



QUESTION WORKBOOK

Progressive waves

Waves · Year 12

AQA 3.3.1.1 · CIE 7.1.1, 7.1.2, 7.1.3, 7.1.4, 7.1.5, 7.1.6, 7.1.7
OCR A 4.4.1(a), 4.4.1(b)(i), 4.4.1(b)(ii), 4.4.1(c), 4.4.1(d), 4.4.1(g)

19 questions · 52 marks

PRINT EDITION

SECTION A · Warm-up

A1 State what a progressive wave transfers, and what the particles of the medium do. [2]

A2 A wave has frequency 50 Hz and wavelength 6.0 m. Calculate its speed. [2]

A3 A wave has a period of 0.020 s. Calculate its frequency. [2]

A4 Define the amplitude of a progressive wave. [1]

A5 The displacement–time graph for one point on a rope repeats every 0.25 s. State the name given to this repeat time and calculate the frequency of the wave. [2]

A6 State, in radians, the phase difference between two points on a progressive wave that are half a wavelength apart. [1]

SECTION B · Standard

- B1** A sound wave travels at 340 m s^{-1} with a frequency of 170 Hz . Calculate its wavelength. [2]

- B2** Red light of wavelength 600 nm travels at $3.0 \times 10^8 \text{ m s}^{-1}$. Calculate its frequency. [2]

- B3** A wave has a frequency of 25 Hz and a wavelength of 1.2 m . Calculate (a) its speed and (b) its period. [3]

- B4** Two points on a progressive wave are 0.75 m apart. The wavelength is 1.0 m . Calculate the phase difference between the two points, in degrees. [3]

- B5** A dolphin emits ultrasound of frequency 120 kHz. The ultrasound travels through seawater at 1500 m s^{-1} . Calculate its wavelength. [2]

- B6** A displacement–distance graph of a wave on a wire shows a vertical distance of 24 mm from a trough to the next crest, and a distance of 0.80 m between adjacent crests. The frequency of the wave is 5.0 Hz. Determine the amplitude of the wave and calculate its speed. [3]

- B7** The transducer of an ultrasonic cleaning bath oscillates with a period of $25 \mu\text{s}$. The sound it produces travels through the cleaning fluid at 1480 m s^{-1} . Calculate the frequency of the sound and its wavelength in the fluid. [3]

SECTION C · Stretch

- C1** On a lake, 20 complete waves pass a fixed post in 10 s, and successive crests are 3.0 m apart. Calculate (a) the frequency, (b) the wave speed and (c) the period. [4]

- C2** Two points on a wave of wavelength 2.4 m have a phase difference of $\pi/2$ radians. Calculate the distance between the points. Determine the phase difference, in degrees, between two points on the same wave that are 3.0 m apart. [4]

- C3** Explain why the particles in a progressive wave do not travel along with the wave, even though the wave itself moves forward. [3]

- C4** Points P and Q are 1.8 m apart on a progressive wave of wavelength 2.4 m. A student claims that P and Q oscillate in antiphase. Deduce whether the student is correct. [3]

- C5** A ship's radar transmits electromagnetic waves of frequency 9.4 GHz. Electromagnetic waves travel at $3.0 \times 10^8 \text{ m s}^{-1}$. Show that the wavelength of the radar waves is about 3 cm. Go on to calculate the period of the waves. [4]

- C6** A machine generates continuous waves on a long stretched rope. A student is given two graphs: a displacement–distance graph showing the whole rope at one instant, and a displacement–time graph for a single point on the rope. Explain how the student can use the two graphs together to determine the speed of the waves, and explain why neither graph on its own is sufficient. [6]
