**4** **(a)** **(i)** State what is meant by the wavelength $\lambda$ and frequency $f$ of a wave.

wavelength: .....

.....

frequency: .....

..... [2]

**(ii)** Deduce a relation between the two quantities in **(a)(i)** and the speed $v$ of propagation of a wave.

[1]

**(b)** Coherent light of wavelength 633 nm is incident normally on a double slit arrangement, as shown in Fig 4.1.

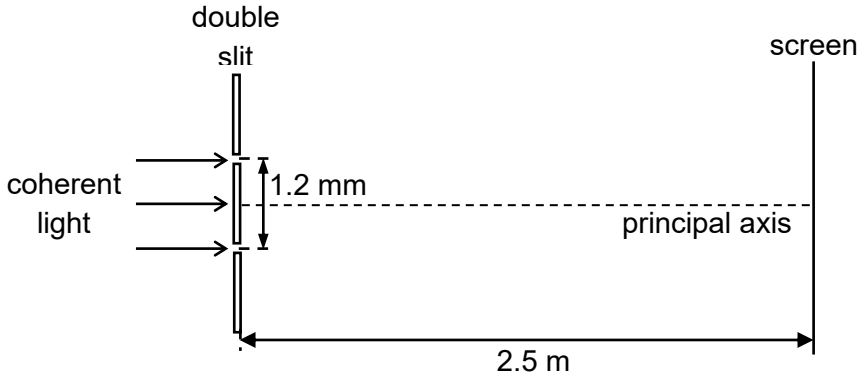


**Fig. 4.1 (not to scale)**

The separation of the slits is 1.2 mm.

Interference fringes are observed on a screen placed parallel to and 2.5 m from the plane of the double slit. The variation with angular position $\theta$ from the principal axis of the intensity of the fringes is shown in Fig. 4.2.

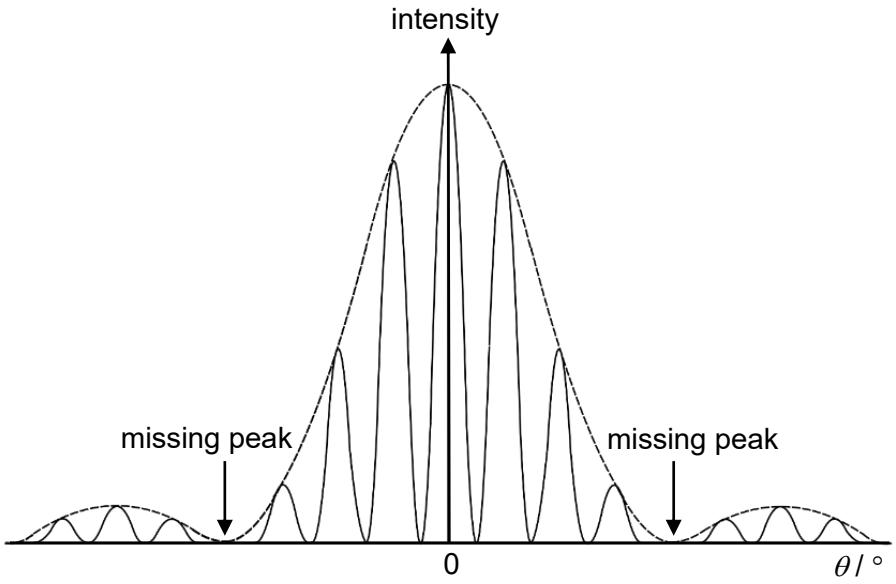


**Fig. 4.2**

**(i)** State two conditions necessary for the superposition of two waves to give rise to a well-defined interference pattern.

**1.** .....

.....

**2.** .....

..... [2]

**(ii)** **1.** Explain why missing peaks are observed in the double slit interference intensity pattern.

.....

.....

..... [1]

**2.** Calculate the width *b* of each slit.

$b$ = ..... mm [2]

**3.** Determine the distance of the missing peak from the centre of the central bright fringe.

distance = ..... m [2]

**(iii)** State and explain the changes to the interference pattern in Fig. 4.2 when the slit widths of the double slits are increased.

.....

.....

.....

..... [2]