

A level Physics A
H556/03 Unified physics

Question Set 18

1 (a) Describe the **Doppler effect**.

[1]

(b) Explain how ultrasound is used to measure the speed of blood flow in an artery.

[2]

(c) In cosmology, the Doppler effect can be observed with light from distant galaxies. The Doppler effect can also be observed with sound waves.

Two students use sound waves to investigate the Doppler effect.

In an open space, one student swings a loudspeaker at constant speed in a horizontal circle of radius 0.60 m.

The other student stands a large distance away and holds a microphone. The microphone is connected to a data logger and computer.

Fig. 6.1 shows the situation, viewed from above.

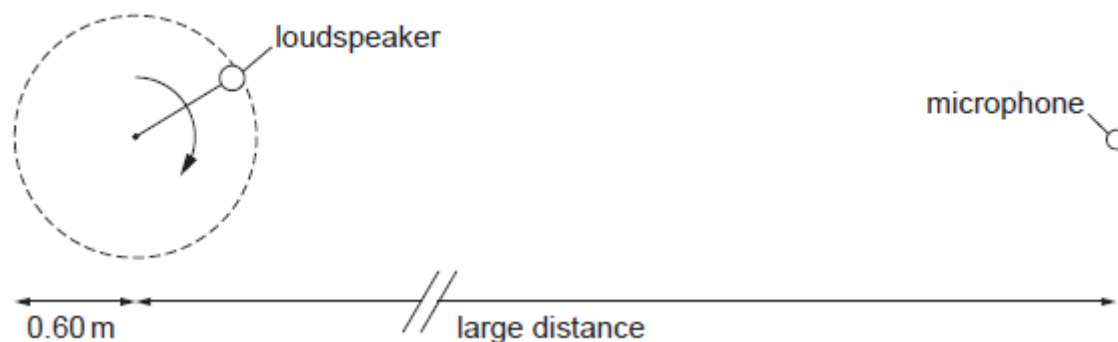


Fig. 6.1

The loudspeaker emits sound in all directions at a single frequency $f_0 = 1700$ Hz.

Fig. 6.2 shows the variation with time t of the frequency f received by the microphone.

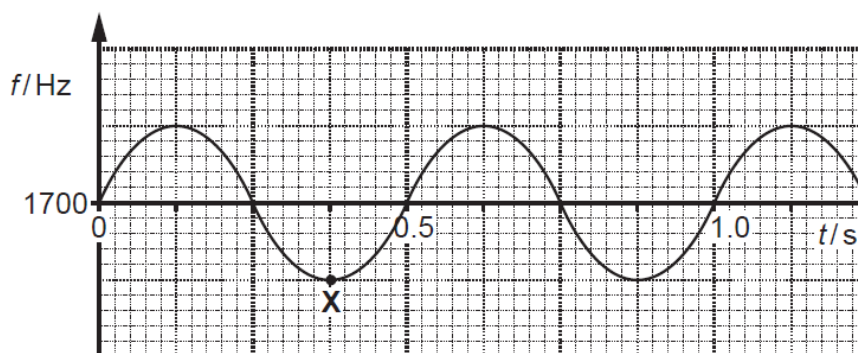


Fig 6.2

[2]

(i) Use Fig. 6.2 to show that the speed of the loudspeaker is 7.5 ms^{-1} .

[2]

(ii) The speed of sound in this experiment is 330 ms^{-1} .

Calculate the maximum change in frequency Δf of the sound detected by the microphone.

$\Delta f = \dots\dots\dots \text{Hz}$ [2]

(iii) Hence complete the scale on the y-axis of Fig. 6.2. [1]

(iv) Mark with an **X** on Fig. 6.1 the position of the loudspeaker which corresponds to the point **X** on Fig. 6.2. [1]

(d) In their laboratory notes, one student writes about the **accuracy** of the measurements whereas the other writes about their **precision**.

Define these terms.

accuracy:

.....

precision:

..... [2]

Total Marks for Question Set 18: 11

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