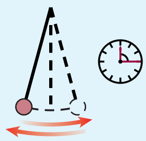
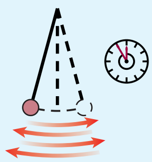
Table 2 Measures of Simple Harmonic Motion

Term	Example	Definition	SI unit
amplitude		maximum displacement from equilibrium	radian, rad meter, m
period, T		time that it takes to complete a full cycle	second, s
frequency, f		number of cycles or vibrations per unit of time	hertz, Hz ($\text{Hz} = \text{s}^{-1}$)

extension

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Keyword HF6VIBX

The period of a simple pendulum depends on pendulum length and free-fall acceleration

Although both a simple pendulum and a mass-spring system vibrate with simple harmonic motion, calculating the period and frequency of each requires a separate equation. This is because in each, the period and frequency depend on different physical factors.

Consider an experimental setup of two pendulums of the same length but with bobs of different masses. The length of a pendulum is measured from the pivot point to the center of mass of the pendulum bob. If you were to pull each bob aside the same small distance and then release them at the same time, each pendulum would complete one vibration in the same amount of time. If you then changed the amplitude of one of the pendulums, you would find that they would still have the same period. Thus, for small amplitudes, the period of a pendulum does not depend on the mass or on the amplitude.

However, changing the length of a pendulum *does* affect its period. A change in the free-fall acceleration also affects the period of a pendulum. The exact relationship between these variables can be derived mathematically or found experimentally.

PERIOD OF A SIMPLE PENDULUM IN SIMPLE HARMONIC MOTION

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

period = 2π × square root of (length divided by free-fall acceleration)

Did you know?

Galileo is credited as the first person to notice that the motion of a pendulum depends on its length and is independent of its amplitude (for small angles). He supposedly observed this while attending church services at a cathedral in Pisa. The pendulum he studied was a swinging chandelier that was set in motion when someone bumped it while lighting the candles. Galileo is said to have measured its frequency, and hence its period, by timing the swings with his pulse.