

8 (a) A source of sound has frequency f . Sound of wavelength λ is produced by the source.

(i) State

1. what is meant by the *frequency* of the source,

.....

[1]

2. the distance moved, in terms of λ , by a wavefront during n oscillations of the source.

distance = [1]

(ii) Hence derive an expression for the speed v of the wave in terms of f and λ .

[2]

- (b) The waveform of a sound wave produced on the screen of a cathode ray oscilloscope (c.r.o.) is shown in Fig. 8.1.

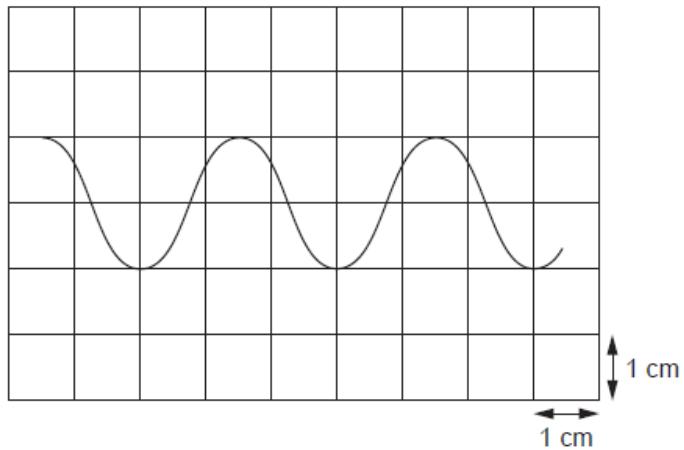


Fig. 8.1

The time base setting of the c.r.o is 2.0 ms cm^{-1} .

Determine the frequency of the sound wave.

frequency = Hz [2]

- (c) Microwaves of the same amplitude and wavelength are emitted in phase from two coherent sources P and Q. The sources are arranged as shown in Fig. 8.2.

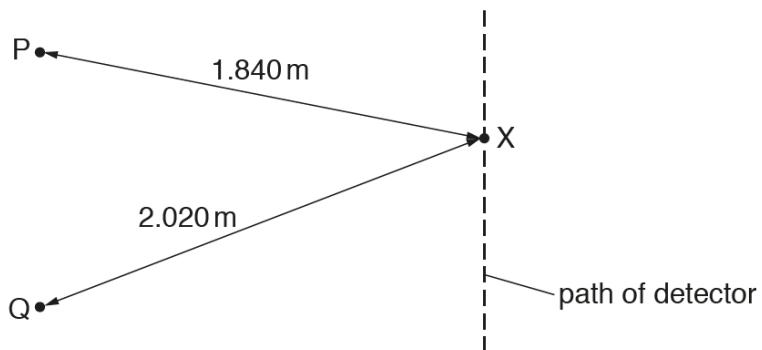


Fig. 5.1

Fig. 8.2

A microwave detector is moved along a path that is parallel to the line joining P and Q. A series of intensity maxima and minima are detected.

When the detector is at point X, the distance PX is 1.840 m and the distance QX is 2.020 m. The microwaves have a wavelength of 6.0 cm.

- (i) State what is meant by *coherent sources*.

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..... [1]

(ii) Calculate the frequency of the microwave.

frequency = Hz [2]

(iii) Describe and explain the intensity of the microwaves detected at X.

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..... [3]

- (iv) The wavelength of the microwaves is then decreased.

Describe the effect on the interference pattern along the path of the detector.

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..... [1]

- (d) Red and green light of wavelengths 640 nm and 520 nm respectively are simultaneously directed through a narrow slit on to a diffraction grating. The grating is perpendicular to the light and has a line spacing of 1.60 μm .
- (i) Complete Fig.8.3 by calculating the values of all the angles of maxima for both colours. Indicate **nil** if there are no maxima detected.

order, n	angle for red maximum / $^{\circ}$	angle for green maximum / $^{\circ}$
0	0	0

1		
2		
3		
4		

[4]

Fig. 8.3

- (ii) The grating is replaced with a double slit of the same spacing. Describe and explain how the new pattern produced differs from the one for the diffraction grating.
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[3]

[Total: 20]

