

# Period of the Pendulum

**Grades:** 9<sup>th</sup> -12<sup>th</sup>

**Duration:** 50 minutes

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## Program Description

Perform experiments to gain an understanding of the variables that influence the period of the pendulum. The mass of the bob, the pendulum's initial angle, and the length of the pendulum will be adjusted, and data will be collected to measure the time between pendulum swings.

## Louisiana GLE:

### Grade 9-12 Science as Inquiry

1. Write a testable question or hypothesis when given a topic (SI-H-A1)
3. Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls (SI-H-A2)
4. Conduct an investigation that includes multiple trials and record, organize, and display data appropriately (SI-H-A2).
6. Use technology when appropriate to enhance laboratory investigations and presentations of findings (SI-H-A3).
9. Write and defend a conclusion based on logical analysis of experimental data (SI-H-A6)
11. Evaluate selected theories based on supporting scientific evidence (SI-H-B1)
15. Analyze the conclusion from an investigation by using data to determine its validity (SI-H-B4)
16. Use the following rules of evidence to examine experimental results:
  - (a) Can an expert's technique or theory be tested, has it been tested, or is it simply a subjective, conclusive approach that cannot be reasonably assessed for reliability?
  - (b) Has the technique or theory been subjected to peer review and publication?
  - (c) What is the known or potential rate of error of the technique or theory when applied?
  - (d) Were standards and controls applied and maintained?
  - (e) Has the technique or theory been generally accepted in the scientific community? (SI-H-B5) (SI-H-B1) (SI-H-B4)

### Physical Science

1. Measure the physical properties of different forms of matter in metric system units (e.g., length, mass, volume, temperature) (PS-H-A1)
2. Gather and organize data in charts, tables, and graphs (PS-H-A1)
29. Differentiate between mass and weight (PS-H-E1)
40. Demonstrate energy transformation and conservation in everyday actions (PS-H-F2)

### Physics

7. Relate gravitational force to mass and distance (PS-H-E1)
17. Analyze simple harmonic motion (PS-H-E3)

19. Explain quantitatively the conversion between kinetic and potential energy for objects in motion (e.g., roller coaster, pendulum) (PS-H-F1)

### **Grade 9 Math**

4. Distinguish between an exact and an approximate answer, and recognize errors introduced by the use of approximate numbers with technology (N-3-H) (N-4-H) (N-7-H)  
28. Identify trends in data and support conclusions by using distribution characteristics such as patterns, clusters, and outliers (D-1-H) (D-6-H) (D-7-H)

### **Key Terms**

**Frequency:** the number of cycles or completed alternations per unit time of a wave or oscillation.

**Pendulum:** A body suspended from a fixed support so that it swings freely back and forth under the influence of gravity, commonly used to regulate various devices, especially clocks.

**Period:** the duration of one complete cycle of a wave or oscillation; the reciprocal of the frequency.

### **Connections to Permanent Exhibits:**

**Water Table:** Play with a set of enclosed spray jets and an open expanse of flowing water.

**Anderson Family Foucault Pendulum:** Watch the pendulum. It knocks down a mallet every 15 minutes. Name two other things a pendulum can do besides tell time.

### **Web Resources:**

**MyPhysicsLab – Simple Pendulum:** A Java simulation which shows a simple pendulum operating under gravity. You can change parameters in the simulation such as mass, gravity, and friction. You can drag the pendulum with your mouse to change the starting position. You can even see the math! <http://myphysicslab.com/pendulum1.html>

**A Virtual Museum of Science, Technology and Culture: The Pendulum:**  
<http://muse.tau.ac.il/museum/galileo/pendulum.html>

**The Foucault Pendulum:** the physics (and math involved from the University of New South Wales in Sydney, Australia. <http://www.phys.unsw.edu.au/~jw/pendulumdetails.html>

### **Pre-Visit Activities:**

#### **Pendulums Make It Swing-Zoom by WGBH**

Have your students take a tour of pendulums and try the various experiments on this website. As they are doing the experiments, have the students make a list of the things that affect a pendulum.

This interactivity is found on-line at

<http://pbskids.org/zoom/games/pendulum/index.html>

### **Post-Visit Activities:**

#### **Hooke's Law Problem-WebPhysics**

This is an interactive experiment using a spring and ball system where the students can calculate the mechanical equilibrium of the system, find the mass of the ball and the natural length of the spring.

This interactive problem is found on-line at

[http://webphysics.davidson.edu/mazur/ch9/ex9\\_3.html](http://webphysics.davidson.edu/mazur/ch9/ex9_3.html)