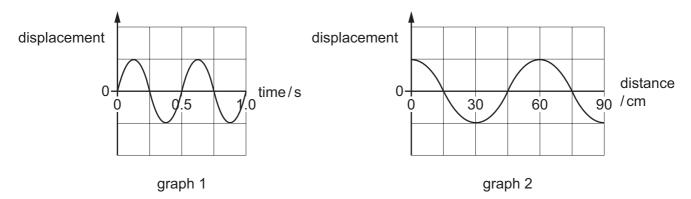
21 The two graphs represent the same wave.

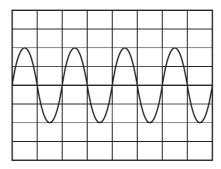
Graph 1 shows the variation with time of the displacement at a particular distance. Graph 2 shows the variation with distance of the displacement at one instant.



What is the speed of the wave?

- **A** $22.5 \,\mathrm{cm}\,\mathrm{s}^{-1}$
- **B** $30.0 \, \text{cm s}^{-1}$
- **C** $90.0 \, \text{cm s}^{-1}$
- **D** $120 \, \text{cm s}^{-1}$

22 A microphone is connected to a cathode-ray oscilloscope (CRO). When a tuning fork is struck and then held next to the microphone, the following waveform is shown on the display of the CRO.



The time-base setting on the CRO is 2.00 ms per division.

What is the best estimate of the frequency of the sound produced by the tuning fork?

- **A** 63 Hz
- **B** 170 Hz
- **C** 250 Hz
- **D** 500 Hz

23 A loudspeaker emitting a constant frequency of 2000 Hz is swung in a horizontal circle with a speed of $15.0\,\mathrm{m\,s^{-1}}$.

A stationary observer is level with the loudspeaker and situated a long distance from the loudspeaker. The observer hears a sound of varying frequency. The maximum frequency heard is 2097 Hz.

What is the speed of the sound in the air?

- **A** $294 \,\mathrm{m \, s^{-1}}$
- **B** $309 \,\mathrm{m \, s^{-1}}$
- $C 324 \,\mathrm{m \, s^{-1}}$
- **D** $330 \,\mathrm{m \, s^{-1}}$