PUNJAB BOARDS / ENGLISH MEDIUM

Class 10 Physics
Wave Basics Notes

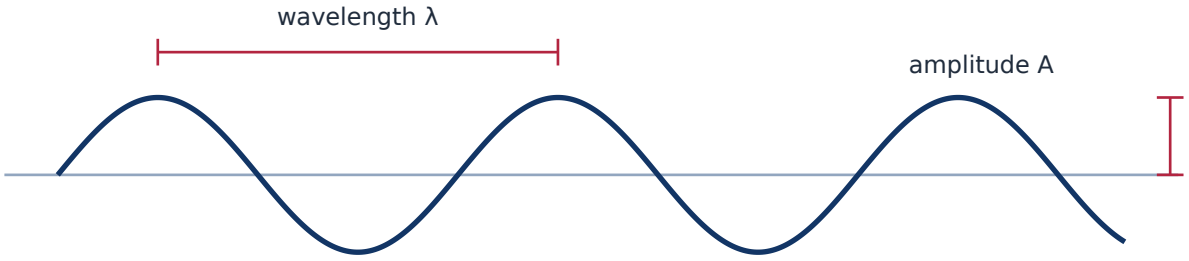
Chapter 12 focus / Quantities and calculations

Learn the difference between wave motion and particle motion, recognise transverse and longitudinal waves, and calculate wavelength, frequency, period and speed.

What moves in a wave

A wave is a travelling disturbance that transfers energy. In a mechanical wave, particles of the medium oscillate about their equilibrium positions; they do not travel along with the wave over long distances. Mechanical waves need a medium. Electromagnetic waves can travel through a vacuum.

Wave type	Particle vibration compared with travel
Transverse	Perpendicular to the direction of propagation. A wave on a stretched rope is an example.
Longitudinal	Parallel to the direction of propagation. Sound in air travels through compressions and rarefactions.



Snapshot of a transverse wave; displacement is shown vertically.

Quantity	Meaning and SI unit
Amplitude A	Maximum displacement from equilibrium; metre (m).
Wavelength λ	Distance between adjacent points in phase, such as two consecutive crests; metre (m).
Frequency f	Number of complete oscillations per second; hertz (Hz).
Period T	Time for one complete oscillation; second (s).
Wave speed v	Distance travelled by the disturbance per second; m/s.

Essential relations: f = 1/T; T = 1/f; v = fλ. Use seconds and metres before substituting.

Worked numericals and practice

Write the data, formula, substitution and unit

Worked example 1 Calculate wave speed

A wave has frequency 25 Hz and wavelength 0.80 m.
$v = f\lambda = 25 \times 0.80 =$ **20 m/s**.
The disturbance travels 20 metres each second.

Worked example 2 Convert milliseconds

A source completes one oscillation in 4.0 ms.
$T = 4.0 \times 10^{-3}$ s = 0.0040 s.
$f = 1/T = 1/0.0040 =$ **250 Hz**.

Worked example 3 Calculate wavelength

A wave travels at 12 m/s with frequency 30 Hz.
$\lambda = v/f = 12/30 =$ **0.40 m**.
This equals 40 cm; the SI answer is 0.40 m.

Independent practice

1. A wave has f = 50 Hz and λ = 0.60 m. Find v.

2. A vibration has T = 5.0 ms. Find f.

3. A wave travels at 24 m/s and has f = 80 Hz. Find λ.

4. A source makes 90 complete oscillations in 3.0 s. Find f and T.

5. In the same unchanged medium, wave speed stays constant. If frequency doubles, what happens to wavelength?

6. A rope particle vibrates vertically while a wave moves horizontally. Identify the wave type and explain.

7. Explain the difference between amplitude and wavelength.

8. A student says sound carries air particles all the way from the speaker to the listener. Correct the statement.

Answers and revision

Check the unit as carefully as the number

1. v = fλ = 50 × 0.60 = **30 m/s**.

2. T = 0.0050 s. f = 1/0.0050 = **200 Hz**.

3. λ = v/f = 24/80 = **0.30 m**.

4. f = number/time = 90/3.0 = **30 Hz**. T = 1/30 s ≈ **0.033 s**.

5. Wavelength halves. Since λ = v/f and v is fixed, doubling the denominator halves λ.

6. It is transverse: particle displacement is perpendicular to the direction of wave propagation.

7. Amplitude is a particle's greatest displacement from equilibrium. Wavelength is a spatial repeat distance along the wave. They describe different features even though both can be measured in metres.

8. Air particles oscillate near their equilibrium positions. The disturbance and energy propagate through the air; there is no bulk transport of those particles from speaker to listener.

Common errors

Convert milliseconds to seconds before calculating frequency. Measure wavelength from crest to the next crest, not crest to adjacent trough. Amplitude is measured from the equilibrium line to a crest, not crest to trough. Do not confuse wave speed with the instantaneous speed of a vibrating particle.

Quick oral check

If f = 4 Hz, T = 0.25 s. If λ = 2 m as well, v = 8 m/s. Explain each answer without looking at the formula list. For a longitudinal wave, identify a compression and a rarefaction.

Scope and reference

Focus: basic wave types and quantities in Chapter 12. The excluded sections on wave properties and seismic/tsunami waves are not covered here.

Curriculum reference: PECTAA Grade 10 ALP, session 2026-27 / exam 2027, dated 14 November 2026. Checked 15 November 2026. See the official Curriculum and Compliance page and Grade 10 notification.

Independently written explanations, examples and questions for Rahnuma Academy. This is a focused revision resource, not an official textbook, a full chapter replacement or a prediction of examination questions. Follow later official updates.