

Exercise walk-through

Sound ■ 3.4

eXercise

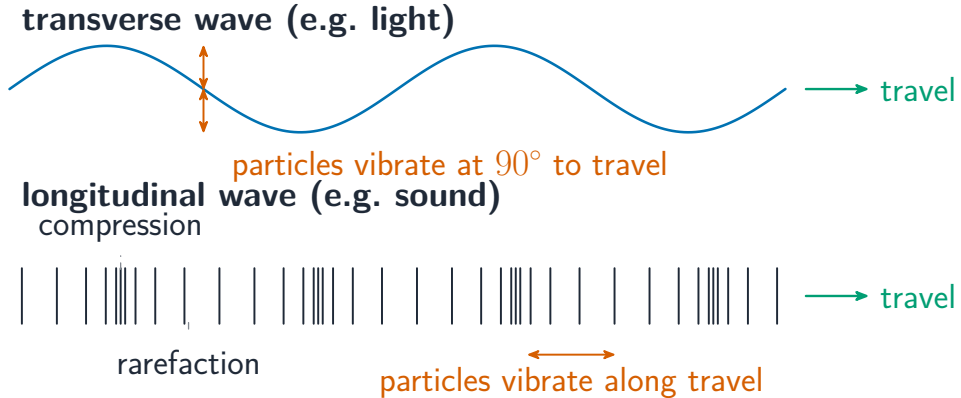
You must be able to

- describe sound as a longitudinal wave (compressions and rarefactions)
- state that sound needs a medium and give the hearing range
- find the speed of sound from an echo

Method — Speed of sound from an echo

Clap 85 m from a wall, echo after 0.50 s: the sound goes there and back,
 $2 \times 85 = 170 \text{ m}$, so $v = \frac{170}{0.50} = 340 \text{ m/s}$.

Method — Speed of sound from an echo



A transverse wave above a longitudinal wave — sound is longitudinal

Practice 2.1 ■ 1 mark

State why sound cannot travel through a vacuum.

Solution 2.1

Method: Speed of sound from an echo

Worked steps

sound needs a medium (particles) to travel through, and a vacuum has none **B1**.

Practice 2.2 ■ 1 mark

State the approximate range of frequencies a human can hear.

Solution 2.2

Worked steps

about 20 Hz to 20 000 Hz **B1**.

Exam-style 3.1 ■ 1 mark

Sound is a:

- A** transverse wave that needs no medium
- B** longitudinal wave that needs a medium
- C** transverse wave that needs a medium
- D** longitudinal wave that needs no medium

Solution 3.1

- A** transverse wave that needs no medium
- B** longitudinal wave that needs a medium 
- C** transverse wave that needs a medium
- D** longitudinal wave that needs no medium

Worked steps

B. Sound is a longitudinal wave that needs a medium.

Exam-style 3.2 ■ 3 marks

A person stands 660 m from a cliff and shouts. The echo returns 4.0 s later.

- (a) Find the speed of sound.
- (b) State whether sound travels faster or slower in water than in air.

Solution 3.2

Method: Speed of sound from an echo

Worked steps

- (a) distance there and back = $2 \times 660 = 1320$ m **M1**; $v = \frac{1320}{4.0}$ **M1**; = 330 m/s **A1**.
- (b) faster in water **B1**.

Exam-style 3.3 ■ 2 marks

Explain why you see lightning before you hear the thunder.

Solution 3.3

Worked steps

light travels much faster than sound **M1**; so the light from the lightning reaches you almost at once, while the sound takes longer to arrive **A1**.