

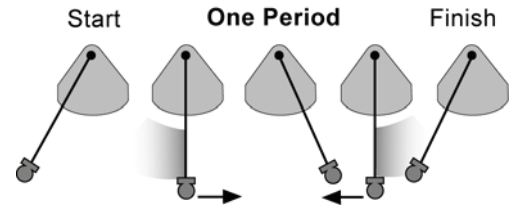
Period and Frequency

READ



The **period** of a pendulum is the time it takes to move through one cycle. As the ball on the string is pulled to one side and then let go, the ball moves to the side opposite the starting place and then returns to the start. This entire motion equals one cycle.

Frequency is a term that refers to how many cycles can occur in one second. For example, the frequency of the sound wave that corresponds to the musical note "A" is 440 cycles per second or 440 hertz. The unit *hertz* (Hz) is defined as the number of cycles per second.



The terms period and frequency are related by the following equation:

$$\begin{array}{c} \text{Period (seconds)} \rightarrow T = \frac{1}{f} \\ \text{Frequency (hertz)} \rightarrow f = \frac{1}{T} \end{array} \quad \begin{array}{c} \text{Frequency (hertz)} \\ \downarrow \\ f \\ \text{Period (seconds)} \leftarrow T \end{array}$$

PRACTICE



- A string vibrates at a frequency of 20 Hz. What is its period? $T = \frac{1}{f} = \frac{1}{20 \text{ Hz}} = 0.05 \text{ sec}$
- A speaker vibrates at a frequency of 200 Hz. What is its period? $T = \frac{1}{f} = \frac{1}{200 \text{ Hz}} = 0.005 \text{ sec}$
- A swing has a period of 10 seconds. What is its frequency? $f = \frac{1}{T} = \frac{1}{10} = 0.1 \text{ Hz}$
- A pendulum has a period of 0.3 second. What is its frequency? $f = \frac{1}{T} = \frac{1}{0.3 \text{ sec}} = 3.33 \text{ Hz}$
- You want to describe the harmonic motion of a swing. You find out that it take 2 seconds for the swing to complete one cycle. What is the swing's period and frequency? $T = 2 \text{ sec}$ $f = \frac{1}{2 \text{ sec}} = 0.5 \text{ Hz}$
- An oscillator makes four vibrations in one second. What is its period and frequency? $f = 4 \text{ Hz}$ $T = \frac{1}{f} = \frac{1}{4} = 0.25$
- A pendulum takes 0.5 second to complete one cycle. What is the pendulum's period and frequency? $T = 0.5 \text{ sec}$ $f = \frac{1}{T} = \frac{1}{.5} = 2 \text{ Hz}$
- A pendulum takes 10 seconds to swing through 2 complete cycles.
 - How long does it take to complete one cycle? $T = 5 \text{ sec}$
 - What is its period? $T = 5 \text{ sec}$
 - What is its frequency? $f = \frac{1}{T} = \frac{1}{5 \text{ sec}} = 0.2 \text{ Hz}$
- An oscillator makes 360 vibrations in 3 minutes. $3 \text{ min} = (3 \cdot 60) = 180 \text{ sec}$
 - How many vibrations does it make in one minute? $360 \div 3 = 120 \frac{\text{vibrations}}{\text{min}}$
 - How many vibrations does it make in one second? $360 \div 180 = 2 \frac{\text{vibrations}}{\text{sec}}$
 - What is its period in seconds? $T = 0.5 \text{ sec}$
 - What is its frequency in hertz? $f = \frac{1}{T} = \frac{1}{0.5} = 2 \text{ Hz}$