AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.6.1.1

Transverse and longitudinal waves

Past-paper questions

Tier	**Foundation**
Question groups	**6**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

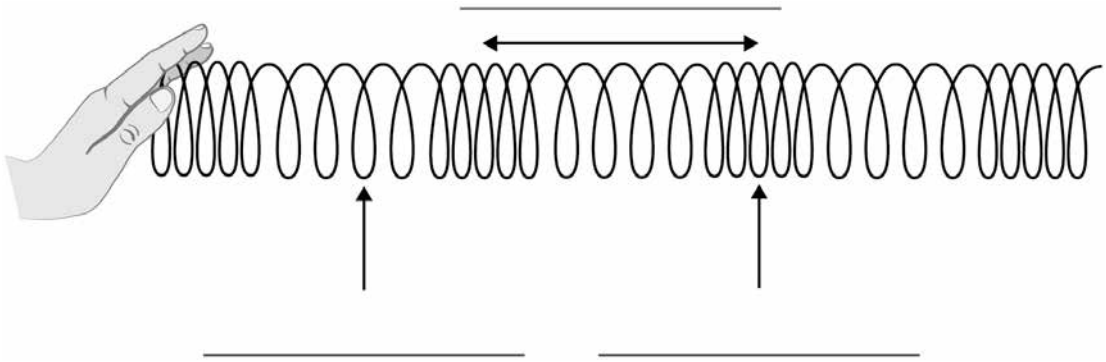
6.6.1.1 Transverse and longitudinal waves

Question 01

June 2018 | 8464/P/2F | Original Q2

0 2 **Figure 2** shows a slinky spring used to model a sound wave.

Figure 2



0 2 . 1 Label the arrows on **Figure 2**

Choose the answers from the box.

[3 marks]

amplitude	**compression**	**frequency**
rarefaction		**wavelength**

0 2 . 2 What type of wave is a sound wave?

[1 mark]

Tick **one** box.

- electromagnetic ☐
- longitudinal ☐
- transverse ☐

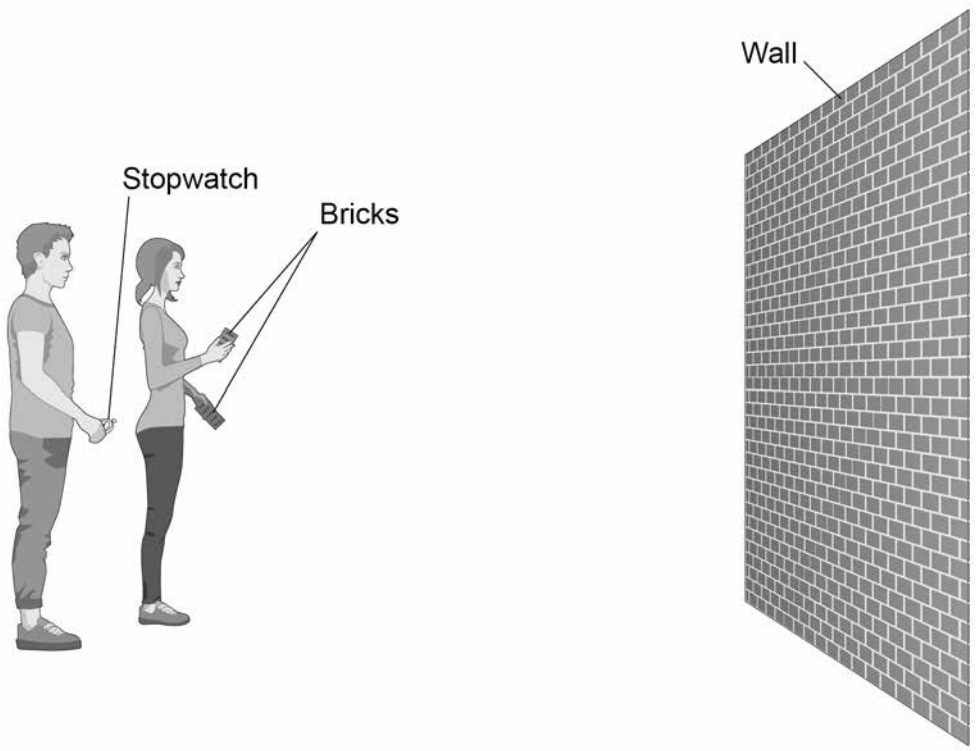
Question 2 continues on the next page

6.6.1.1 Transverse and longitudinal waves

Question 01 · continued

0 2 . 3 **Figure 3** shows two students measuring the speed of sound in air.

Figure 3



One student bangs two bricks together.

The sound wave produced is reflected from the wall and travels back to the students.

Describe how they can determine the speed of sound.

[4 marks]

8

6.6.1.1 Transverse and longitudinal waves

Question 02

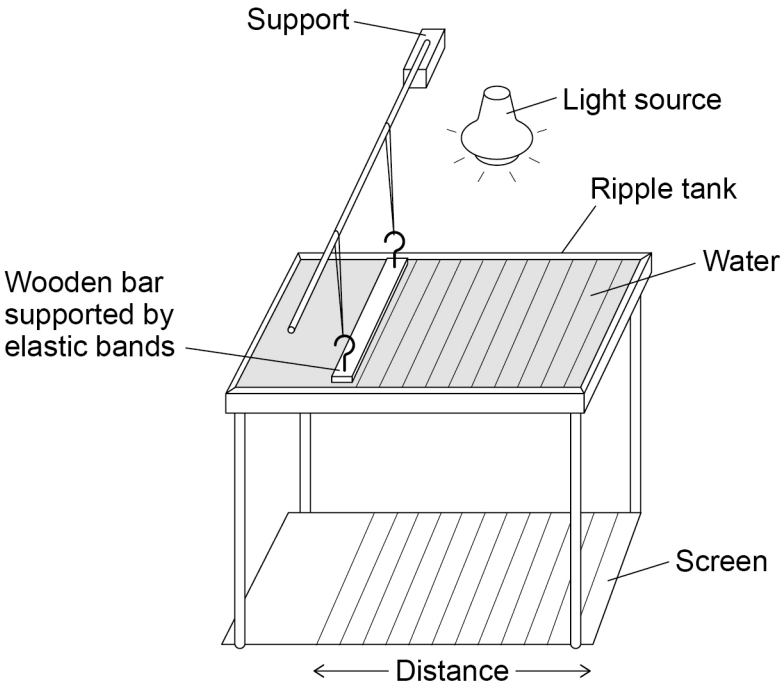
June 2019 | 8464/P/2F | Original Q7

0 7 **Figure 11** shows the equipment a teacher used to determine the speed of a water wave.

The equipment includes:

- a ripple tank filled with water
- a wooden bar that creates ripples on the surface of the water
- a light source which causes a shadow of the ripples on the screen.

Figure 11



0 7 . 1 Describe how equipment in **Figure 11** can be used to measure the wavelength, frequency and speed of a water wave.

[6 marks]

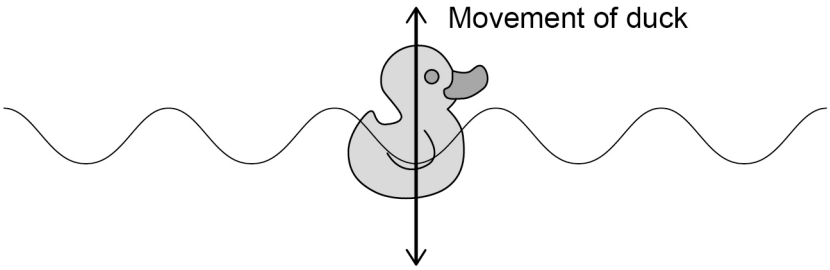
6.6.1.1 Transverse and longitudinal waves

Question 02 · continued

The teacher put a plastic duck in the ripple tank as shown in **Figure 12**.

The plastic duck moved up and down as the waves in the water passed.

Figure 12



0 7 . 2 How does the movement of the plastic duck in **Figure 12** demonstrate that water waves are transverse?

[1 mark]

Question 7 continues on the next page

6.6.1.1 Transverse and longitudinal waves

Question 02 · continued

June 2019 | 8464/P/2F | Original Q7

0 7 . 3 The teacher measured the maximum height and the minimum height of the plastic duck above the screen as the wave passed.

The teacher repeated his measurements.

Table 4 shows the teacher's measurements.

Table 4

Maximum height in mm	509	513	511
Minimum height in mm	503	498	499

Calculate the mean amplitude of the water wave.

[3 marks]

Mean amplitude = _____ mm

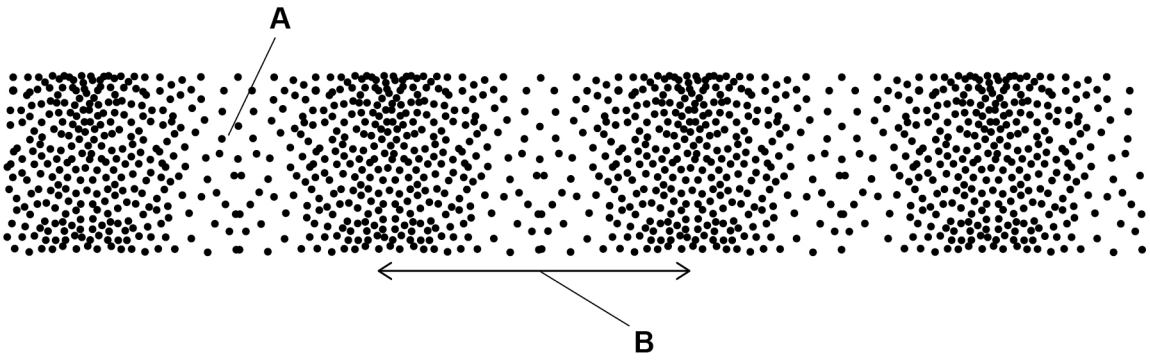
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6.6.1.1 Transverse and longitudinal waves

Question 03

0 6 **Figure 8** shows a longitudinal wave.

Figure 8



0 6 . 1 What do the labels **A** and **B** on **Figure 8** represent?

Choose answers from the box.

[2 marks]

amplitude	**frequency**	**rarefaction**	**reflection**	**wavelength**

A _____

B _____

6.6.1.1 Transverse and longitudinal waves

Question 03 · continued

0 6 . 2 The wave shown in **Figure 8** has a frequency of 4.0 kHz

Calculate the period of the wave.

Use the Physics Equations Sheet.

Give the unit.

[4 marks]

Period = _____ Unit _____

Question 6 continues on the next page

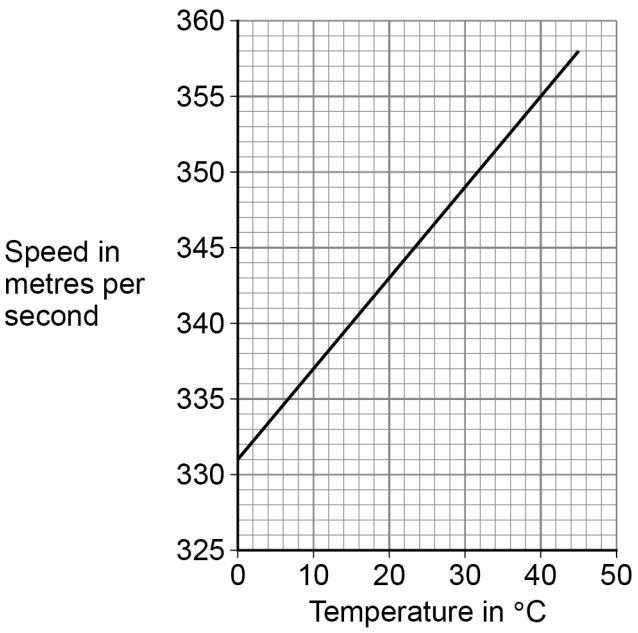
6.6.1.1 Transverse and longitudinal waves

Question 03 · continued

Sound waves are longitudinal.

Figure 9 shows how the speed of sound varies with the temperature of the air.

Figure 9



6.6.1.1 Transverse and longitudinal waves

Question 03 · continued

Use the Physics Equations Sheet to answer questions **06.3** and **06.4**.

0 6 . 3 Write down the equation that links frequency (f), wavelength (λ) and wave speed (v).

[1 mark]

0 6 . 4 A sound wave with a frequency of 300 Hz travels through the air.

The air has a temperature of 28.0 °C

Determine the wavelength of the sound wave.

Use **Figure 9**.

[4 marks]

Wavelength = _____ m

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6.6.1.1 Transverse and longitudinal waves

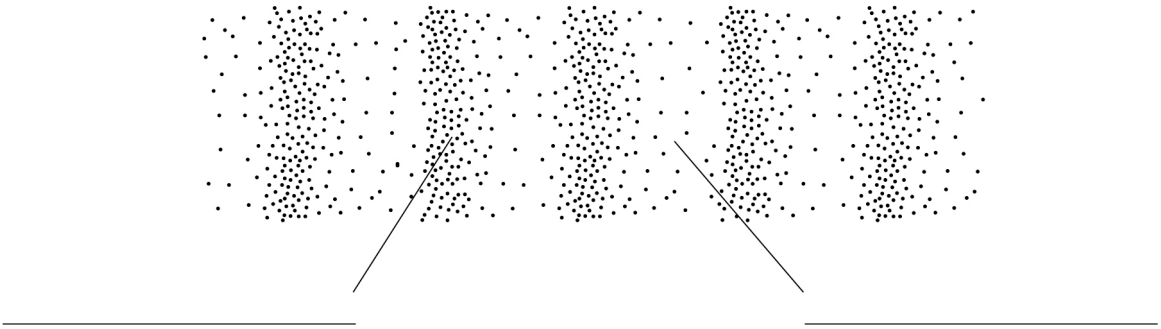
Question 04

June 2023 | 8464/P/2F | Original Q4

0 4 Sound waves are longitudinal waves.

0 4 . 1 **Figure 9** shows a sound wave.

Figure 9



Complete the labels on **Figure 9**.

Choose answers from the box.

[2 marks]

compression	**extension**	**rarefaction**
reflection		**resistance**

6.6.1.1 Transverse and longitudinal waves

Question 04 · continued

0 4 . 2 Which of the following is true for longitudinal waves?

[1 mark]

Tick (✓) **one** box.

Longitudinal waves transfer charge. ☐

Longitudinal waves transfer energy. ☐

Longitudinal waves transfer matter. ☐

Question 4 continues on the next page

6.6.1.1 Transverse and longitudinal waves

Question 04 · continued

Figure 10 shows a device a farmer uses to scare away birds.

Figure 10



The device emits a very loud sound.

The farmer measures the sound emitted by the device at different distances from the device.

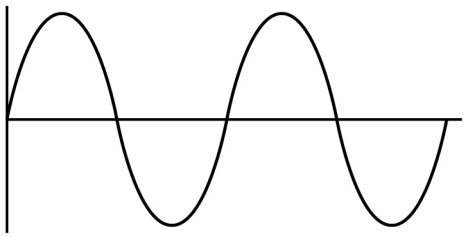
6.6.1.1 Transverse and longitudinal waves

Question 04 · continued

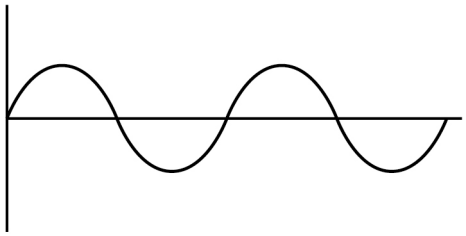
0 4 . 3 **Figure 11** shows a visual display of the sound waves at different distances from the device.

Both waves are drawn to the same scale.

Figure 11



At a distance of 80 m



At a distance of 200 m

Which property of the wave changes between 80 m and 200 m?

[1 mark]

Tick (✓) **one** box.

Amplitude ☐

Frequency ☐

Period ☐

Wavelength ☐

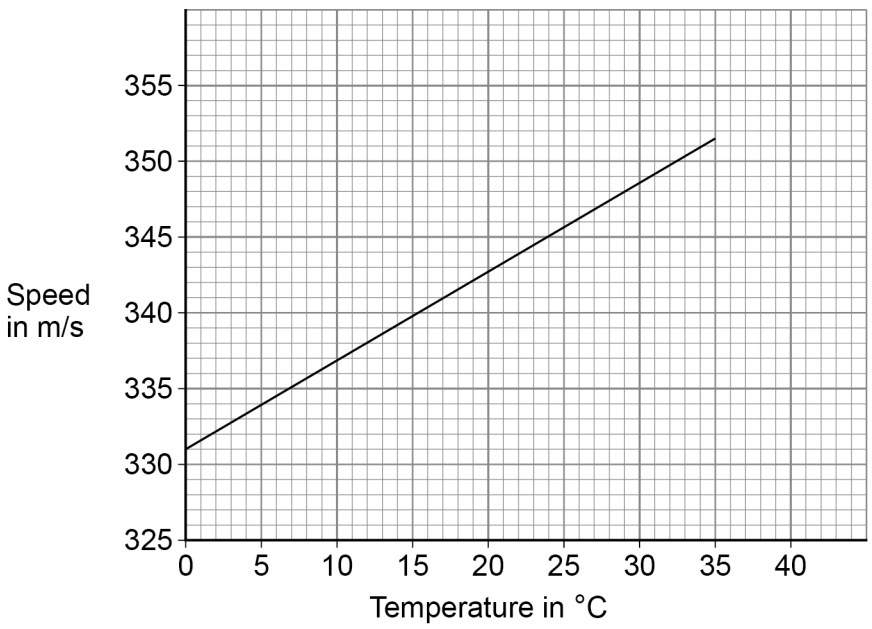
Question 4 continues on the next page

6.6.1.1 Transverse and longitudinal waves

Question 04 · continued

Figure 12 shows how the speed of the sound emitted by the device is affected by the temperature of the air.

Figure 12



0 4 . 4 The farmer tests the device on a day when the temperature of the air is 15 °C.

What is the speed of the sound emitted by the device when the temperature of the air is 15 °C?

[1 mark]

Speed = _____ m/s

6.6.1.1 Transverse and longitudinal waves

Question 04 · continued

0 4 . 5 The farmer stands a safe distance from the device.

It takes a time of 0.20 s for the sound to travel from the device to the farmer.

Calculate the distance between the device and the farmer.

Use your answer to Question **04.4** and the equation:

distance = speed × time

[2 marks]

Distance = _____ m

0 4 . 6 Explain how the time taken for the sound to reach the farmer is affected by the temperature of the air.

Use **Figure 12**.

[2 marks]

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6.6.1.1 Transverse and longitudinal waves

Question 05

June 2024 | 8464/P/2F | Original Q3

0 3 **Figure 6** shows an electronic whistle used by a referee in a football match.

Figure 6



When the button is pressed the whistle emits sound waves that travel through the air.

0 3 . 1 What is transferred by the sound waves as they travel through the air?

[1 mark]

Tick (✓) **one** box.

- Energy ☐
- Mass ☐
- Temperature ☐

Question 3 continues on the next page

6.6.1.1 Transverse and longitudinal waves

Question 05 · continued

0 3 . 2 What is a typical value for the speed of sound in air?

[1 mark]

Tick (✓) **one** box.

- 33 m/s ☐
- 330 m/s ☐
- 3300 m/s ☐
- 33 000 m/s ☐

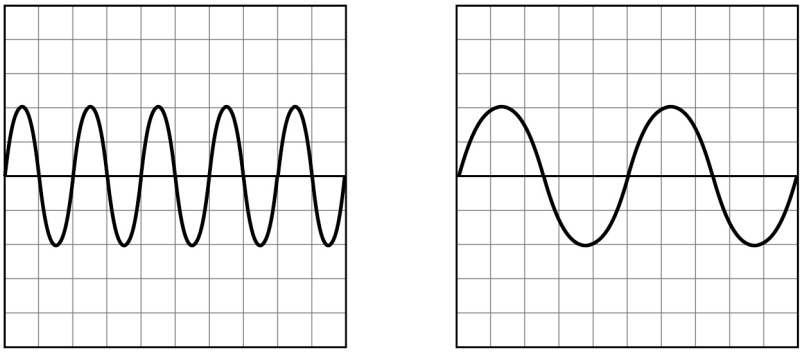
Question 05 · continued

The whistle can emit two different sound waves, **A** and **B**.

Figure 7 shows the two different sound waves as displayed on a screen.

The sound waves are drawn to the same scale.

Figure 7



Wave **A**

Wave **B**

0 3 . 3 Complete the sentences to describe a difference and a similarity between the two waves.

Choose answers from the box.

[2 marks]

amplitude	**frequency**	**wavelength**	**period**

Difference

Wave **A** has a greater _____ than wave **B**.

Similarity

Wave **A** has the same _____ as wave **B**.

Question 3 continues on the next page

6.6.1.1 Transverse and longitudinal waves

Question 05 · continued

0 3 . 4 Wave **A** has a frequency of 4.0 kHz.

Which of the following is the same as 4.0 kHz?

[1 mark]

Tick (✓) **one** box.

- 4.0 Hz ☐
- 4000 Hz ☐
- 4 000 000 Hz ☐
- 4 000 000 000 Hz ☐

0 3 . 5 Calculate the period of wave **A**.

Use your answer from Question **03.4** and the equation:

$$\text{period} = \frac{1}{\text{frequency}}$$

[2 marks]

Period = _____ s

6.6.1.1 Transverse and longitudinal waves

Question 05 · continued

0 3 . 6 Sound waves in air are longitudinal waves.

Complete the sentence to describe a sound wave.

Choose answers from the box.

[2 marks]

compression	**deflection**	**diffraction**	**rarefaction**	**reflection**

When sound waves travel through air they create areas

of _____ and _____.

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Turn over for the next question

6.6.1.1 Transverse and longitudinal waves

Question 06

June 2025 | 8464/P/2F | Original Q2

0 2 Food colouring can be used to change the colour of water.

A student investigated how the colour of water affects the time taken for the water to cool.

This is the method used.

1. Put 200 cm^3 of hot water into a conical flask.

2. Add four drops of food colouring to the water.

3. Place a digital thermometer in the water.

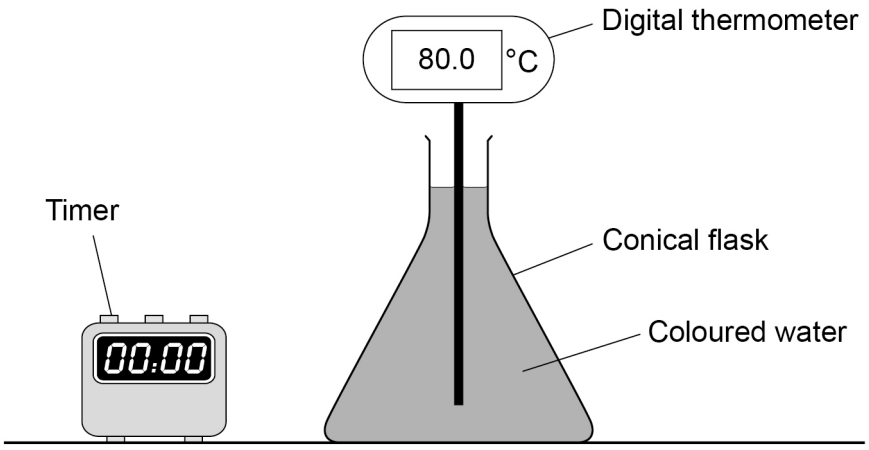
4. Start a timer when the temperature of the water is 80.0 °C.

5. Record the time taken for the water to cool to 65.0 °C.

6. Repeat steps 1 to 5 using different colours of food colouring.

Figure 3 shows the apparatus.

Figure 3



0 2 . 1 What was the independent variable in this investigation?

[1 mark]

Tick (✓) **one** box.

Colour of water ☐

Final temperature of water ☐

Volume of water ☐

6.6.1.1 Transverse and longitudinal waves

Question 06 · continued

0 2 . 2 Which of the following was a control variable in this investigation?

[1 mark]

Tick (✓) **one** box.

Initial temperature of water ☐

Time taken for water to cool ☐

Type of thermometer used ☐

0 2 . 3 What equipment should have been used to make sure 200 cm^3 of water was put in the conical flask?

[1 mark]

Tick (✓) **one** box.

Beaker ☐

Measuring cylinder ☐

Metre rule ☐

0 2 . 4 The student also tested water with no food colouring.

The temperature of the water changed from 80.0 °C to 65.0 °C in a time of 5.0 minutes.

Calculate the average rate of change of temperature of the water.

Use the equation:

$$\text{average rate of change of temperature} = \frac{\text{change in temperature}}{\text{time taken}}$$

[2 marks]

Average rate of change of temperature = _____ °C/minute

Question 06 · continued

Table 1 shows the results for the different coloured water.

Table 1

Colour of water	Rate of change of temperature in °C/minute
Red	6.1
Yellow	5.0
Green	4.3
Blue	4.0
Violet	3.7

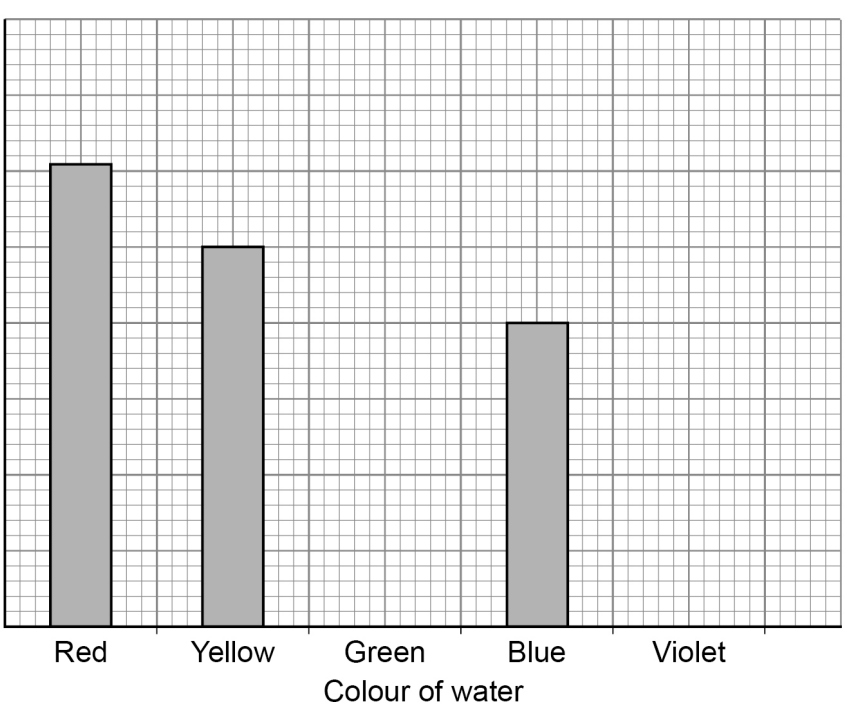
0 2 . 5 Complete **Figure 4**.

You should:

- label the *y*-axis
- add a scale to the *y*-axis
- draw bars for the green water and the violet water.

[3 marks]

Figure 4



6.6.1.1 Transverse and longitudinal waves

Question 06 · continued

0 2 . 6 In the visible spectrum, orange light is between red light and yellow light.

Estimate the rate of change of temperature if orange food colouring was used.

Use **Table 1**.

[1 mark]

Estimated rate of change of temperature = _____ °C/minute

0 2 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

infrared	**ultraviolet**	**x-rays**

The results show that the colour of the water affects the rate at which the water emits _____.

0 2 . 8 Complete the sentence.

Choose the answer from the box.

[1 mark]

energy	**rarefactions**	**temperature**

The water in each conical flask cools down because the electromagnetic radiation emitted by the water transfers _____.

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