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# The Plot & the Pendulum Lab

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A pendulum is any mass that swings back and forth on a rope, string, or chain. Pendulums can be found in old clocks and other machinery. A playground swing is a pendulum. Many amusement park rides are pendulums.

     If you pull the mass away from its rest position, so that the string is at an angle, and then let go, the mass will begin to swing back and forth. One trip back and forth is called a period. How fast the pendulum swings back and forth can change.

**Problem**: What variables affect how fast a pendulum swings?

For this lab you will investigate two possible factors that affect the speed of a pendulum. There are two separate experiments, graphs, data charts, & hypothesis. Your conclusion will need to include both hypotheses.

**Materials:**

|  |  |  |
| --- | --- | --- |
| String 60 cm long | Paperclip | Ruler |
| 3 washers | Pencil | Masking Tape |

**Variable #1**: Does the length of string determine how fast a pendulum swings?

**Hypothesis**:

If the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the independent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the dependent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name two controlled variables. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Procedure:**

1. Cut a piece of string to 52 cm.
2. Tie a paperclip to one end of the 52 cm string
3. Tape a pencil to the end of the table.
4. Tie the other end of the string to the pencil.
5. Tape the string in place with a small piece of masking tape.
6. Hang three metal washers on the paperclip.
7. Raise the washers to a medium height and let go.
8. Start the stopwatch
9. Count the number of times the pendulum makes a complete trip (a period) in 10 seconds.
10. Record your results in your data table.
11. Repeat this experiment for 5 more trials.
12. Cut the string away from the pencils and paper clip. and throw away.
13. Cut the string down to 42 cm/ Repeat steps 2-12
14. Cut the string down to 32 cm. Repeat steps 2-12.
15. Cut the string down to 22cm. Repeat steps 2-12
16. Cut the string down to 12cm. Repeat steps 2-12
17. Repeat steps 2-10 with the 32 cm, 22 cm and 12 cm string

# Data

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **How many periods in 10 seconds?** | **Length of string** | | | | |
| **50 cm** | **40cm** | **30cm** | **20cm** | **10cm** |
| **Trial 1** |  |  |  |  |  |
| **Trial 2** |  |  |  |  |  |
| **Trial 3** |  |  |  |  |  |
| **Trial 4** |  |  |  |  |  |
| **Trial 5** |  |  |  |  |  |
| **Average** |  |  |  |  |  |

**Graph:** *Construct a* ***line graph*** *showing the length of string vs. the average number of swings.*

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**Analysis:**

1. What was the independent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What was the dependent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What relationship occurred between the independent variable & the dependent variable? Was it a **Positive relationship (***When one variable increases the other variable increases*.) or was it a **Negative relationship** (*When one variable decreases the other variable increases.*)

(circle the words so that it describes your graph.)

As length (increased / deceased), speed (increased / decreased).

This is a (positive / negative / neutral) relationship

**Conclusion:**

1. Restate the problem in your own words (What did you want to know?) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Restate your hypothesis: (What was your prediction?) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. How did you test your hypothesis? (What experiment did you do?) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What was the independent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. What was the dependent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. What are three variables you controlled (kept the same)? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Does the data support your hypothesis? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Use the data to explain your answer to the question above. (Use the averages to explain why your hypothesis (prediction) was correct or incorrect.) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Did you or your partner notice any variables that could have affected the outcome of your experiment? (Sources of error.) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. What other experiments could you do with pendulums? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

