1)

(a) Fig. 4.1 shows the variation with time *t* of the displacement *x* of one point in a progressive wave.

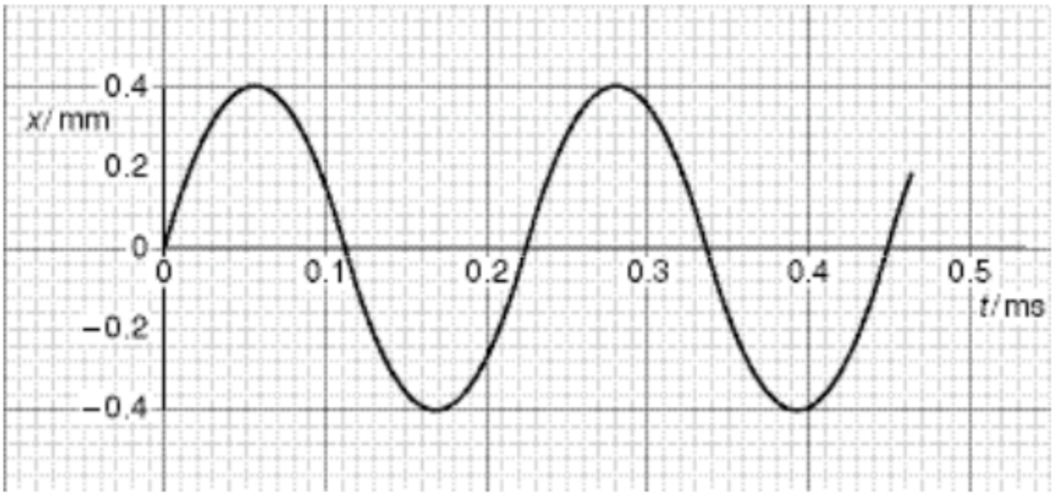

Fig. 4.1

Fig. 4.2 shows the variation with distance *d* along the same wave of the displacement *x*.

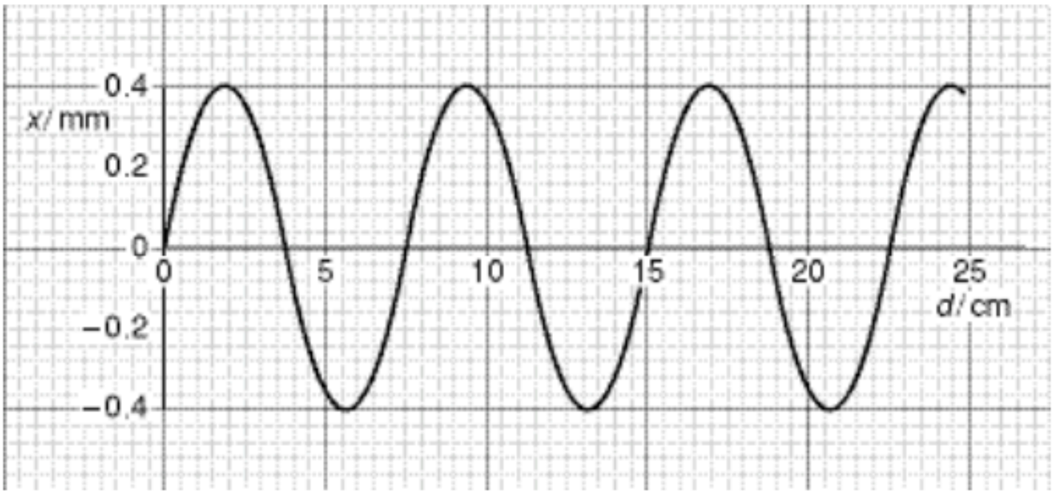

Fig. 4.2

(i) Use Figs. 4.1 and 4.2 to determine, for this wave,

1. the amplitude,

amplitude = ... mm

2. the wavelength,

wavelength = ... m

3. the frequency,

frequency = ……………………….…….. Hz

4. the speed.

speed = …………………………….. m s^{-1}
[6]

(ii) On Fig. 4.2, draw a second wave having the same amplitude but half the frequency as that shown. [1]

2)

(a) State what is meant by

(i) the *frequency* of a progressive wave,

....

....

....[2]

(ii) the *speed* of a progressive wave.

....

....[1]

3)

Fig. 2.1 shows the variation with distance *x* along a wave of its displacement *d* at a particular time.

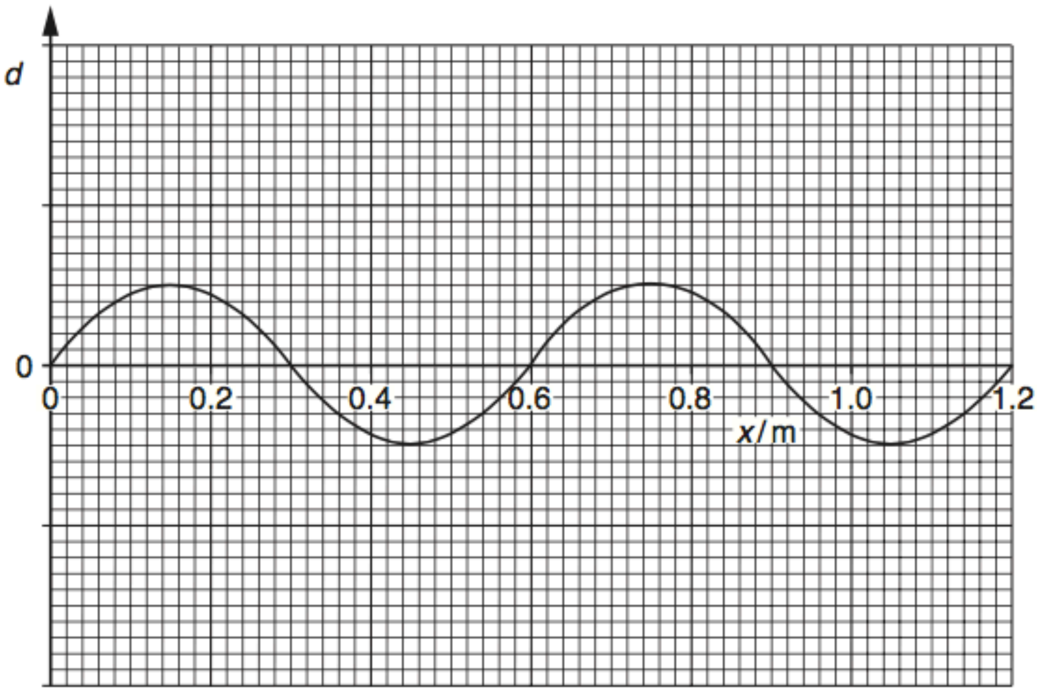

Fig. 2.1

The wave is a progressive wave having a speed of $330\,\text{m}\,\text{s}^{-1}$.

(a) **(i)** Use Fig. 2.1 to determine the wavelength of the wave.

wavelength = ... m

(ii) Hence calculate the frequency of the wave.

frequency = ... Hz [3]

(b) A second wave has the same frequency and speed as the wave shown in Fig. 2.1 but has double the intensity. The phase difference between the two waves is 180°.

On the axes of Fig. 2.1, sketch a graph to show the variation with distance *x* of the displacement *d* of this second wave. [2]

4)

The spectrum of electromagnetic waves is divided into a number of regions such as radio waves, visible light and gamma radiation.

(a) State three distinct features of waves that are common to all regions of the electromagnetic spectrum.

1. ....

2. ....

3. .... [3]

(b) A typical wavelength of visible light is 495 nm. Calculate the number of wavelengths of this light in a wave of length 1.00 m.

number = ... [2]

(c) State a typical wavelength for

(i) X-rays,

wavelength = ... m

(ii) infra-red radiation.

wavelength = ... m
[2]

5)

A string is stretched between two fixed points. It is plucked at its centre and the string vibrates, forming a stationary wave as illustrated in Fig. 4.1.

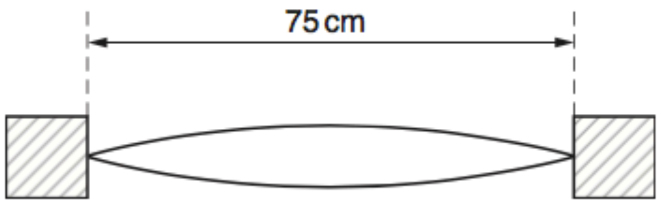

Fig. 4.1

The length of the string is 75 cm.

(a) State the wavelength of the wave.

wavelength = ... m [1]

(b) The frequency of vibration of the string is 360 Hz. Calculate the speed of the wave on the string.

speed = ... $m\,s^{-1}$ [2]

6)

Fig. 5.1 shows the variation with time t of the displacements x_A and x_B at a point P of two sound waves A and B.

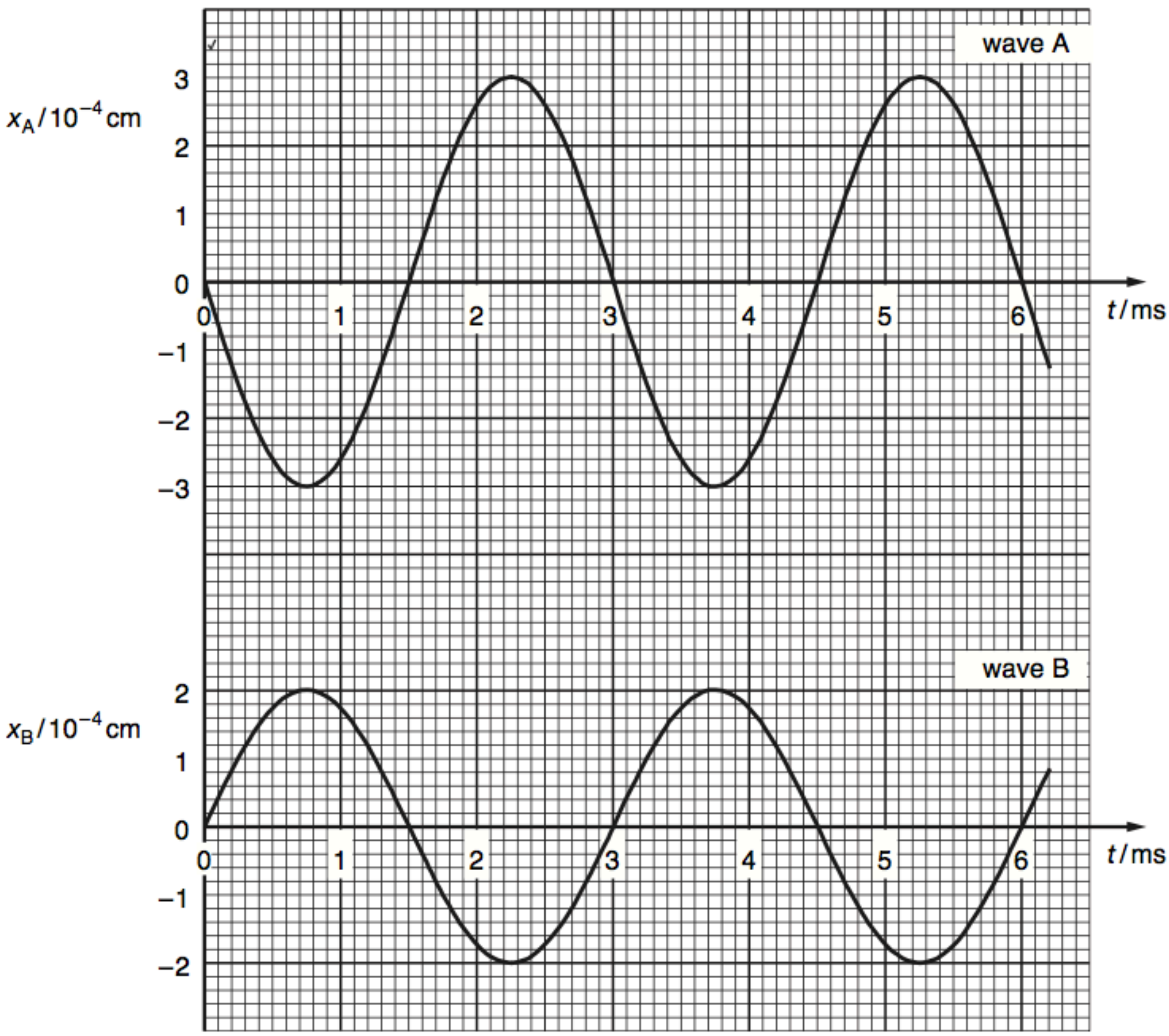

Fig. 5.1

(a) By reference to Fig. 5.1, state one similarity and one difference between these two waves.

similarity: ....

difference: .... [2]

(b) State, with a reason, whether the two waves are coherent.

....

.... [1]

(c) The intensity of wave A alone at point P is I.

(i) Show that the intensity of wave B alone at point P is $\frac{4}{9}I$.

[2]

(ii) Calculate the resultant intensity, in terms of I, of the two waves at point P.

resultant intensity = ... I [2]

(d) Determine the resultant displacement for the two waves at point P

(i) at time $t = 3.0$ ms,

resultant displacement = ... cm [1]

(ii) at time $t = 4.0$ ms.

resultant displacement = ... cm [2]

7)

Light reflected from the surface of smooth water may be described as a polarised transverse wave.

(a) By reference to the direction of propagation of energy, explain what is meant by

(i) a *transverse wave*,

....

....[1]

(ii) *polarisation*.

....

....[1]

(b) A glass tube, closed at one end, has fine dust sprinkled along its length. A sound source is placed near the open end of the tube, as shown in Fig. 5.1.

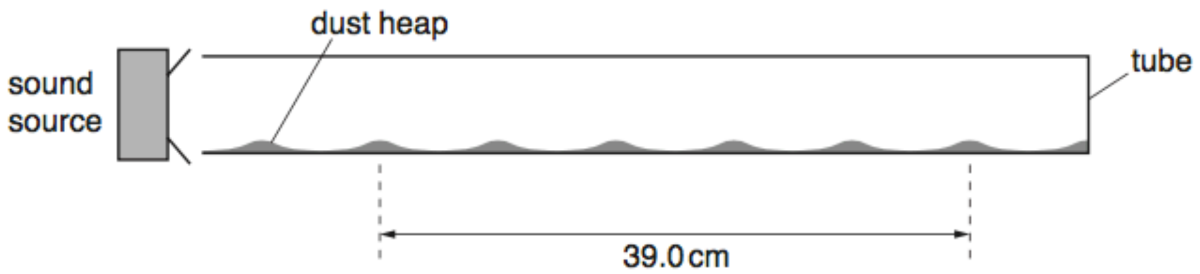

Fig. 5.1

The frequency of the sound emitted by the source is varied and, at one frequency, the dust forms small heaps in the tube.

(i) Explain, by reference to the properties of stationary waves, why the heaps of dust are formed.

....

....

....

....[3]

(ii) One frequency at which heaps are formed is 2.14 kHz.
The distance between six heaps, as shown in Fig. 5.1, is 39.0 cm.
Calculate the speed of sound in the tube.

speed = ... $m\,s^{-1}$ [3]

(c) The wave in the tube is a stationary wave. Explain, by reference to the formation of a stationary wave, what is meant by the speed calculated in **(b)(ii)**.

....

....

....

....[3]