4 **(a)** A ripple tank is used to show the diffractionand interference of waves.
On Fig. 4.1, plane wavefronts are shown approaching an object.

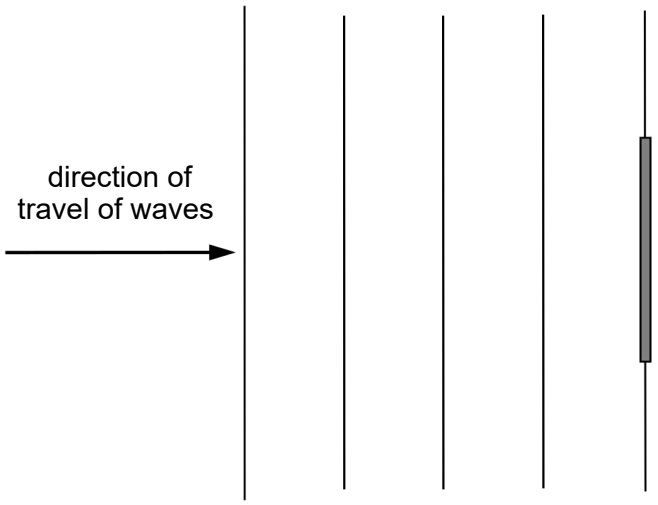

Fig. 4.1

(i) On Fig. 4.1, draw four wavefronts to show the waves after they have passed through the object. [2]

(ii) The object is now made shorter.

Describe the change in appearance of the diffracted wavefronts.

……

…… [1]

(b) Alaserisplacedin front of a slit as shownin Fig. 4.2.

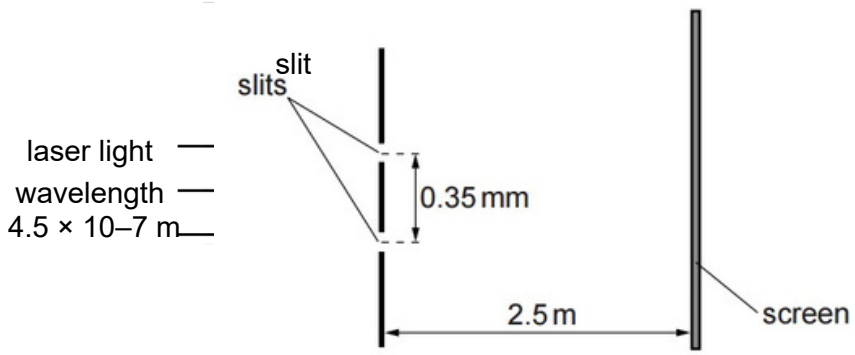

Fig. 4.2 (not drawn to scale)

Thelaseremitslight of wavelength 4.5 × 10–7 m. The distance from the slit to the screen is2.5m.Thewidth of the slit is 0.50 mm.
Aninterferencepattern is observed on the screen.

Thewidthofthecentral fringe as observed on the screen is *y*.

(i) Showthat*y* is 4.5 mm.

[2]

(ii) Thesingleslit is replaced with a double slit as shown in Fig. 4.3.

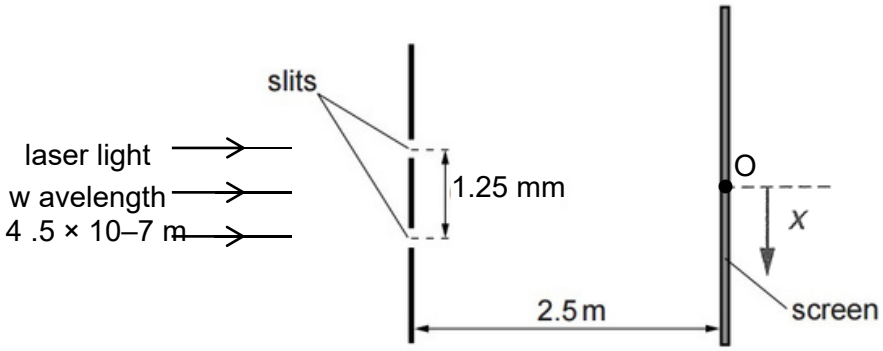

Fig. 4.3 (not drawn to scale)

Theseparation of the slits is 1.25 mm. The width of each slit is 0.50 mm.

Thecentreof the interference pattern formedon the screen is at O.

1. Explain why an interference pattern is formed on the screen.

……

……

……

……

……

…… [3]

2. Show that there are five bright fringes in the region $-\frac{y}{2} \leq x \leq \frac{y}{2}$, where x is the distance measured downwards along the screen from point O.

[2]

3. On Fig. 4.4, sketch the variation with distance x from point O of the intensity I for the image observed on the screen.

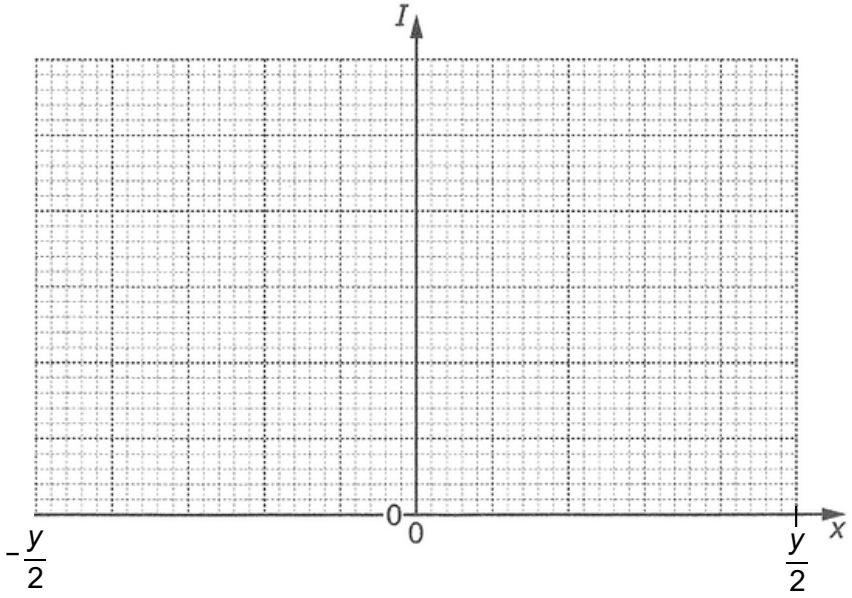

Fig. 4.4

[3]

[Total: 13]