8 A ripple tank is used to show the diffraction and interference of waves.

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On Fig. 8.1, plane wavefronts are shown approaching a single slit.

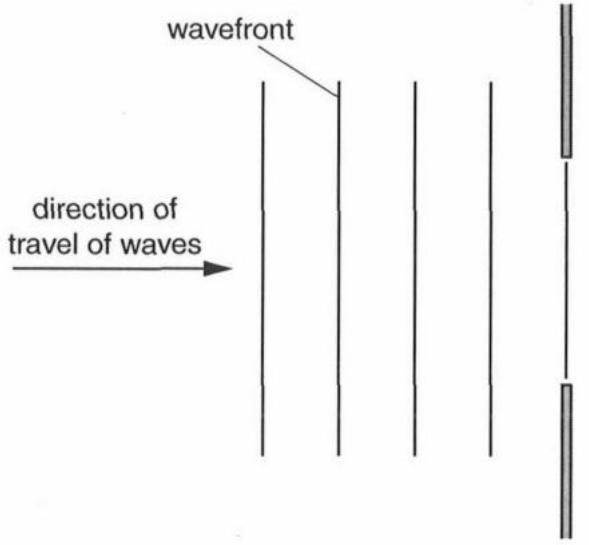

Fig. 8.1

(a) (i) On Fig. 8.1, draw four wavefronts to show the waves after they have passed through the slit. [3]

(ii) The slit is now made more narrow.

Describe the change in the appearance of the diffracted wavefronts.

.....

.....

.....

..... [2]

(b) (i) State what is meant by *coherent sources*.

.....

.....

..... [2]

(ii) Two coherent sources produce wavefronts as shown in Fig. 8.2.

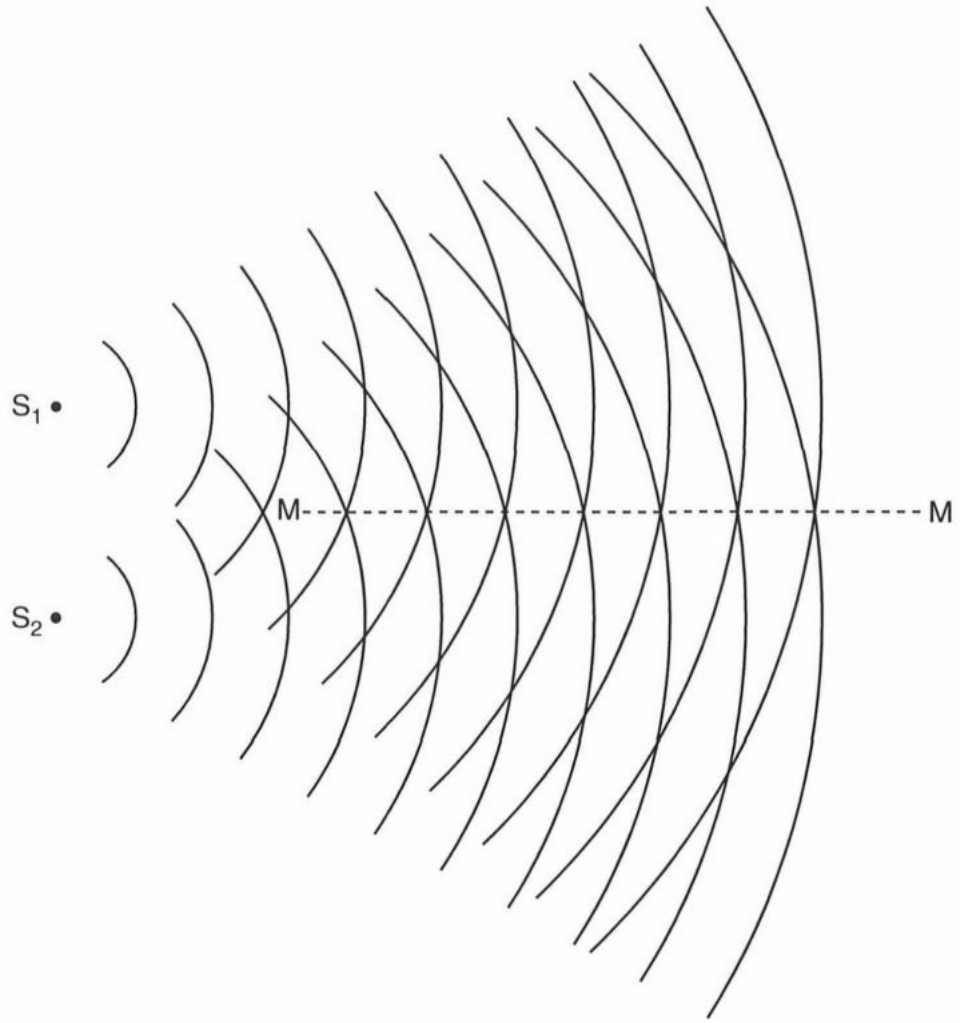

Fig. 8.2

The amplitude of the resultant of the waves is seen to be a maximum along the direction MM.

On Fig. 8.2, draw a line to show

1. a second direction along which the amplitude is a maximum (label this line AA), [1]

2. a direction in which the amplitude is a minimum (label this line NN). [1]

(c) Two-source interference of light is demonstrated using the apparatus illustrated in Fig. 8.3.

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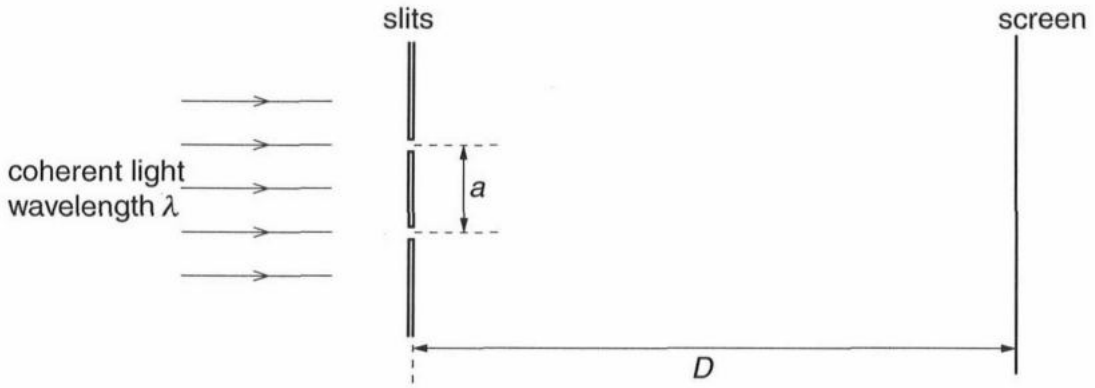

Fig. 8.3 (not to scale)

Coherent light of wavelength λ is incident on two parallel slits that are separated by a distance a of 1.20 mm.
The light emerging from the slits forms an interference pattern on a screen placed parallel to, and a distance D of 247 cm from, the plane of the slits.

(i) The separation of the fringes is 1.3 mm.
Determine, to an appropriate number of significant figures, the wavelength λ of the light.

$\lambda =$ ..... m [4]

(ii) State the relation between a and D for the expression you have used in **(i)** to be valid.

.....

..... [1]

(iii) Suggest changes to the appearance of the fringes when each of the following changes is made separately.

1. The intensity of the light on one of the slits is reduced.

.....

.....

..... [2]

2. The width of both slits is reduced without altering their separation.

.....

.....

..... [2]

3. The screen is rotated so that it is no longer parallel to the plane of the two slits.

.....

.....

..... [2]

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