

# GCSE Combined Science: Trilogy

## Worksheet: Transverse and longitudinal waves

|                |                   |                       |                            |
|----------------|-------------------|-----------------------|----------------------------|
| TIME<br>35 min | TOTAL<br>31 marks | CALCULATOR<br>Allowed | DIFFICULTY<br>Easy, Medium |
|----------------|-------------------|-----------------------|----------------------------|

Topics: Transverse and longitudinal waves

|      |       |      |
|------|-------|------|
| NAME | CLASS | DATE |
|------|-------|------|

- 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

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 3 . 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 3 . 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]

0 4

Waves can be described as transverse or longitudinal.

0 4 . 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]

0 5

Maya drops a small cork into a still pond. Maya then throws a stone into the pond 3 m away from the cork. Ripples spread out across the surface of the water and pass the cork.

0 5 . 1

Describe the motion of the cork as the ripples pass it.

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[1 mark]

0 5 . 2

Explain how the motion of the cork shows that it is the wave, and not the water, that travels across the pond.

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[2 marks]

0 5 . 3

A candle flame is placed a few centimetres in front of a loudspeaker. When the loudspeaker plays a loud, low-pitched note, the flame moves backwards and forwards but it is not blown away from the loudspeaker.  
Explain what this shows about the sound wave travelling through the air.

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[3 marks]

0 6

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

0 6 . 1

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

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**[4 marks]**

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**END OF QUESTIONS**

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

# Mark scheme

## GCSE Combined Science: Trilogy · Worksheet: Transverse and longitudinal waves · 31 marks

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### 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

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#### 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'.

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#### 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

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### 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.

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### 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.

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### 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 (5 marks)

### 03.1 [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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### 03.2 [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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## Question 4 (6 marks)

### 04.1 [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.

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## Question 5 (6 marks)

### 05.1 [1 mark]

**Answer:** The cork bobs up and down but stays in the same place.

- it moves up and down (in the same place) / it is not carried along with the ripples (1)

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### 05.2 [2 marks]

**Answer:** The cork, and the water it floats on, only oscillates about a fixed point, so the water does not move across the pond; only the wave (energy) does.

- the cork (and the water around it) only oscillates about a fixed position (1)
- so the water is not carried across the pond; the wave transfers energy without transferring the water (1)

**Notes:** Allow 'the cork is not carried towards the edge of the pond' for the first mark.

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### 05.3 [3 marks]

**Answer:** The air oscillates backwards and forwards along the direction the sound travels (a longitudinal wave), but the air is not carried away from the loudspeaker; only the wave travels.

- the air (particles) oscillate / vibrate backwards and forwards (1)
- parallel to the direction of energy transfer / sound is a longitudinal wave (1)
- the air itself does not travel away from the loudspeaker; only the wave (energy) travels through the air (1)

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## Question 6 (4 marks)

### 06.1 [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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