4 Mr Tan is studying a water wave in which all the wavefronts are parallel to one another. The variation with time t of the displacement x of a particular particle in the wave is shown in Fig. 4.1.
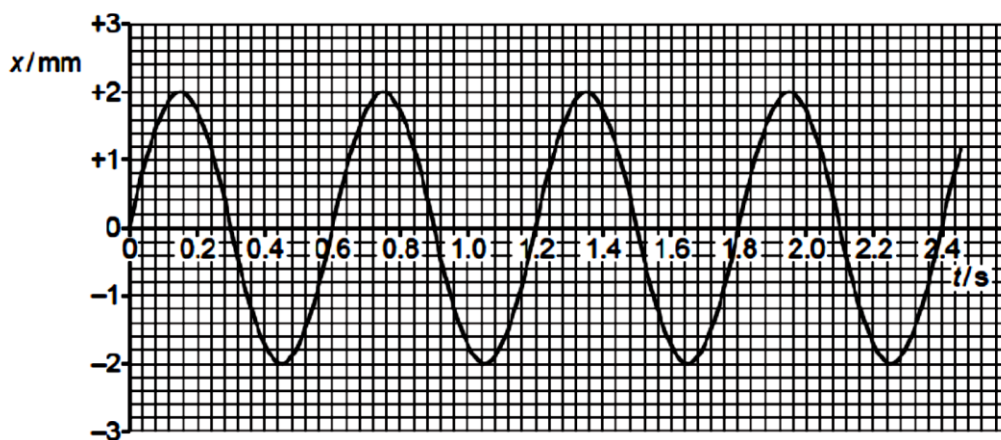

Fig. 4.1

The distance d of the oscillating particles from the source of the waves is measured.

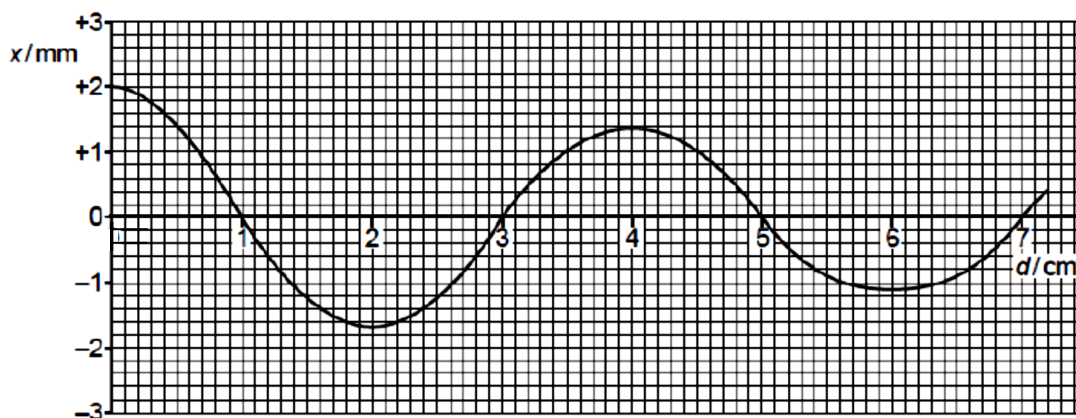At a particular time, the variation of the displacement x with this distance d is shown in Fig. 4.2.

Fig. 4.2

(a) (i) Use Figs. 4.1 and 4.2 to state and explain whether the wave is losing power as it moves away from the source.

....

....

....

.... [2]

(ii) Determine the ratio $\dfrac{\text{intensity of the wave at source}}{\text{intensity of wave 6.0 cm from source}}$

ratio = ………………… [2]

(b) A beam of plane-polarised light of intensity I_o is incident on an ideal polariser. This polariser is rotated so that its polarising axis makes an angle θ with the plane of polarisation of the incident beam.

(i) State an expression for the intensity I of the light transmitted by the polariser.
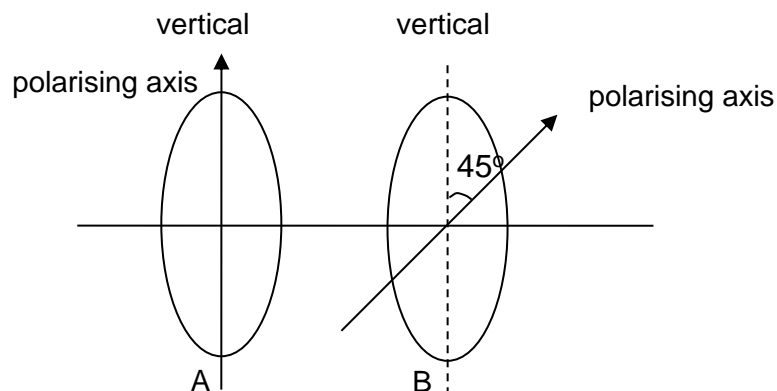
….....…………………………………………………………………………………… [1]

(ii) On Fig. 4.3, sketch a labelled graph to show the variation with angle θ of the intensity I when the polariser is rotated through 360º.

Fig. 4.3   [2]

(iii) Fig. 4.4 shows two ideal polarisers A and B placed parallel to each other.

Fig. 4.4

1. Vertically polarised light of intensity I_o enters both polarisers, passing through in the direction from A to B. Determine the intensity I_{AB} of the light emerging from B.

I_{AB} = ………………… I_o [2]

2. The vertically polarised light of intensity I_o now enters both polarisers from the other side, passing through in the direction from B to A. Calculate the intensity I_{BA} of the light emerging from A.

I_{BA} = ………………… I_o [2]

[Total: 11]