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1. Fig. shows one swimmer in a race starting before the signal.



The swimmer is called back by a loud, low-pitched sound from a loudspeaker positioned just at water level. The speed of sound in air is 330 m / s.

(a) (i) Describe how the loudspeaker causes sound to travel through the air. [3]

(ii) Explain, in terms of wave properties, what is meant by loud and low-pitched. [3]

(iii) The swimmer is 0.57 m from the loudspeaker when he hears the sound. Calculate the time taken for the sound to reach him through the air. [2]

(iv) Explain how the time taken differs when sound travels the same distance through air and through water. [2]

(b) The loudspeaker produces sound of frequency 0.20 kHz.

(i) Calculate the wavelength of this sound. [3]

(ii) Draw a diagram to show what is meant by the term wavelength when applied to a longitudinal wave such as sound. [2]

1. A student stands at a distance d from the base of a tall cliff.

He claps together two pieces of wood and measures the time that elapses before he hears the echo. He conducts the experiment five times and obtains these results.

0.72 s 0.80 s 0.71 s 0.81 s 0.71 s

The speed of sound is 320 m / s.

What is the distance d?

**A** 120 m **B** 240 m **C** 480 m **D** 600 m