5 The variation with time t of the displacement x of a point in a transverse wave T_1 is shown in Fig. 5.1.

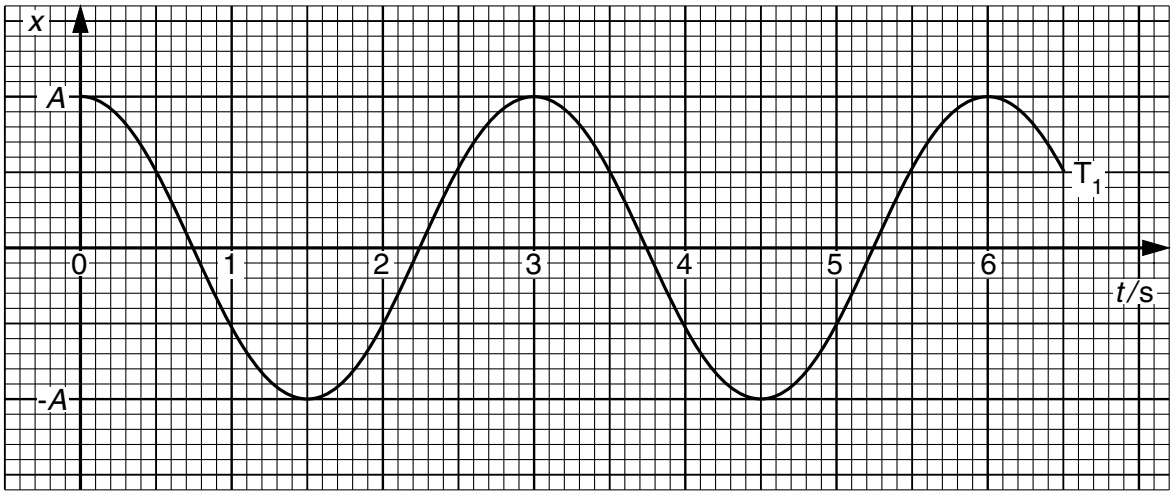

Fig. 5.1

(a) By reference to displacement and direction of travel of wave energy, explain what is meant by a *transverse wave*.

.....

.....[1]

(b) A second transverse wave T_2, of amplitude A has the same waveform as wave T_1 but lags behind T_1 by a phase angle of 60°. The two waves T_1 and T_2 pass through the same point.

(i) On Fig. 5.1, draw the variation with time t of the displacement x of the point in wave T_2. [2]

(ii) Explain what is meant by the *principle of superposition* of two waves.

.....

.....

.....[2]

(iii) For the time $t = 1.0$ s, use Fig. 5.1 to determine, in terms of A,

1. the displacement due to wave T_1 alone,

displacement = ...

2. the displacement due to wave T_2 alone,

displacement = ...

3. the resultant displacement due to both waves.

displacement = ...
[3]

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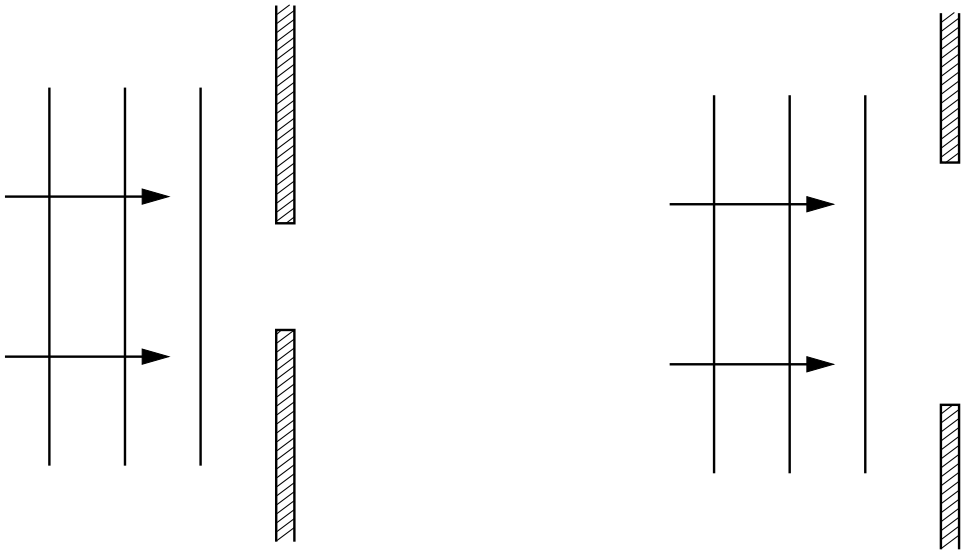
Turn over for question 6

7 **(a)** Figs. 7.1(a) and (b) show plane wavefronts approaching a narrow gap and a wide gap respectively.



(a) **(b)**

Fig. 7.1

On Figs. 7.1(a) and (b), draw three successive wavefronts to represent the wave after it has passed through each of the gaps. [5]

(b) Light from a laser is directed normally at a diffraction grating, as illustrated in Fig. 7.2.

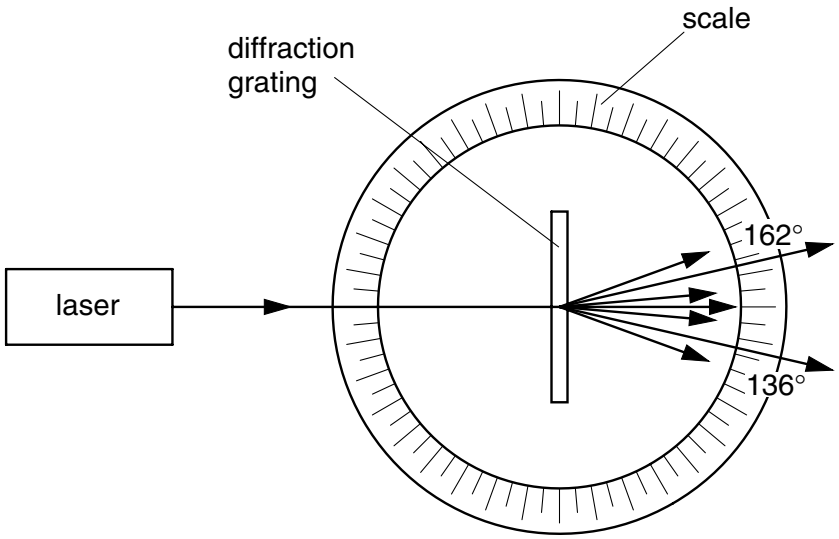


Fig. 7.2

The diffraction grating is situated at the centre of a circular scale, marked in degrees. The readings on the scale for the second order diffracted beams are 136° and 162°.

The wavelength of the laser light is 630 nm.

Calculate the spacing of the slits of the diffraction grating.

spacing = ... m [4]

(c) Suggest one reason why the fringe pattern produced by light passing through a diffraction grating is brighter than that produced from the same source with a double slit.

.....

.....[1]

6 Light of frequency 4.8×10^{14} Hz is incident normally on a double slit, as illustrated in Fig. 6.1.

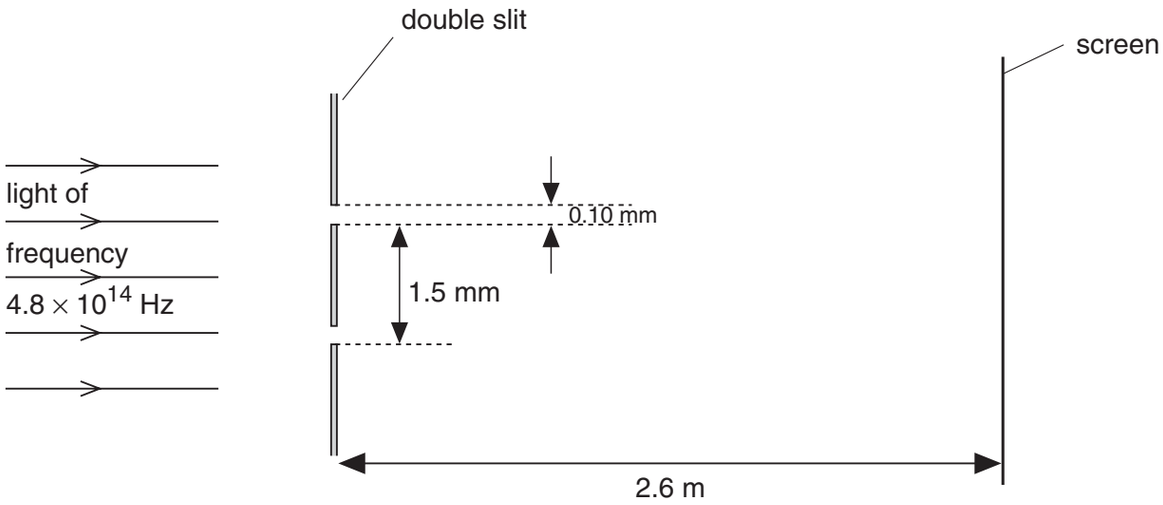


Fig. 6.1 (not to scale)

Each slit of the double slit arrangement is 0.10 mm wide and the slits are separated by 1.5 mm. The pattern of fringes produced is observed on a screen at a distance 2.6 m from the double slit.

(a) (i) Show that the width of each slit is approximately 160 times the wavelength of the incident light.

[3]

(ii) Hence explain why the pattern of fringes on the screen is seen over a *limited* area of the screen.

.....

.....

.....

.....[3]

(b) Calculate the separation of the fringes observed on the screen.

separation = ... mm [3]

(c) The intensity of the light incident on the double slit is increased. State the effect, if any, on the separation and on the appearance of the fringes.

.....

.....

.....

.....

.....[3]