

How waves carry energy without matter

Grade 7 science (Year 8 · Class 7) · Lab

Name: _____ Date: _____ Class: _____

Do bigger waves travel faster? In this lab you time pulses along a stretched spring, compare small and large pulses, and then test whether $v = f \times \lambda$ predicts the wavelengths you see when you shake the spring steadily.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS4-1

Aim

To measure the speed of a pulse on a stretched spring, to find out whether the size of the pulse changes it, and to link frequency, wavelength and speed with $v = f \times \lambda$.

Equipment

- A long spring toy or a loose skipping rope, about 5 m long
- Tape measure and masking tape for two marks
- Stopwatch or phone timer
- A helper holding the far end, or a fixed post
- A phone to film the wave, optional

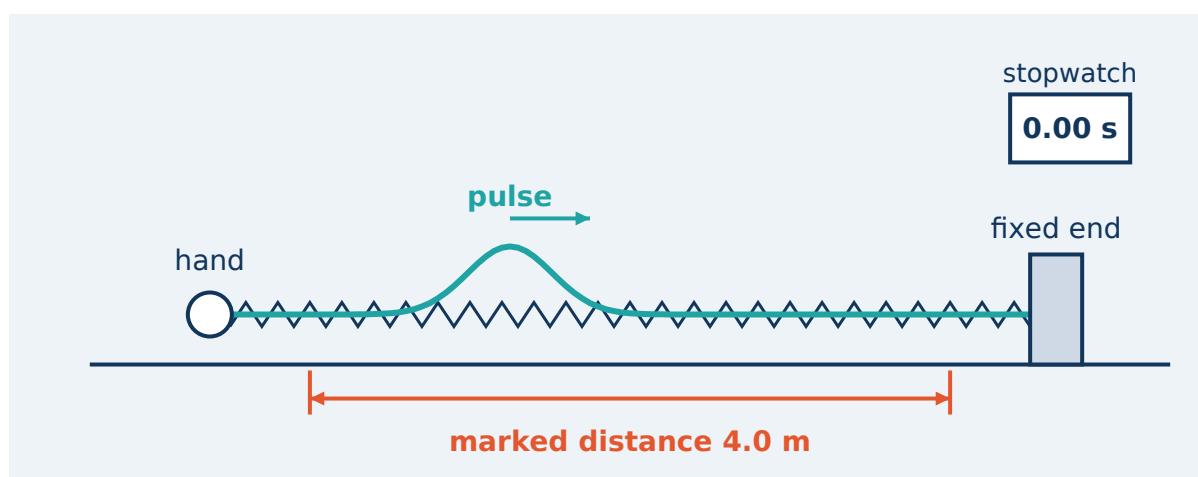
Safety

Safety

Work on a clear, dry floor. Do not stretch the spring beyond its natural stretch, because it can snap back. Keep your face away from the free end and release it slowly.

Method

1. Stretch the spring along the floor and mark two points exactly 4.0 m apart.
2. Flick the hand end sideways once to make a small pulse of about 5 cm. Time the pulse between the two marks. Repeat three times.
3. Repeat with a large pulse of about 20 cm, three times.
4. Shake the end steadily and count the number of full shakes in 10 s. Estimate the wavelength by marking crest positions or from a film.
5. Repeat with faster shaking and record the results.



Set-up for measuring the speed of a pulse over 4.0 m.

Results

Sample measurements for the pulse over 4.0 m:

Pulse size	Run 1 (s)	Run 2 (s)	Run 3 (s)
Small, 5 cm	1.62	1.58	1.66
Large, 20 cm	1.60	1.64	1.60

Sample measurements for steady shaking (wave speed from the pulse test):

Shaking	Shakes in 10 s	Measured wavelength (m)
Slow	14	1.8
Fast	20	1.2

Analysis questions

Question 1 Mean times

Calculate the mean time for the small pulse and for the large pulse.

Question 2 Pulse speeds

Calculate the speed of each pulse over the 4.0 m distance.

Question 3 Effect of pulse size

State and explain your conclusion about the effect of pulse size on speed.

Question 4 Frequencies

Calculate the frequency for slow and for fast shaking.

Question 5 Predicting wavelengths

Use $v = 2.5$ m/s to calculate the wavelength predicted for each frequency and compare it with the measured values.

Question 6 Another prediction

Predict the wavelength if the spring is shaken at 2.5 Hz, and explain your reasoning.

Question 7 Timing error

Reaction time is about 0.2 s when you start and stop the stopwatch by eye. Calculate the percentage uncertainty in a 1.62 s time and name a way to reduce it.

Question 8 Improving the lab

Suggest two improvements that make the speed more reliable.