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Swing

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Do you need an idea for a scientific study? Try out one of our ideas or make one of your own.

Swing back and forth. To many, watching the movement of a pendulum is hypnotic. Take the following brief quiz to see how much you already know about pendulums. See the bottom of page 4 to check your answers.

1. In what year was the first pendulum clock built?
   a. 1492
   b. 1515
   c. 1656
   d. 1708

2. Evidence that Earth was *not* a perfect sphere was supported using a pendulum clock.
   a. true
   b. false

3. The creation of the first pendulum clock changed the accuracy of existing mechanical clocks from deviating by 15 minutes each day to:
   a. 5 minutes each day.
   b. 2 minutes each day.
   c. 1 minute each day.
   d. 15 seconds each day.

4. Galileo's interest in experimenting with pendulums was spurred when he watched a bird sway back and forth.
   a. true
   b. false

5. The San Francisco Airport architects designed their building with frictional pendulums to protect the buildings from earthquake damage.
   a. true
   b. false

Bowling Pendulum

Galileo was one of the first people who experimented with pendulums. Although he tried, he was unable to develop a working pendulum clock. In this investigation, you'll create a pendulum of sorts that you can use to study one aspect of pendulums.

Materials Required
stopwatch or watch with second hand
large round glass or metal bowl
water

Procedure

1. Make sure to get permission to complete this investigation.
2. Place the large round bowl on a flat, stable surface such as a kitchen counter.
3. Hold the marble against the edge of the bowl about ¼ of the way from the bottom of the bowl.
4. At the same time, release the marble and start the stopwatch.
5. Note and record in Table 1 the length of time for the marble to make one complete back and forth motion (this is called one cycle).
6. Hold the marble against the edge of the bowl about ½ of the way from the bottom of the bowl.
7. Repeat the experiment.
8. Collect data for releasing the marble ¾ of the way from the bottom and at the top of the bowl. Record your data in Table 1.

Table 1. Experimental Results

Experiment	Length of Time to Complete One Cycle (seconds)
Marble released ¼ way from bottom	
Marble released ½ way from bottom	
Marble released ¾ way from bottom	
Marble released at top edge	

Questions

1. What variable were you changing in this investigation: length, mass, or release angle of the "pendulum"?

2. Describe how the "pendulum" in this investigation differs from a real pendulum.

3. What was the length of your "pendulum"?

4. Construct an explanation for the results of your investigation.

Swing

The Foucault Pendulum

Pendulums were used to help determine that the shape of Earth was not a perfect sphere but was slightly bulged at its equator. This shape is known as an oblate spheroid. Pendulums were also used to help show the rate of Earth's rotation on its axis. In 1851, the French physicist, Leon Foucault used a pendulum to provide the first direct evidence that Earth rotated on its axis.

He suspended a 28-kilogram lead mass with a 67-meter-long cable from the dome of a cathedral in Paris. The extreme length of the cable caused the pendulum to have a long period and continue moving for an extended length of time. Although his pendulum would take one day (about 24 hours) to appear to rotate in one complete circle at the North or South geographic poles, his pendulum located in Paris took almost 32 hours making one clockwise rotation. This length of time was due to Paris being located at a latitude of about 48 degrees north.

Foucault's pendulum was not rotating clockwise during the course of one day. Instead, Earth was rotating counterclockwise under the free-swinging pendulum. Since no motors or drives were employed to supply energy to keep the pendulum moving, the pendulum would have to be relaunched periodically once the motion of the pendulum bob was reduced due to air resistance and internal friction of the fixed point. To avoid any unwanted sideways motion of the bob during launch, a rope was tied to the bob when displaced to its launch point and a flame was used to burn through the rope and release the bob.

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Answers: Page 2 Answers: 1) c, 2) a, 3) d, 4) b (it was from watching a chandelier swing back and forth), 5) a. **Page 3 Answers:** Bowling Pendulum 1) The release angle was tested. 2) No string and no fixed point. 3) The radius of the round bowl. 4) Answers will vary. Photo by Rémih, 2011.