

- 5 (a) A progressive wave travels through a medium. The wave causes a particle of the medium to vibrate along a line P. The energy of the wave propagates along a line Q.

Compare the directions of lines P and Q if the wave is:

- (i) a transverse wave

..... [1]

- (ii) a longitudinal wave.

..... [1]

- (b) A tube is closed at one end. A loudspeaker is placed near the other end of the tube, as shown in Fig. 5.1.

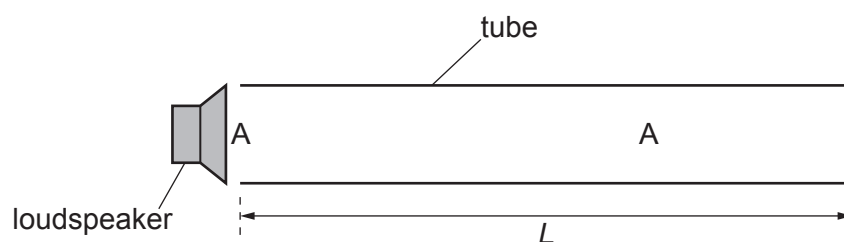


Fig. 5.1 (not to scale)

The loudspeaker emits sound of frequency 1.7 kHz . The speed of sound in the air in the tube is 340 m s^{-1} . A stationary wave is formed with an antinode A at the open end of the tube. There is only one other antinode A inside the tube, as shown in Fig. 5.1.

Determine:

- (i) the wavelength of the sound

wavelength = m [2]

- (ii) the length L of the tube

$L = \dots\dots\dots \text{m}$ [1]

- (iii) the maximum wavelength of the sound from the loudspeaker that can produce a stationary wave in the tube.

maximum wavelength = m [1]

- (c) Two polarising filters are arranged so that their planes are vertical and parallel. The first filter has its transmission axis at an angle of 35° to the vertical and the second filter has its transmission axis at angle α to the vertical, as shown in Fig. 5.2.

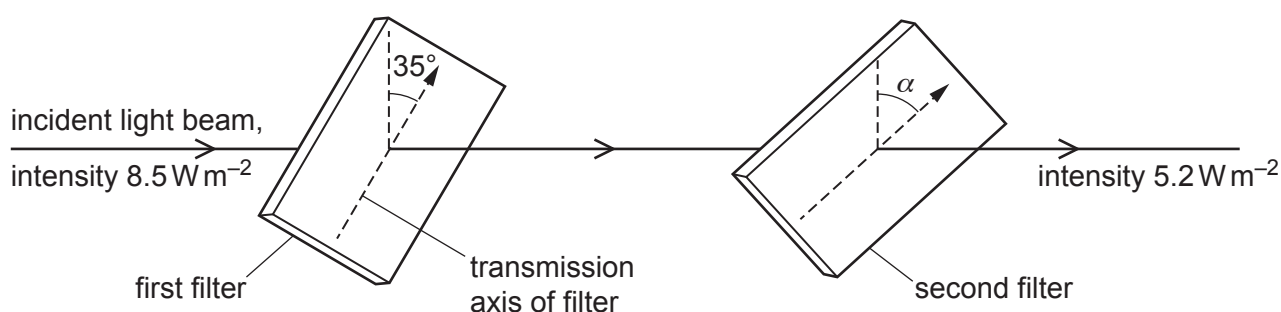


Fig. 5.2

Angle α is greater than 35° and less than 90° . A beam of vertically polarised light of intensity 8.5 W m^{-2} is incident normally on the first filter.

- (i) Show that the intensity of the light transmitted by the first filter is 5.7 W m^{-2} .

[1]

- (ii) The intensity of the light transmitted by the second filter is 5.2 W m^{-2} .

Calculate angle α .

$\alpha = \dots\dots\dots^\circ$ [2]

[Total: 9]