Solutions

Each answer shows the steps, then the **result**.

2.1

- **amplitude**: the maximum displacement from the rest position
- **wavelength**: the shortest distance between two points oscillating **in phase**

2.2

- $v = f\lambda$

$$v = (50\text{ Hz})(6.0\text{ m}) = \mathbf{300}\text{ m s}^{-1}$$

2.3

- $f = 1/T$

2.4

- π radians (or 180°) — exactly out of phase

3.1 B

- $\lambda = v/f$

$$\lambda = \frac{340\text{ m s}^{-1}}{170\text{ Hz}} = \mathbf{2.0}\text{ m}$$

3.2

- one period is four of the 5 ms intervals

$$T = 4 \times 5\text{ ms} = 20\text{ ms} = 0.020\text{ s}$$

$$f = \frac{1}{T} = \frac{1}{0.020\text{ s}} = \mathbf{50}\text{ Hz}$$

3.3

- in one period T the wave moves one wavelength λ, so $v = \lambda/T$
- $f = 1/T$, so $v = f\lambda$

3.4

- intensity $\propto A^2$, so doubling A makes intensity **four times** larger

3.5

- they transfer **energy** (the cork gains and loses energy as it bobs)
- they do **not** transfer matter — the cork oscillates about the same place

3.6

(a) amplitude = **8.0** cm; wavelength = **0.50** m

(b) $v = f\lambda$

$$v = (12\text{ Hz})(0.50\text{ m}) = \mathbf{6.0}\text{ m s}^{-1}$$

(c) **coherent**

- same frequency and a **constant phase difference** ($180° = \pi$ rad); equal amplitudes are **not** required

(d) a single wave of the same wavelength, 0.50 m

- amplitude 8.0 cm − 4.0 cm = **4.0** cm
- in phase with **X** (the larger wave)

(e) intensity $\propto$ (amplitude)^2

$$\frac{I_\mathrm{X}}{I_\mathrm{Y}} = \left(\frac{8.0\ \mathrm{cm}}{4.0\ \mathrm{cm}}\right)^2 = \mathbf{4.0}$$