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.

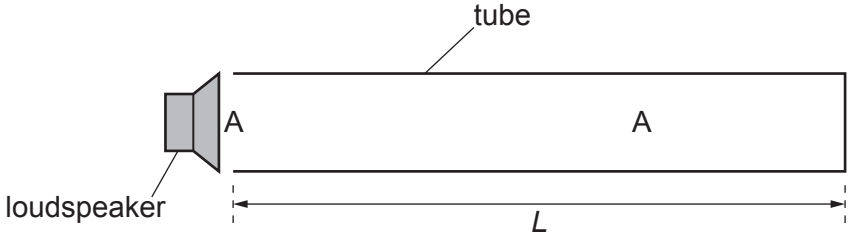

Fig. 5.1 (not to scale)

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 = ... 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.

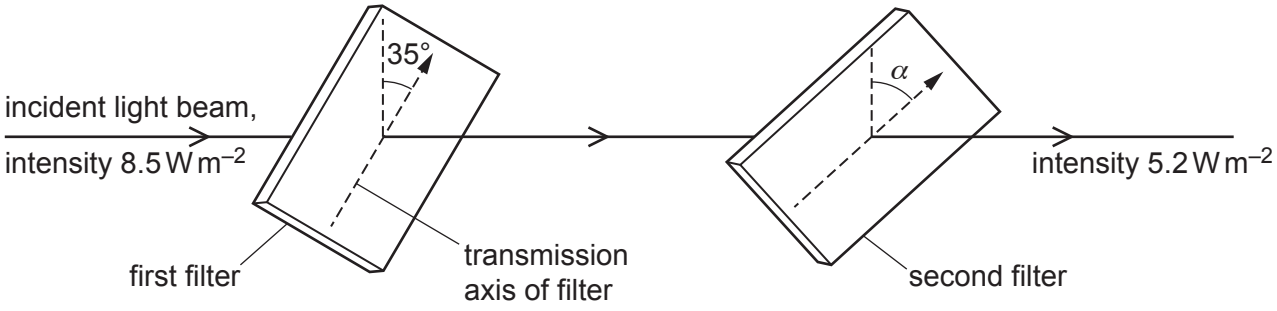

Fig. 5.2

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.

α = ...° [2]

[Total: 9]