

Wave speed required practical

AQA GCSE Combined Trilogy 8464 and Separate Physics 8463 | Paper 2 | Both tiers

Suggested: 35–40 minutes + 15–20 review | 29 parts | 47 marks

Specification points covered

8463 4.6.1.1 / 8464 6.6.1.1: transverse oscillations and wave energy transfer
8463 4.6.1.2 / 8464 6.6.1.2: wavelength, amplitude, frequency, period and wave speed
Practical follow-up: wave measurements in water and a solid — 8463 RP8 / 8464 RP20

A science centre is commissioning two wave displays: a ripple tank and a vibrating solid elastic cord. Your measurements and instructions must help a technician check the displays before visitors arrive.

Use a calculator, ruler and equations sheet. Equations: $v = f\lambda$; $T = 1 / f$; frequency = complete oscillations / time. Use metres and seconds. 1 cm = 0.01 m. The figures are schematic; use their labelled values, not measurements of the printed page. Complete every section.

1 Checking the visitor explanations

A small cork floats at a fixed horizontal position in the ripple tank. It oscillates vertically as straight wave crests travel horizontally to the right.

1(a) State what a travelling wave transfers from one place to another. **[1 mark]**

1(b) State what is meant by the period of an oscillation. **[1 mark]**

1(c) The cork moves up and down while the crests move to the right. Explain why this observation is consistent with a transverse wave. **[2 marks]**

1(d) The cork's highest position is 6.0 mm above its undisturbed position. Its lowest position is 6.0 mm below. State the amplitude. **[1 mark]**

1(e) A trainee labels this 6.0 mm vertical displacement as the wavelength. Explain why that label is wrong and describe the distance that should be measured for wavelength. **[2 marks]**



2 Reading a calibrated water-wave image

Figure 1 is a top view at one instant. Each vertical line represents a crest. P and Q label the first and last crests shown. The scale is calibrated in the actual water-surface plane; it is not a magnified screen image.

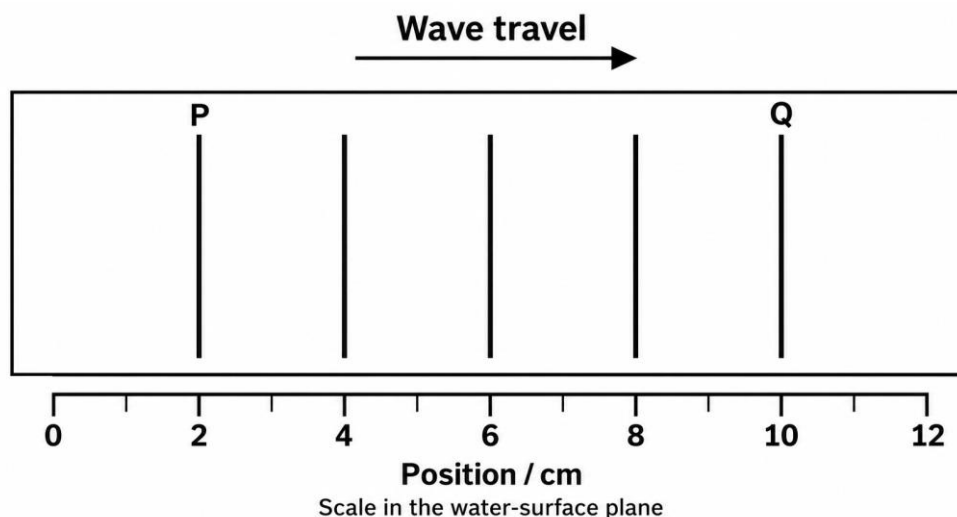


Figure 1

2(a) How many complete wavelengths lie between P and Q? **[1 mark]**

2(b) Use the scale readings at P and Q to calculate the wavelength in metres. Show your working. **[2 marks]**

2(c) A trainee calculates $8.0 \text{ cm} \div 5 = 1.6 \text{ cm}$. Explain the counting error and state which divisor should be used. **[2 marks]**

2(d) To measure crest spacing, should a ruler be parallel or perpendicular to the straight crests? **[1 mark]**

2(e) Explain why this single still image is not sufficient to determine the frequency. **[1 mark]**



3 Using the camera's real recording time

A camera records the same cork for ten COMPLETE oscillations in each trial. Table 1 gives elapsed times from the recording timestamps, not playback times. The driver setting and water depth stay the same. For 3(d), use a wavelength of 0.020 m.

Table 1

Trial	Time for ten complete oscillations / s
1	1.96
2	2.04
3	2.00

3(a) Calculate the mean elapsed time for ten complete oscillations. **[1 mark]**

3(b) Use the mean elapsed time to calculate the frequency. **[1 mark]**

3(c) Calculate the period of the cork's oscillation. **[1 mark]**

3(d) Use the stated wavelength of 0.020 m and your frequency to calculate the wave speed. **[1 mark]**

3(e) A slowed video takes 8.0 s to play the ten oscillations. A trainee uses $10 \div 8.0 = 1.25$ Hz. Explain why this is not the actual frequency and identify the correct time to use. **[2 marks]**

3(f) Explain why timing ten oscillations rather than one can reduce the effect of reaction-time error when using a stopwatch. **[2 marks]**



4 Commissioning the solid-cord display

Figure 2 shows a snapshot of the vibrating cord. P to Q is 1.20 m long. A clear loop pattern stays in position while the cord vibrates at 25 Hz. Use this rule: each loop span is HALF a wavelength; two adjacent loop spans make one complete wavelength. Do not derive this rule.

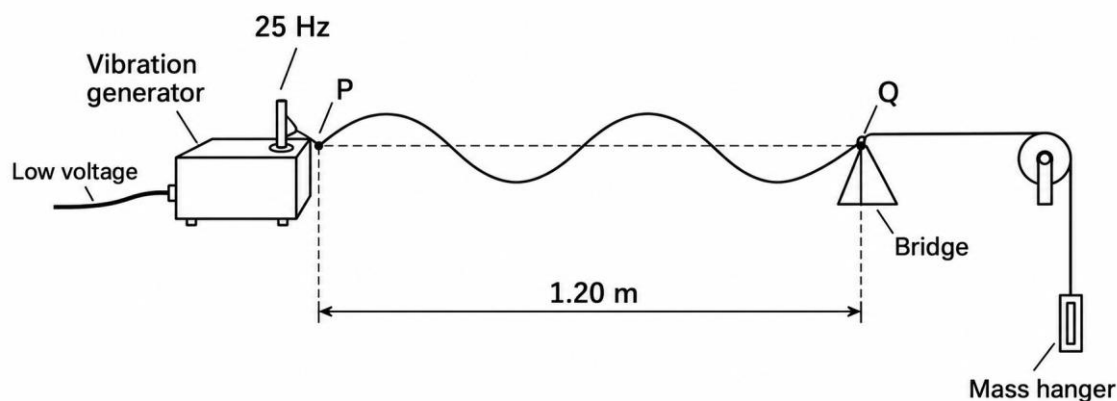


Figure 2

4(a) How many complete wavelengths fit between P and Q in Figure 2? [1 mark]

4(b) Calculate the wavelength and then the wave speed along the cord. [2 marks]

4(c) Calculate the period of the vibration generator at 25 Hz. [1 mark]

4(d) A painted mark on the cord moves up and down. Does it travel along the cord at the calculated wave speed? Explain. [1 mark]

4(e) At another setting, the wave speed is 15 m s^{-1} and the wavelength is 30 cm. Calculate the frequency. [2 marks]

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5 Checking other test settings

Each part below is an independent commissioning check. Use only its stated values. The water and solid displays need not have the same wave speed.

5(a) A new water-wave test gives a frequency of 8.0 Hz. Five complete wavelengths span 6.0 cm. Calculate the wavelength in metres and the wave speed. **[2 marks]**

5(b) A different solid-cord test has six half-wave loop spans over 1.50 m at 40 Hz. Use the rule in section 4 to calculate the wavelength and the wave speed. **[2 marks]**

5(c) Describe how a technician could obtain the wavelength and the frequency using the solid-cord apparatus in Figure 2. **[2 marks]**

5(d) An uncalibrated screen projection enlarges all crest spacings. A trainee repeats measurements on that same image and takes a mean. Explain why this does not remove the error and suggest a valid correction. **[2 marks]**

5(e) Suggest one precaution to reduce the electrical risk when using a ripple tank. **[1 mark]**



