Does changing the length and the mass of a pendulum can change the period at which the pendulum swings?

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Abstract

How length and mass of the pendulum can change period in which it swings. Pendulum is small weight hanging and swinging at predetermined amplitude. In my experiment I changed two main parts, first was length of the rope and second was changing weight. To build pendulum I used improvised materials. After I found what I needed I started. Changing length of the rope effected on a data a lot, but changing weight haven't showed any difference, it was the same. Most probably number was changing, but it was too small.

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Introduction

Pendulum is an object, which swings from side to side in a regular periodic motion. Pendulum needs initial force in order to move which is added while pulling and letting it go and pulling have angle. In this experiment we keep angle constant and change the length and weight of the pendulum. Period of a pendulum is the time required for one complete cycle, which is the time that it goes and comes back. According to theory, period of a pendulum is dependent on its length rather than the weight and in this experiment we find out about the effect of length on the period and independence of weight. Because of using acceleration of gravity, the period becomes in the limit of zero amplitude that becomes less accurate as the amplitude of the motion increases.

Materials

- Rope
- Scissors
- Coconut shell (As a weight)
- Little rocks
- Rulers

To build my pendulum I used long rope to hang weights, scissors to cut the rope, container to put weight inside. I had two experiments, in first I changed length of rope and second where I was changing weight.

Variables

First part with difference in the weight:

Independent variable: length of the rope

Controlled variable: time , degree of angle

Dependent variable: weight of the pendulum

Second part with difference in length of the rope:

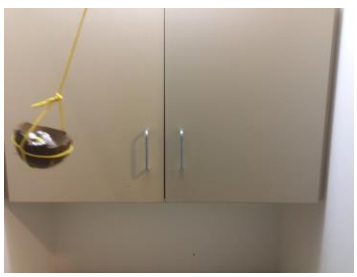
Independent variable: weight of the pendulum

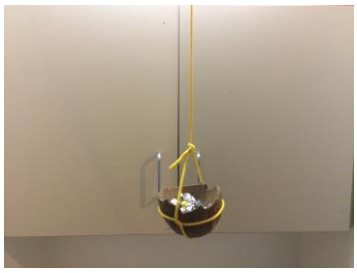
Controlled variable: Time, degree of angle

Dependent variable: length of the rope

Method

In my experiment I needed to do 2 experiments, first with different weight and second different length of the rope. For the both of them I pulled coconut shell on right side (20 °) and putted 10 seconds on timer, during this 10 seconds I counted oscillation. Below you can see pictures of how it was moving to the sides.



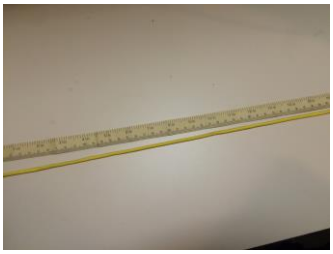
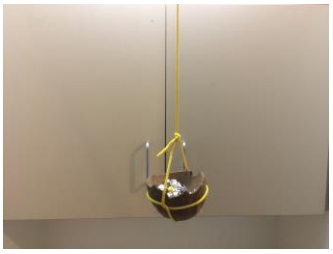


Procedure

I started from collecting all materials for experiment. After I found everything I needed to build pendulum I started.

1. I had two parts of experiment, so I started experiment with changing weight.
2. I took rope and measured 0.75m
3. I attached it to ceiling
4. I used coconut shell to put weight inside
5. I used special knot to attached coconut shell
6. Then took weight and putted it in coconut shell
7. I pulled coconut on right side (20 °)
8. Used timer to count down 10 seconds
9. At the same time was counting how much weight moved (Oscillation)
10. Putted collected data in table
11. Then I added 100 grams
12. Repeated 6 times
13. Started second part of experiment with changing length of the rope
14. I took coconut shell and putted needed weight
15. Then I measured 0.5 m of rope
16. Attached weight to rope
17. I pulled coconut on right side (20 °)
18. Used timer to count down 10 seconds
19. At the same time was counting how much weight moved (Oscillation)
20. Putted collected data in table
21. Then I added 0.1 m of rope
22. Repeated 6 times

23. Finished experiment, cleaned everything
24. Putted data in table
25. By using data in the table created graphs


Data presentation

I this tables I have data which I collected from my experiments. In the middle line I have constant number. On the left line I have Length and Mass which are changing. On The right side I have data which I have got from experiment.

Mass	Length	Oscillation
1	0,75	5,75
1,1	0,75	5,75
1,2	0,75	5,75
1,3	0,75	5,75
1,4	0,75	5,75
1,5	0,75	5,75

Length	Mass	Oscillation
0,5	1,25	7,04
0,6	1,25	6,45
0,7	1,25	5,95
0,8	1,25	5,59
0,9	1,25	5,26
1	1,25	4,97

Data Analysis

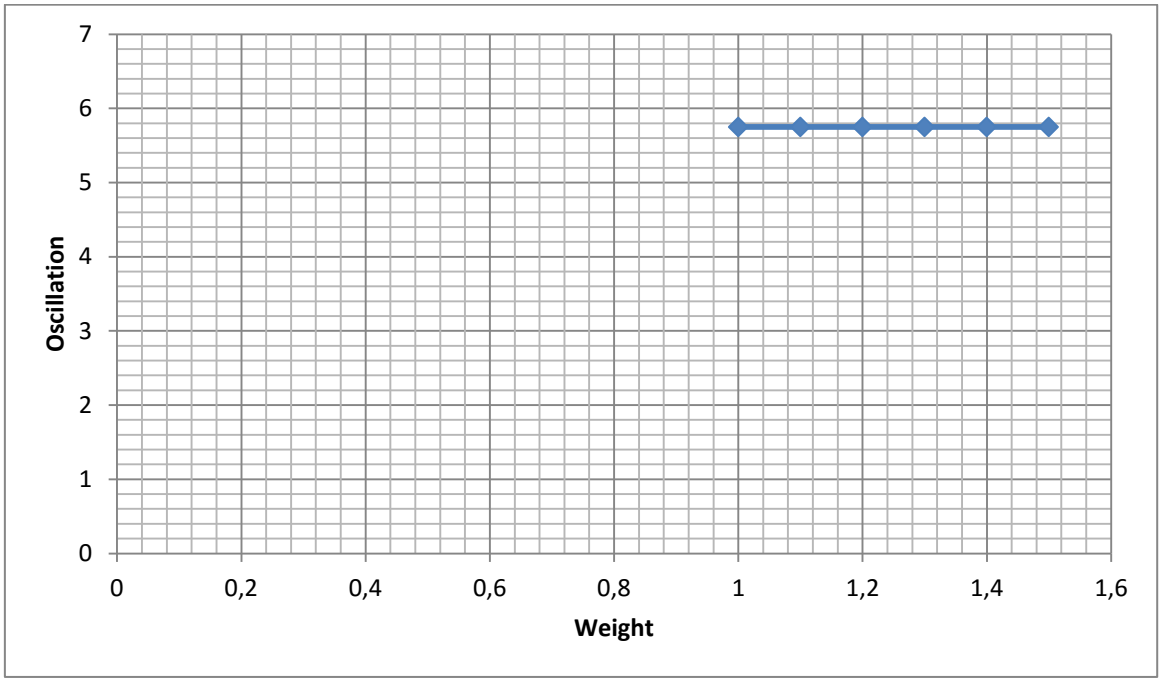
The graphs below are created based on the tables above. My first graph is about how changing of weight changing oscillation, but in my data I understood that changing of weight does not affect oscillation. There is why data in the table is not changing and on the graph it is shown as a straight line with slope of zero. As we see in the second graph, the length of the rope affects the oscillation. On the graph we can see how oscillation is going down from 7.04 to 4.97 while the length is increasing from 0.5 to 1.

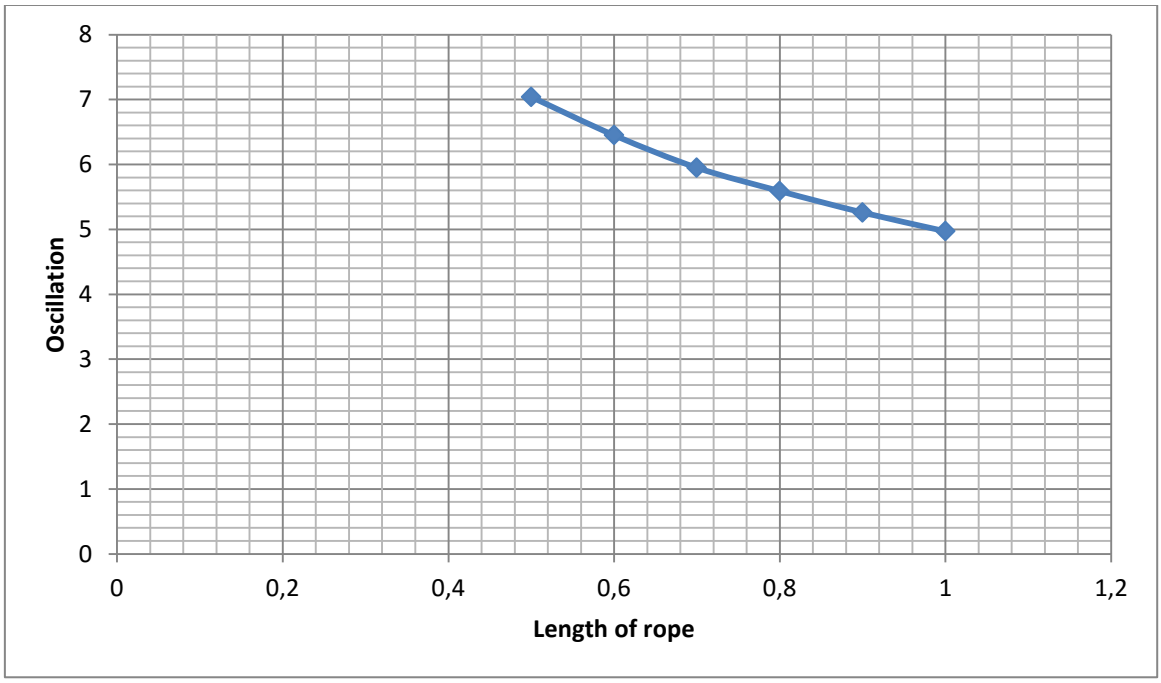
$$T = 2\pi\sqrt{\frac{L}{g}}$$

L= Length of the rope

g = Gravity

I have used this formula to calculate the oscillation.


Oscillation
0
1
2
3
4
5
6
7
0
0,2
0,4
0,6
0,8
1
1,2
1,4
1,6
Weight


Oscillation
0
1
2
3
4
5
6
7
8
0
0,2
0,4
0,6
0,8
1
1,2
Length of rope

Conclusion

In conclusion I founded that by changing length of the rope can change the pendulum's period in which it swings, but also I founded that changing of weight in pendulum didn't effect on a period in which it swinging, because to have visible difference I needed to have bigger weight maybe longer rope. There is why my graph showing just a straight line.

Suggested improvements

To improve this experiment I suggest to use precision instruments to measure weight of coconut shell and measure exact length of the rope, because by using items which I had I could make little mistakes in measurement. Also ask someone to help with a timer, because it was difficult to start a timer, pull and count at the same time.

Bibliography

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