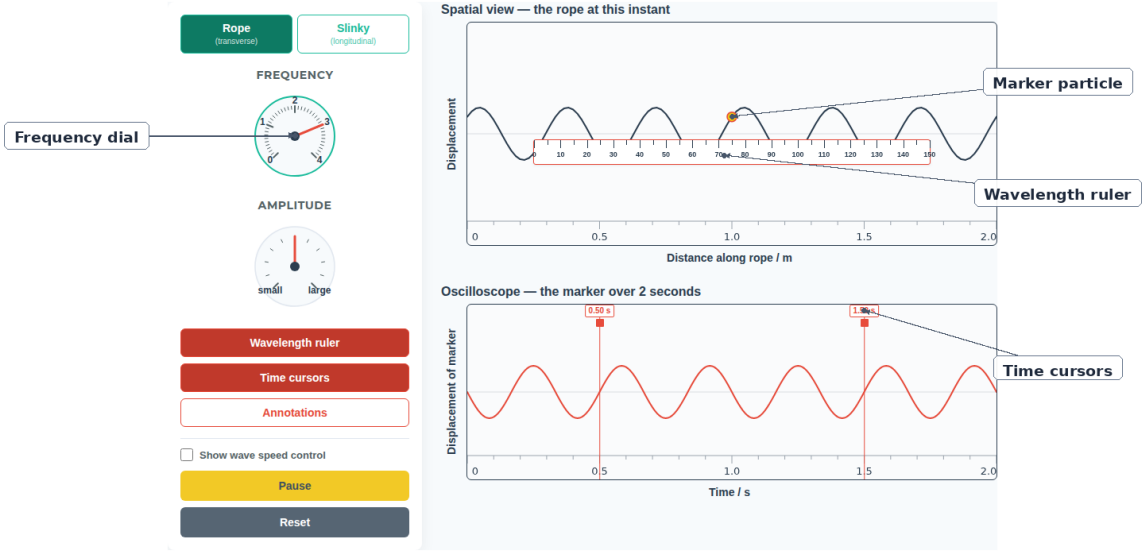
Investigating Wave Frequency, Wavelength and Period

Using the Wavelength Ruler and Time Cursors

Aim:

You are investigating how the frequency of a wave affects its wavelength and period.



Method:

1. Set the medium toggle to Rope and the Frequency dial to about 1 Hz. Watch the gold marker particle on the spatial view for about ten seconds.
2. Switch the medium toggle to Slinky and watch the marker again.
3. Switch back to Rope. Set the Frequency dial to a value of your choice and set the Amplitude dial to any position.
4. Turn on the Wavelength ruler and drag it so it lines up with two adjacent crests on the spatial view. Read the wavelength λ from the ruler scale.
5. Turn on the Time cursors. Drag them on the oscilloscope view so they sit one full cycle apart (for example, both on a peak). Read the two times shown and subtract to find the period T.
6. Record the frequency setting f, the wavelength λ and the period T in your results table.
7. Repeat for at least five more frequency settings spread across the dial's range (0.5 Hz to 4 Hz), including 1 Hz, 2 Hz and 3 Hz.

Prediction:

Before you take your last reading: if you set the Frequency dial to its highest value, do you predict the wavelength will be longer or shorter than at your lowest frequency setting?

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Test this by taking a reading at the highest frequency setting and adding it to your table.

Results:

frequency f (Hz)	wavelength λ (m)	period T (s)	1/T (Hz)	f × λ (m/s)

Analysis:

Did the marker particle travel along with the wave, or did it stay in the same region as the wave passed through it? Complete the sentence: Waves transfer _____ but they do not transfer _____.

For each row, compare your calculated 1/T value with the frequency f you set on the dial. What do you notice?

For each row, look at your calculated f × λ column. What do you notice about these values across your different frequency settings?

Plot wavelength λ (m) on the vertical axis against frequency f (Hz) on the horizontal axis. Describe the shape of the graph.

Applying it:

Tick "Show wave speed control". Keep the frequency fixed at 2 Hz and change the wave speed dial. What happens to the wavelength λ as wave speed increases?

Use the relationship you found above to predict λ when the wave speed v = 1.5 m/s and f = 2 Hz. Then set the dials to check your prediction by measuring λ with the ruler. State your predicted value and your measured value.