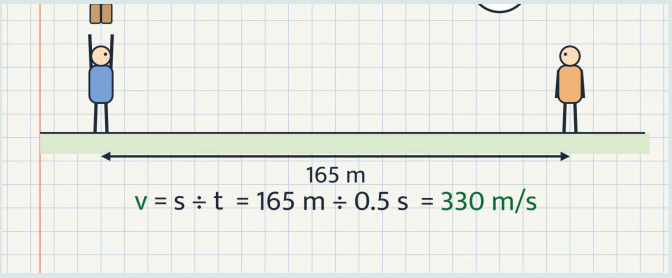
Measuring wave speed

Sound in air and ripples on water

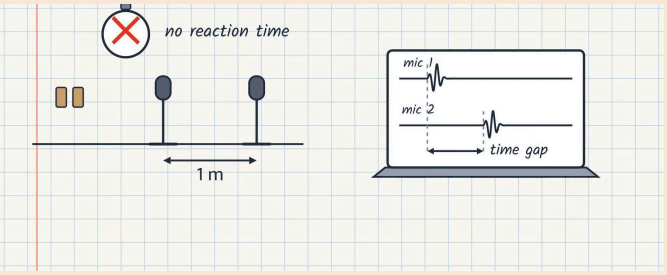
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Summary sheet

1 Speed of sound



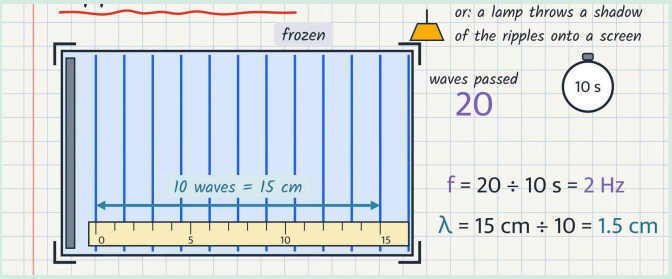
- Measure a long distance (e.g. **165 m**). One person bangs two blocks; the other **starts the stopwatch on seeing** the hit and **stops it on hearing** the bang.
- **speed = distance ÷ time**: 165 m ÷ 0.5 s = **330 m/s**.

2 More accuracy



- **Reaction time** is the biggest error: a 0.1 s delay is a large part of 0.5 s.
- Use a **longer distance, repeat and take a mean**, swap roles (wind), or use **two microphones and a computer** (no reaction time).

3 Ripples on water



- **Frequency**: count the waves passing a point in 10 s, divide by 10 (20 waves → **2 Hz**).
- **Wavelength**: freeze the pattern (photo with a ruler, or a lamp's shadow), measure across **10 waves**, divide by 10 (15 cm → **1.5 cm**).

4 Calculation check

f = 20 ÷ 10 s = 2 Hz

λ = 15 cm ÷ 10 = 1.5 cm

1.5 cm = 0.015 m

$$v = f \lambda$$

v = 2 Hz × 0.015 m = 0.03 m/s

= 3 cm/s

- **v = f λ** = 2 Hz × 0.015 m = **0.03 m/s = 3 cm/s**.
- Or time one ripple over a known distance: 30 cm in 10 s = **3 cm/s**.

$$v = f \lambda$$

wave speed = frequency × wavelength

Exam tip

Measure across several waves, then divide. A reading error is a much smaller share of a long length.

Check yourself

1. Sound takes 1.2 s to travel 400 m. What is its speed?
2. Why is measuring over a longer distance more accurate?

Answers: 1. 400 ÷ 1.2 ≈ 333 m/s 2. The time is longer, so reaction time is a smaller fraction of it