Exercise walk-through

Transverse and longitudinal waves ▪ 7.2

eXercise

You must be able to

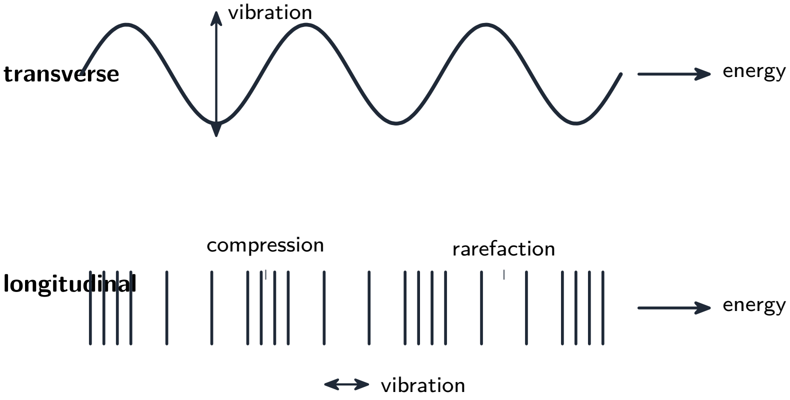
- compare **transverse 横波** and **longitudinal 纵波** waves
- give examples of each and identify **compressions** and **rarefactions**
- interpret displacement–distance and displacement–time graphs

Method — Transverse vs longitudinal

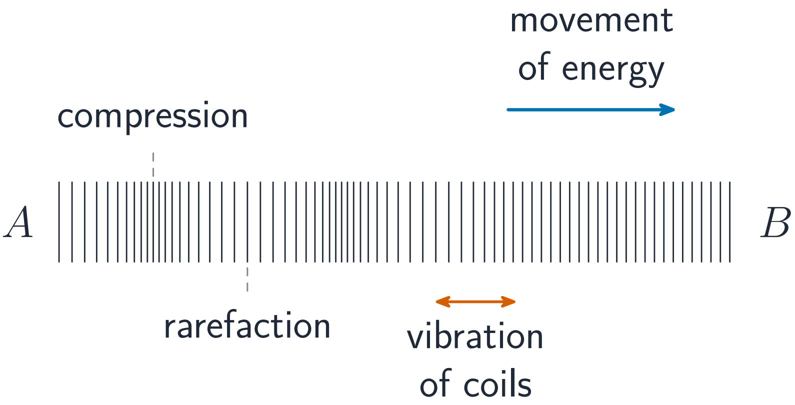
- **Transverse:** particles vibrate **perpendicular** to the energy travel (rope, all EM waves, water ripples).
- **Longitudinal:** particles vibrate **parallel** to the energy travel; the wave is **compressions** and **rarefactions** (sound, slinky squashes).

A key difference often tested: only **transverse** waves can be **polarised** (restricted to one plane of vibration); longitudinal waves **cannot** (covered fully in 7.5).

Method — Transverse vs longitudinal



Method — Transverse vs longitudinal



A longitudinal wave on a slinky

Method — Graphs

Both look like a **sine curve**. A **displacement–distance** graph gives the **wavelength** λ; a **displacement–time** graph gives the **period** T (then $f = 1/T$).

Practice 2.1 ▪ 2 marks

State the difference between a **transverse** and a **longitudinal** wave.

Solution 2.1

Method: Transverse vs longitudinal

Worked steps

In a **transverse** wave the particles vibrate **perpendicular** to the direction of energy travel; in a **longitudinal** wave they vibrate **parallel** to it **B1** **B1**.

Practice 2.2 ▪ 2 marks

Give **one** example of a transverse wave and **one** of a longitudinal wave.

Solution 2.2

Method: Transverse vs longitudinal

Worked steps

Transverse — any one: light/EM wave, wave on a rope, water ripple. Longitudinal — sound, slinky compression wave **B1** **B1**.

Practice 2.3 ▪ 1 mark

Name the two features that make up a **longitudinal** wave.

Solution 2.3

Method: Transverse vs longitudinal

Worked steps

Compressions and **rarefactions** **B1**.

Practice 2.4 ▪ 2 marks

State what you read from a **displacement–time** graph and from a **displacement–distance** graph.

Solution 2.4

Method: Graphs

Worked steps

Displacement–time $\rightarrow$ the **period** T (and so frequency); displacement–distance $\rightarrow$ the **wavelength** λ **B1** **B1**.

Exam-style 3.1 ▪ 1 mark

Which of these is a **longitudinal** wave?

A light

B a wave on a rope

C sound

D water ripples

Solution 3.1

Method: Transverse vs longitudinal

A light

B a wave on a rope

C sound ✓

D water ripples

Worked steps

C — sound.

Exam-style 3.2 ▪ 2 marks

Sound is a longitudinal wave. Describe how the **air particles** move as the wave passes.

Solution 3.2

Method: Transverse vs longitudinal

Worked steps

The air particles vibrate **back and forth parallel** to the wave's direction **B1**, forming regions of high pressure (**compressions**) and low pressure (**rarefactions**) **B1**.

Exam-style 3.3 ▪ 1 mark

State whether **all electromagnetic waves** are transverse or longitudinal.

Solution 3.3

Method: Transverse vs longitudinal

Worked steps

Transverse B1.

Exam-style 3.4 ▪ 2 marks

A displacement–time graph for a wave shows a period of 0.020 s. Calculate the **frequency**.

Solution 3.4

Method: Graphs

Worked steps

$f = 1/T = 1/0.020 = 50$ Hz M1 A1.

Exam-style 3.5 ▪ 1 mark

State **one** property that a **transverse** wave has but a **longitudinal** wave does not.

Solution 3.5

Method: Transverse vs longitudinal

Worked steps

It can be **polarised** (restricted to one plane of vibration) — a longitudinal wave cannot **B1**.