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

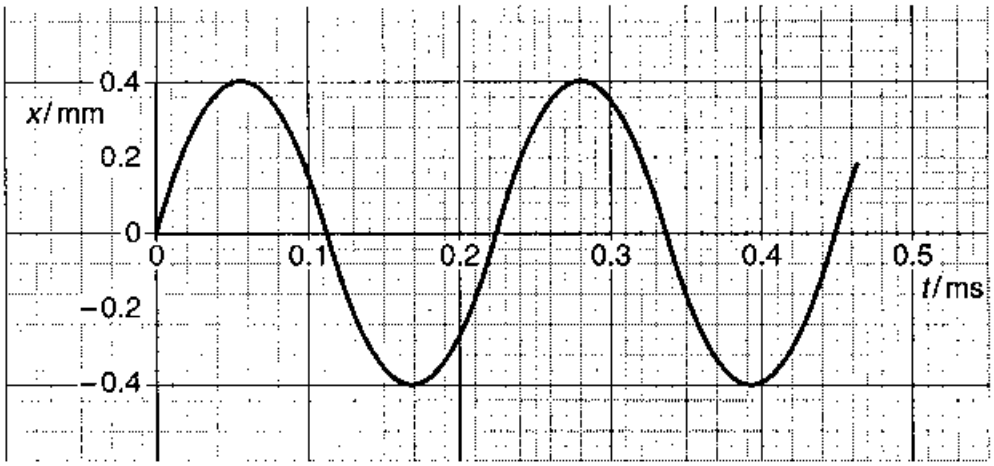

Fig. 4.1

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

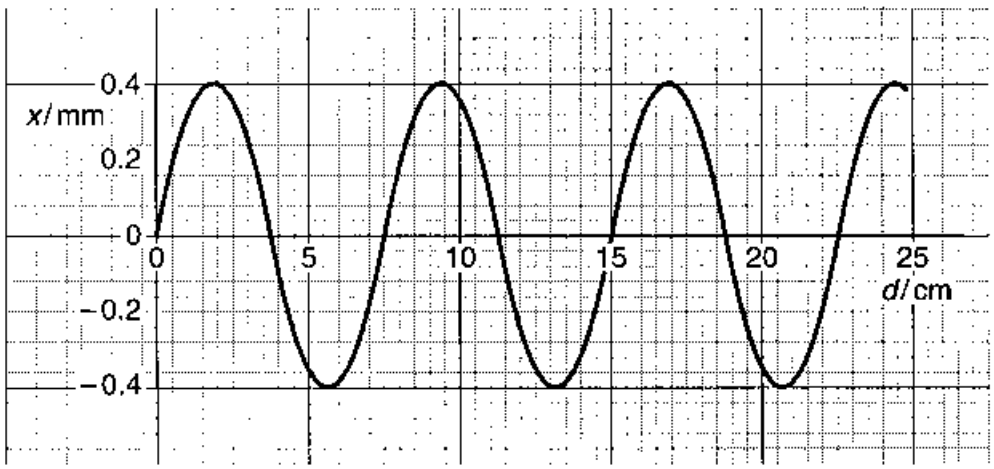

Fig. 4.2

(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]

(b) Light of wavelength 590 nm is incident at right angles to a diffraction grating having 5.80×10^5 lines per metre, as illustrated in Fig. 4.3.

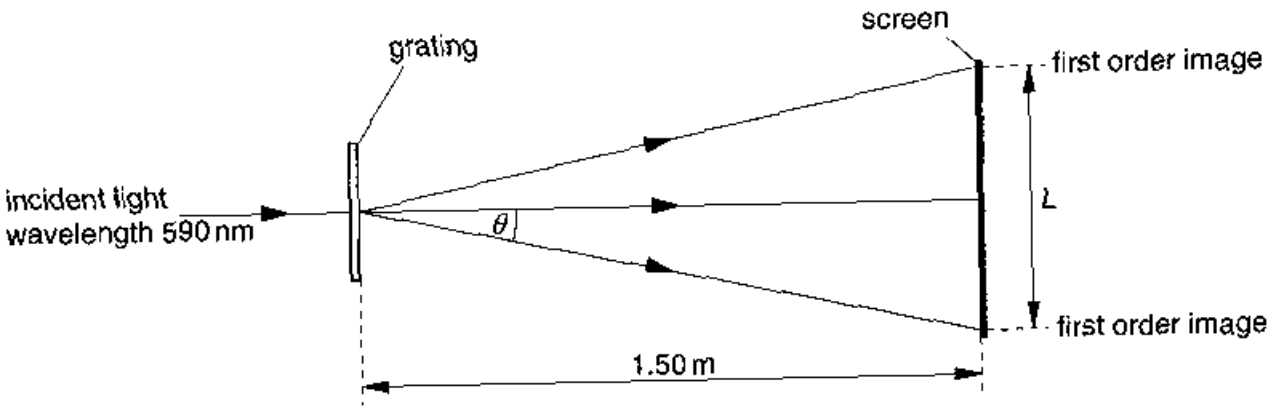

Fig. 4.3

A screen is placed parallel to and 1.50 m from the grating. Calculate

(i) the spacing, in μm, of the lines of the grating,

spacing = ... μm

(ii) the angle θ to the original direction of the light at which the first order diffracted image is seen,

angle = ... °

(iii) the minimum length L of the screen so that both first order diffracted images may be viewed at the same time on the screen.

length = ... m

[5]