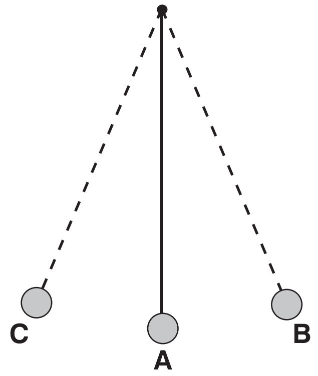
The Pendulum

Extension Sheet

A simple **pendulum** consists of a mass (weight) called a ‘bob’ swinging at the end of a string. Examples include a ‘conker’ on a string, and a swing in the park.



one complete cycle (or oscillation) is from A to B to C and back to A travelling in the same direction again

Timing a pendulum
If you are timing a pendulum (using a stop-clock), it is important to time ***complete cycles*** (complete oscillations).

A complete cycle is shown in the diagram:

In practical work you should time 20 complete cycles, then divide by 20, to get the **time period** for 1 cycle.

Time period, or Periodic time, *T*

This is the time for one complete cycle, measured in seconds.

It is connected to the ***frequency***, which is the number of cycles per second (or hertz, Hz).

$$\underset{\text{(s)}}{\textbf{Time period, } T} = \frac{\mathbf{1}}{\textbf{frequency, } f \text{ (Hz)}}$$

So if the frequency is 2 Hz (2 cycles per second), the time period is ½ second.
If the frequency is 10 Hz, the time period is 0.1 s

This equation applies to all oscillations, vibrations and waves, including sound waves and light waves.

Time period of a simple pendulum

The periodic time of a simple pendulum depends on only 2 things:

- The **length** of the pendulum
  The longer the pendulum, the longer the time period.
- The **pull of gravity** of the planet that the pendulum is on.
  A pendulum would have a longer time period on the Moon.

Note : the time period of a simple pendulum does **not** depend on the mass (weight) on the bob. Changing the weight makes no difference.

The formula for the time period of a simple pendulum is shown in the box, but you probably do not need to know this formula.

$$T = 2\pi\sqrt{\frac{l}{g}}$$

where T = Time period
l = length of pendulum
g = acceleration due to gravity, see pages 132, 135

