4 **(a)** **(i)** State the conditions required for the formation of a stationary wave.

.....

.....

.....

[2]

.....

(b) Fig. 4.1 shows two small and identical microwave emitters S_1 and S_2 placed 0.12 m apart in a wide open space. The emitters are in phase and emit microwaves of wavelength 0.040 m uniformly in all directions.

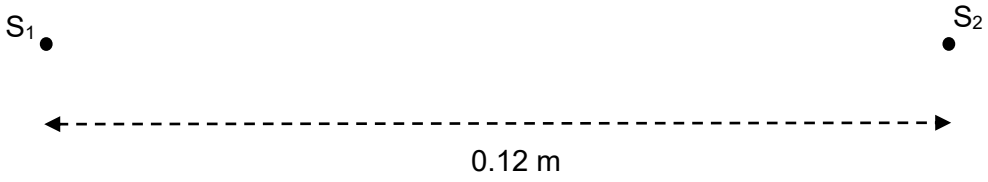
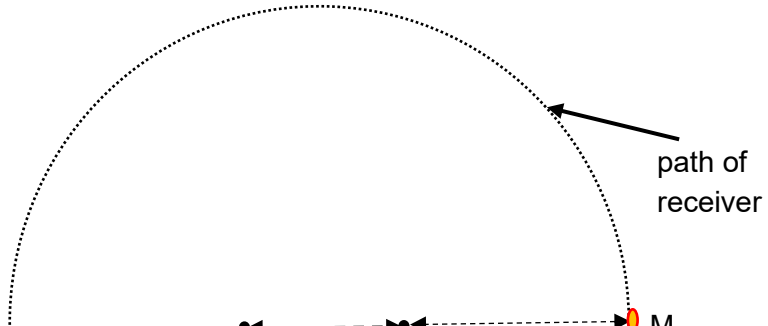


Fig. 4.1

(i) On Fig. 4.1, sketch the stationary wave pattern formed in the space between S_1 and S_2. Mark all the positions of the displacement nodes (use the letter N) and the displacement antinodes (use the letter A).

[2]

(ii) A microwave receiver is now placed at the point M, 0.18 m to the right of S_2, and along the line S_1S_2 as shown in Fig. 4.2.



1. State and explain whether the intensity of the signal detected by the receiver at M is a maximum or a minimum.

.....

.....

[2]

.....

2. The receiver is now moved in a circular path for one complete round around the two emitters. Determine the number of intensity maxima it detects.

number of intensity maxima = ... [1]

(c) A parallel beam of monochromatic light of wavelength 550 nm falls normally on a narrow slit of width *d*, as shown in Fig. 4.3. The diffraction pattern is observed on a screen placed 1.2 m away, where it is found that the distance between the first dark fringes on both sides of the central maximum O is 2.3 mm.

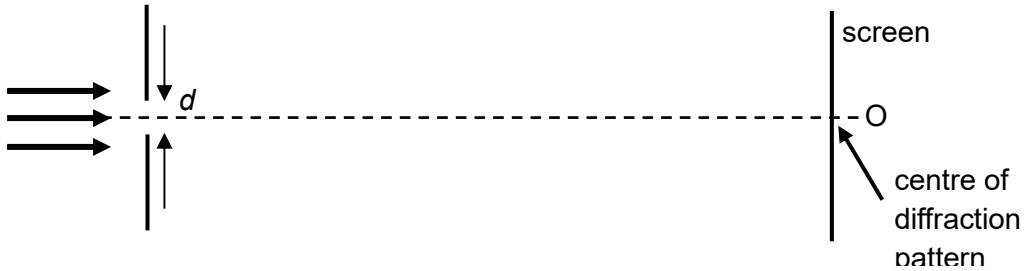


Fig. 4.3

(i) On Fig. 4.4 below, sketch the variation with distance along the screen of the intensity of the light in the single-slit diffraction pattern formed on the screen.

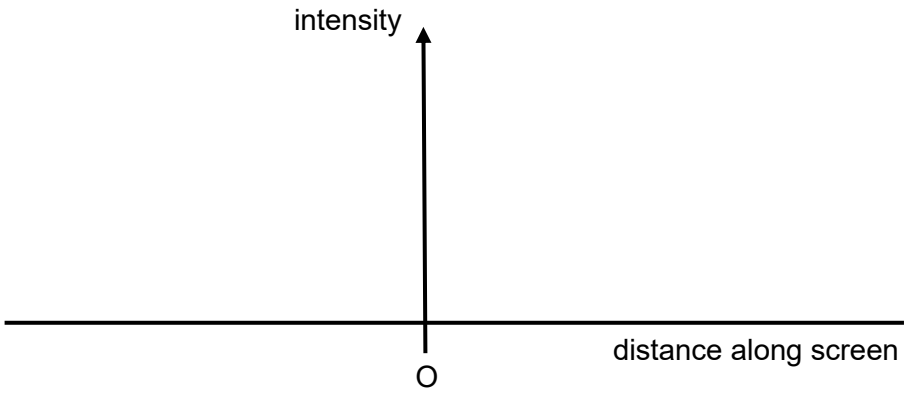


Fig. 4.4

[2]

(ii) Show that the width d of the slit is 5.7×10^{-4} m.

[1]