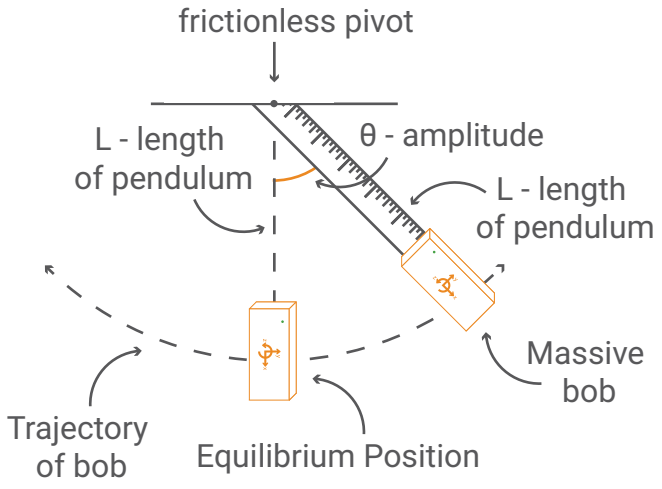
Simple Pendulum Motion

Exploration

A simple pendulum consists of a mass, m, hanging from a string of length, L, and fixed at a pivot point, P. When displaced from equilibrium and to an initial angle (amplitude, θ) and released, the motion will be regular and repeat. This is an example of periodic motion.

Materials

- PocketLab
- Meter stick
- A set of various masses
- Protractor



Objective

In this experiment, students will:

1. Use PocketLab's accelerometer and the scientific method to discover what variables affect the period of the pendulum.
2. Explain why certain variables affect the period of the pendulum and certain variables do not.

Method

Note: For this lab it will be especially important to conduct multiple trials.

1. Attach PocketLab to the bottom of the meter stick.
2. Move PocketLab to a specific amplitude (measured with the protractor), keeping the tension and release.
3. Record with the acceleration graph.
4. Test how the length of the pendulum, L, affects the period by changing the position of the PocketLab on the meter stick.
5. For each test of different length, move the PocketLab up the meter stick 15 cm. Because the PocketLab is the bob in the pendulum set-up, this will effectively change the length of the pendulum. Repeat steps 2 and 3 while keeping the amplitude, θ, and the mass, m, constant.
6. Test how the amplitude, θ, affects the period by changing the amplitude from which the mass is released, while keeping the pendulum length, L, and the mass, m, constant.
7. Move the PocketLab to the specific amplitude being tested and release.
8. Record with the acceleration graph.
9. Test how the mass, m, affects the period by adding different masses to the PocketLab while keeping the amplitude, θ, and the pendulum length, L, constant.
10. Move the PocketLab to the specific amplitude, keeping and release.
11. Record with the acceleration graph.

Predictions

- How do you think changing the length of the pendulum will affect the period of the pendulum? Will it increase decrease, or stay the same? Explain.
- How do you think changing the initial angle of the pendulum will affect the period of the pendulum? Will it increase or stay the same? Explain.
- How do you think changing the mass of the pendulum will affect the period of the pendulum? Will it speed up, slow down, or stay the same? Explain.

Data Analysis and Observations

- For the different pendulum lengths, examine the data from all the trials and the averages of each trial. How did the length of the pendulum affect the period of the pendulum? Use data to support your answer.
- For the different initial angles, examine the data from all the trials and the averages of each trial. How did the initial angle affect the period of the pendulum? Use data to support your answer.
- For the different masses, examine the data from all the trials and the averages of each trial. How did the length of the string affect the period of the pendulum? Use data to support your answer.

Conclusions

- How accurate were your predictions compared with your observations? How were they similar or different?
- Which variable (pendulum length, initial angle, or mass had the greatest effect on the period of the pendulum? Support your answer with data you gathered during the experiment.
- Explain why you think the variable from the previous question had the greatest affect on the period of the pendulum.