

GCSE Physics

Worksheet: Transverse and longitudinal waves

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Transverse and longitudinal waves

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

A student demonstrates waves using a long spring (a slinky) and a tray of water.

0 1 . 1

Which **two** of these actions produce a transverse wave?

Tick (✓) **two** boxes.

- Moving one end of the spring from side to side☐
- Sharply pushing and pulling one end of the spring along its length☐
- Dipping a finger repeatedly into the water☐
- Clapping hands together once, making a loud bang☐

[2 marks]

0 1 . 2

Sound travelling through air is a longitudinal wave.

State the direction of the oscillations of the air particles, relative to the direction the sound wave travels.

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[1 mark]

0 1 . 3

Give **one** example of an electromagnetic wave.

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[1 mark]

0 2

A student uses a long spring stretched along a bench to model two types of wave.

0 2 . 1

The student moves one end of the spring backwards and forwards along the length of the spring.

What type of wave does this produce?

Tick (✓) **one** box.

Electromagnetic

☐

Longitudinal

☐

Transverse

☐

[1 mark]

0 2 . 2

The student then moves the end of the spring from side to side, at right angles to the length of the spring. This produces a transverse wave.

Give **one** other example of a transverse wave.

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[1 mark]

0 2 . 3

Describe the difference between a longitudinal wave and a transverse wave.

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[2 marks]

0 2 . 4

In a longitudinal wave on the spring, there are regions where the coils are closer together than normal and regions where the coils are further apart than normal. Name these **two** types of region.

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[2 marks]

0 3

A student has a long spring (a slinky), fixed at one end.

0 3 . 1

Describe how the student could use the same spring to demonstrate a transverse wave and then a longitudinal wave.

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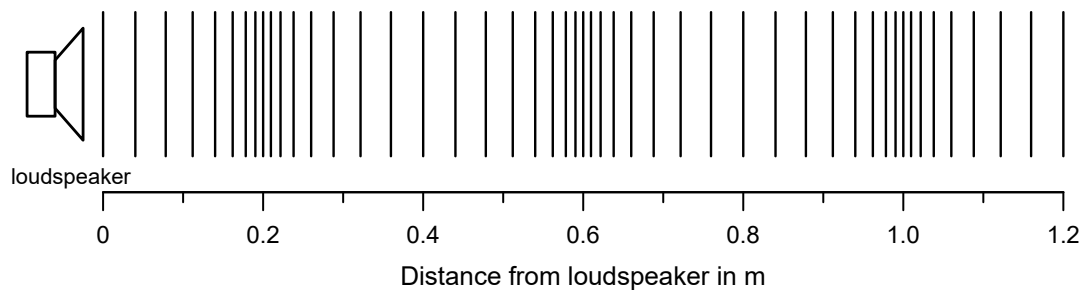
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[4 marks]

0 4

A loudspeaker produces a sound wave in a long tube of air. Figure 1 represents the positions of layers of air particles in the tube at one instant.

Figure 1



0 4 . 1

Give the name of the region of the wave at a distance of 0.60 m from the loudspeaker.

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[1 mark]

0 4 . 2

Use Figure 1 to determine the wavelength of the sound wave.

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Wavelength = m

[2 marks]

0 4 . 3

Describe how one layer of air particles moves as the wave passes through the tube.

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[2 marks]

0 4 . 4

Sound cannot travel through a vacuum.
Explain why.

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[2 marks]

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0 5

Waves can be described as transverse or longitudinal.

0 5 . 1

Describe the difference between transverse and longitudinal waves, giving one example of each, and describe how you could demonstrate the difference between them using a long spring (slinky).

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[6 marks]

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0 6

Table 1 shows the direction in which a point on three different waves oscillates, compared with the direction the wave travels.

Table 1

Wave	Direction the point moves, compared with the direction of travel
Sound wave in air	parallel
Wave on the surface of a lake	at right angles (perpendicular)
Seismic P-wave	parallel

0 6 . 1

Use Table 1 to state which of the three waves is transverse, and which two are longitudinal.

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[3 marks]

0 6 . 2

Explain how the direction of oscillation of a point on a wave is used to classify the wave as transverse or longitudinal.

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[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Physics · Worksheet: Transverse and longitudinal waves · 32 marks

Question 1 (4 marks)

01.1 [2 marks]

Correct: Moving one end of the spring from side to side; Dipping a finger repeatedly into the water

01.2 [1 mark]

Answer: Parallel to the direction of travel.

- parallel to the direction the wave travels (the direction of energy transfer) (1)

Notes: Allow 'in the same direction as the wave travels' / 'backwards and forwards along the direction of travel'. Do not accept 'perpendicular' or 'at right angles'.

01.3 [1 mark]

Answer: Light (or any other electromagnetic wave).

- any correctly named electromagnetic wave, e.g. light / radio waves / microwaves / infrared / ultraviolet / X-rays / gamma rays (1)
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Question 2 (6 marks)

02.1 [1 mark]

Correct: Longitudinal

02.2 [1 mark]

Answer: Ripples on the surface of water (or any electromagnetic wave).

- ripples on the surface of water / any electromagnetic wave, e.g. light / waves on a string / S-waves (1)

Notes: Do not accept sound.

02.3 [2 marks]

Answer: In a longitudinal wave the oscillations are parallel to the direction of energy transfer; in a transverse wave they are perpendicular to it.

- longitudinal: the oscillations are parallel to the direction of energy transfer (1)
- transverse: the oscillations are perpendicular to the direction of energy transfer (1)

Notes: Allow 'vibrations' for oscillations, 'direction the wave travels' for direction of energy transfer and 'at right angles' for perpendicular.

02.4 [2 marks]

Answer: Closer together: compression. Further apart: rarefaction.

- (coils closer together:) compression(s) (1)
 - (coils further apart:) rarefaction(s) (1)
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Question 3 (4 marks)

03.1 [4 marks]

Answer: Side-to-side movement of the end gives a transverse wave (coils move perpendicular to the spring); pushing and pulling the end along the spring's length gives a longitudinal wave (compressions and rarefactions travel along the spring).

- for a transverse wave, move the free end from side to side, at right angles to the length of the spring (1)
 - the coils move from side to side (perpendicular to the spring) as the wave travels along it (1)
 - for a longitudinal wave, sharply push the free end forward and pull it back, along the length of the spring (1)
 - the coils move backwards and forwards along the spring (parallel to the direction of travel), so compressions and rarefactions travel along the spring (1)
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Question 4 (7 marks)

04.1 [1 mark]

Answer: Compression

- compression (1)

04.2 [2 marks]

Answer: 0.40 m

- distance between the centres of two adjacent compressions (or rarefactions) used, e.g. $0.60 - 0.20$ (1)
- 0.40 (m) (1)

Notes: Allow 0.38–0.42 m. Allow a correct answer found from the length of several wavelengths divided by the number of wavelengths.

04.3 [2 marks]

Answer: It oscillates backwards and forwards about a fixed position, parallel to the direction the wave travels.

- it oscillates / vibrates backwards and forwards (about a fixed position) (1)
- parallel to the length of the tube / parallel to the direction of energy transfer (1)

04.4 [2 marks]

Answer: A vacuum has no particles, so there is nothing to vibrate and pass the wave on.

- there are no particles in a vacuum (1)
 - so there is nothing to oscillate / to pass the vibrations (energy) on (1)
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Question 5 (6 marks)

05.1 [6 marks]

Answer: Level-of-response answer: in a transverse wave the oscillations are perpendicular to the direction of travel (e.g. light); in a longitudinal wave they are parallel to it, with compressions and rarefactions (e.g. sound). Moving one end of a slinky side to side shows a transverse wave; moving it back and forth along its length shows a longitudinal wave.

Levels of response

- **Level 3 (5–6)** A detailed, coherent answer. Relevant points are accurate, linked in a logical sequence and use correct scientific terms.
- **Level 2 (3–4)** Several relevant points with some linking, but the answer has gaps, errors or lacks detail.
- **Level 1 (1–2)** Simple statements making one or two relevant points, with little or no linking.
- **No marks (0)** Nothing relevant or worthy of credit.

Indicative content

- in a transverse wave, the oscillations of the particles/field are perpendicular (at right angles) to the direction the wave travels
- example of a transverse wave: electromagnetic waves (e.g. light), water ripples, or a wave on a shaken string
- in a longitudinal wave, the oscillations of the particles are parallel to (along the same line as) the direction the wave travels
- example of a longitudinal wave: sound waves in air, or a wave sent along a stretched spring by pushing/pulling one end
- longitudinal waves show compressions (particles/coils close together) and rarefactions (particles/coils spread apart), rather than the peaks and troughs of a transverse wave
- moving one end of a slinky from side to side (perpendicular to its length) produces a transverse wave; moving one end backwards and forwards along its length instead produces a longitudinal wave, visible as compressions and rarefactions moving along the coils

Notes: Level 1 (1–2 marks): states one correct difference or gives one correct example. Level 2 (3–4 marks): describes both wave types with a correct example of each, or describes the slinky demonstration, but not both fully. Level 3 (5–6 marks): a full, clear description of both wave types (with correct examples) and a correct, detailed description of how a slinky demonstrates each.

Question 6 (5 marks)

06.1 [3 marks]

Answer: Transverse: the lake wave. Longitudinal: the sound wave and the P-wave.

- transverse: the wave on the surface of the lake (1)
 - longitudinal: the sound wave in air (1)
 - longitudinal: the seismic P-wave (1)
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06.2 [2 marks]

Answer: Longitudinal: oscillations parallel to the direction of travel. Transverse: oscillations perpendicular to it.

- if the oscillations are parallel to the direction the wave travels, the wave is longitudinal (1)
 - if the oscillations are at right angles (perpendicular) to the direction the wave travels, the wave is transverse (1)
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