

- 5 (a) An electromagnetic wave in a vacuum has a wavelength of  $8.4 \times 10^{-6}$  m.

(i) State the name of the principal region of the electromagnetic spectrum for the wave.

..... [1]

(ii) Calculate the frequency, in THz, of the wave.

$$\text{frequency} = \dots \text{THz} \quad [2]$$

- (b) An arrangement that uses a double slit to demonstrate the interference of light from a laser is shown in Fig. 5.1.

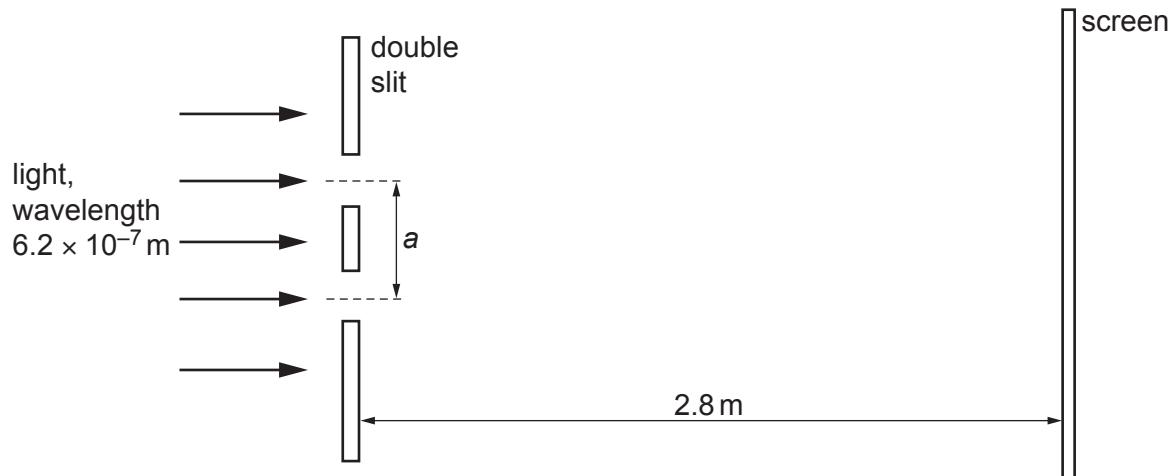


Fig. 5.1 (not to scale)

The light from the laser has a wavelength of  $6.2 \times 10^{-7}$  m and is incident normally on the slits. The separation of the two slits is  $a$ . The slits and screen are parallel and separated by a distance of 2.8 m.

An interference pattern of bright fringes and dark fringes is formed on the screen. The distance on the screen across 8 bright fringes is 22 mm, as illustrated in Fig. 5.2.

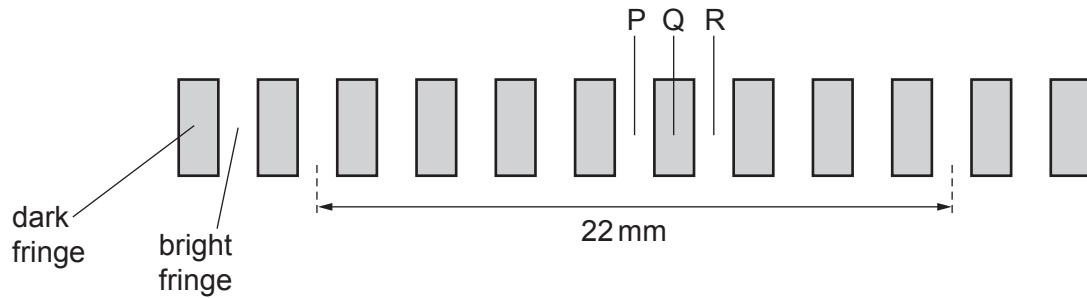


Fig. 5.2

- (i) The light waves emerging from the two slits are coherent.

State what is meant by coherent.

..... [1]

- (ii) Calculate the separation  $a$  of the slits.

$$a = \dots \text{m} \quad [3]$$

- (c) Fringe P is the central bright fringe of the interference pattern in (b). Fringe Q and fringe R are the nearest dark fringe and the nearest bright fringe respectively to the right of fringe P, as shown in Fig. 5.2.

- (i) Calculate the difference in the distances (the path difference) from each slit to the centre of fringe Q.

$$\text{difference in the distances} = \dots \text{m} \quad [1]$$

- (ii) State the phase difference between the light waves meeting at the centre of fringe R.

$$\text{phase difference} = \dots^\circ \quad [1]$$