

Exercise walk-through

Periodic Waves ■ 14.2

eXercise

You must be able to

- define **frequency** 频率, **period** 周期, and **wavelength** 波长 of a periodic wave
- apply the **wave equation** 波速公式 $v = f\lambda$
- relate the wave speed to the properties of the medium

Method — Definitions

- **Frequency** f — cycles per second (Hz).
- **Period** $T = \frac{1}{f}$ — time for one cycle.
- **Wavelength** λ — length of one full wave.

Method — The wave equation

$v = f\lambda$. The wave **speed** is set by the medium, so if f rises, λ falls to keep v fixed.

Method — Example

$f = 50 \text{ Hz}$ and $\lambda = 2.0 \text{ m}$ give $v = 100 \text{ m s}^{-1}$.

Practice 2.1 ■ 2 marks

A wave has frequency 20 Hz and wavelength 1.5 m. Find its speed.

Solution 2.1

Method: Definitions

Worked steps

$$v = f\lambda = 20 \times 1.5 = 30 \text{ m s}^{-1} \quad \text{M1} \quad \text{A1}.$$

Practice 2.2 ■ 1 mark

A wave has a period of 0.25 s. Find its frequency.

Solution 2.2

Method: Definitions

Worked steps

$$f = \frac{1}{T} = \frac{1}{0.25} = 4.0 \text{ Hz} \quad \text{B1}.$$

Practice 2.3 ■ 1 mark

State the wave equation.

Solution 2.3

Method: The wave equation

Worked steps

$$v = f\lambda \quad \text{B1.}$$

Exam-style 3.1 ■ 1 mark

The wave equation is

A $v = f/\lambda$

B $v = f\lambda$

C $v = \lambda/f$

D $f = v\lambda$

Solution 3.1

Method: The wave equation

A $v = f/\lambda$

B $v = f\lambda$



C $v = \lambda/f$

D $f = v\lambda$

Worked steps

B.

Exam-style 3.2 ■ 1 mark

If the frequency of a wave doubles at constant speed, the wavelength

- A** doubles
- B** halves
- C** stays the same
- D** quadruples

Solution 3.2

Method: Definitions

A doubles

B halves 

C stays the same

D quadruples

Worked steps

B.

Exam-style 3.3 ■ 2 marks

A sound wave travels at 340 m s^{-1} with a frequency of 170 Hz .

- (a) Find the wavelength.
- (b) Find the period.

Solution 3.3

Method: Definitions

Worked steps

$$(a) \lambda = \frac{v}{f} = \frac{340}{170} = 2.0 \text{ m} \quad \text{M1 A1}. \quad (b) T = \frac{1}{f} = \frac{1}{170} = 5.9 \times 10^{-3} \text{ s} \quad \text{M1 A1}.$$