

SCIENCE MUSEUM OF VIRGINIA

Foucault Pendulum

What is it?

A Foucault Pendulum is a pendulum designed to show that the Earth rotates on its axis.

Why is it called a Foucault Pendulum?

It is named after Jean Bernard Leon Foucault. He set up such a pendulum in the Pantheon in Paris in 1851. His pendulum was 220 feet long and weighed 61 pounds. Witnesses were invited to come and watch the Earth rotate under the pendulum. At the time, the experiment caused great excitement. Though most people believed the Earth rotated, no one before Foucault had actually demonstrated it in a direct way.

How does the Foucault Pendulum show that the Earth rotates?

The pendulum swings back and forth in a straight line and knocks down the pegs as the Earth rotates on its axis. All the pegs are set up each morning and are knocked down in sequence as they rotate with the Earth under the straight line swing of the pendulum's path.

More than 200 years before Foucault's experiment, Galileo stated that if all causes of a change in motion were removed, a body in motion in a straight line, such as a pendulum, would remain in motion along the same straight line. Thus, without an external force the pendulum's direction will not change.

As air resistance slows the pendulum down, a small magnetic push is carefully given at each swing by a magnet near the top to keep it swinging. This does not affect the pendulum's direction.

If such a pendulum were set up at the North Pole, the Earth would turn eastward (counterclockwise), completely around under it, in one day. From the moving Earth the pendulum would appear to move clockwise. At the Equator a pendulum swinging parallel to the Earth's axis would remain swinging in the same direction. The same would be true for any direction it was set swinging at the Equator: it would not appear to turn at all with respect to the Earth. At our latitude (37.5°N), the pendulum will appear to turn less than at the North Pole and more than at the Equator.

A pendulum at the following places would appear to precess (change direction) different amounts with respect to the Earth in one day.

Degrees turned

LOCATION	LATITUDE	DIRECTION	IN 24 HOURS
North Pole	90.0°N	clockwise	360°
Richmond	37.5°N	clockwise	219°
Panama City	8.6°N	clockwise	54°
Equator	0.0°N	—	0°

An Example

Suppose we imagine three pendulums, each swinging along the same meridian (a north – south line).

Two Hours Later

- The Earth has turned 30° (1/12 of 360°).
- The pendulum at the North Pole is still swinging in the same direction, but appears to have turned 30°.
- The pendulum at the Equator is swinging parallel to its original direction, and does not appear to have changed direction at all.
- The pendulum at Richmond is still swinging parallel to its original direction, but appears to have turned 18°.

PENDULUM FACTS

Length: 96 feet, 10 inches

Weight: 235 pounds

Period: 10.9 seconds

Length of swing: 11 feet

Rate of turning: 9.2° per hour or 219° per day

Number of pegs: 79

Angle between pegs: 4.56°

Time between adjacent pegs: 30 minutes (approx.)

Time between opposite pegs: 15 minutes (approx.)

Time to knock down all pegs: 19 hours, 43 minutes

Time for pendulum to turn 360°: 39 hours, 27 minutes



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