 seconds
2	40 Inches	60 Degrees	1.33 seconds
2	60 Inches	60 Degrees	1.75 seconds

Table 7. Period of 4 Washers with a Small Starting Angle

Amount of Washers	String Length	Angle of Starting Point	Average Time of One Swing
4	20 Inches	20 Degrees	0.970 seconds
4	40 Inches	20 Degrees	1.21 seconds
4	60 Inches	20 Degrees	1.61 seconds

Table 8. Period of 4 Washers with a Medium Starting Angle

Amount of Washers	String Length	Angle of Starting Point	Average Time of One Swing
4	20 Inches	40 Degrees	1.02 seconds
4	40 Inches	40 Degrees	1.24 seconds
4	60 Inches	40 Degrees	1.67 seconds

Table 9. Period of 4 Washers with a Medium Starting Angle

Amount of Washers	String Length	Angle of Starting Point	Average Time of One Swing
4	20 Inches	60 Degrees	.990 seconds
4	40 Inches	60 Degrees	1.31 seconds
4	60 Inches	60 Degrees	1.68 seconds

Discussion:

The challenge of this experiment is to test only one variable at a time. To do this we had to take many different tests and try to eliminate as many lurking variables as possible. We had to manipulate the length of the string, the starting angle and the amount of washers to determine if they had any effect on the period of the pendulum. Our original hypothesis was that the weight of the washers, the length of the string and the starting angle would all affect the outcome. However, after testing each variable by itself, the data causes us to come to the conclusion that only the length of the string and the starting angle majorly affects the period of the pendulum. This is shown in our data because when the length of the string would change, the time the washer took to swing changed. An example of this is in table 1, when the length of the string changed from twenty to sixty inches, the period of the washer became 0.44 seconds longer. Also, when the length of the string changed from forty inches to sixty inches, the period of the washer 0.360 seconds longer. Therefore, when the string was made longer, then the time it took to swing was longer. In the same way, if the starting angle was made larger, the time for the washer to swing was longer. This is shown in tables 1 and 2 because when the angle changed from 20 degrees to 40 degrees and the length of the string length was the same in both, the average time of a swing for the 40-degree angle was slightly greater. I came to the conclusion that the washers don't affect the experiment majorly because our data shows that the amount of washers being used did not affect the time very significantly. This is shown in the data in tables 3 and 6. In both tables, it has a 60-degree starting angle, and the length of the string is 20 inches. However, one has 1 washer and one has 2. The difference in the periods is extremely slight and the period of one with one washer is the greater period. This is what led me to believe that either the amount of washers used doesn't affect the period greatly of in our experiment or we made errors.

Conclusion:

Our results were not very definitive because some of the date we have recorded makes sense with what is logically correct, however some of our data was affected by mistakes that can affect our interpretation of the data. Some problems we faced throughout the experiment were nudging the string with our hand and getting precise times on the timer. Perhaps next time we can use more precise timers to insure the accuracy of our calculations. In conclusion, our data tells us that the length of the string and the starting angle majorly affects the period of the pendulum.

References:

Mays, John D. The Student Lab Report Handbook. Austin: Novare Science and Math, 2014. Print.

past tense

data do not support this. No consistent increase in period w/ increased angle.

But the other tables show there is no trend

majorly is not a word.

data is plural

1tal.