

The Pit and the Pendulum Experiment

You just watched a dramatic interpretation of the Edgar Allen Poe story, *The Pit and the Pendulum*. It is about a man who is tortured during the Spanish Inquisition. As he lay strapped to a wooden board, a razor-sharp pendulum slowly drops from the ceiling of his cell and inches closer and closer to his chest.

Today you be performing a simple experiment with a pendulum to recreate the event that brought horror to the prisoner.

A pendulum is any mass which swings back and forth on a rope, string, or chain. Pendulums can be found in old clocks and other machinery. A playground swing is another example of a pendulum.

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. The length of time it takes the mass to swing all the way over an back, once, is called the **period** of the pendulum.

Here's a list of what you need for your group's experiment:

1. 3 lengths of string
 - a. 100 cm
 - b. 50 cm
 - c. 25 cm
2. 3 equal mass weights
3. Tape
4. A protractor
5. Pencil/paper to record data
6. A stop watch

You will be collecting data from your experiments and using the formula:

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

where T=period, L=length of string in meters, g=gravity.
Gravity on earth is constant and is 9.8m/s².

Use the formula $T = 2\pi\sqrt{\frac{L}{g}}$ to determine the period of a pendulum with a string

(SHOW ALL WORK)

a. 100 cm.

b. 50 cm.

c. 25 cm.

Now find the period experimentally by using your string and 3 masses.

Draw the weight back to your desired angle, and allow it to swing for five (5) full periods (over and back, 5 times). Time how long it takes to do this. Divide your answer by five to get the time for one full period.

Repeat this process two more times. **Don't forget to divide by 5 each time...** we want **one** period. Average your answers.

RECORD YOUR DATA ON THE NEXT PAGE

100 cm string

Trial 1: Time for 5 periods _____

Time for 1 period _____

Trial 2: Time for 5 periods _____

Time for 1 period _____

Trial 3: Time for 5 periods _____

Time for 1 period _____

AVERAGE OF ALL THREE TRIALS: _____

50 cm string

Trial 1: Time for 5 periods _____

Time for 1 period _____

Trial 2: Time for 5 periods _____

Time for 1 period _____

Trial 3: Time for 5 periods _____

Time for 1 period _____

AVERAGE OF ALL THREE TRIALS: _____

25 cm string

Trial 1: Time for 5 periods _____

Time for 1 period _____

Trial 2: Time for 5 periods _____

Time for 1 period _____

Trial 3: Time for 5 periods _____

Time for 1 period _____

AVERAGE OF ALL THREE TRIALS: _____

How does your experimental period data compare to that of the theoretical period data?

What do you think may have been some sources of error for your data?

Find the theoretical period of a pendulum with length of:

- a. 5.3 meters

- b. The prisoner in the story concluded that the ceiling of his cell was roughly 35 feet high. What would be the period of his terrorizing pendulum if 1 foot = .305 meters.

Challenge:

The largest pendulum in the U.S. has a period of 9.274 seconds. How long is the pendulum cable?

Grandfather clocks typically keep time by having a pendulum swing with a period of exactly 1 second. If my grandfather clock was running slow and had a period of 1.4 seconds, by how much should I shorten the pendulum?