5 **(a)** An electromagnetic wave in a vacuum has a wavelength of 8.4×10^{-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.

frequency = ... THz [2]

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

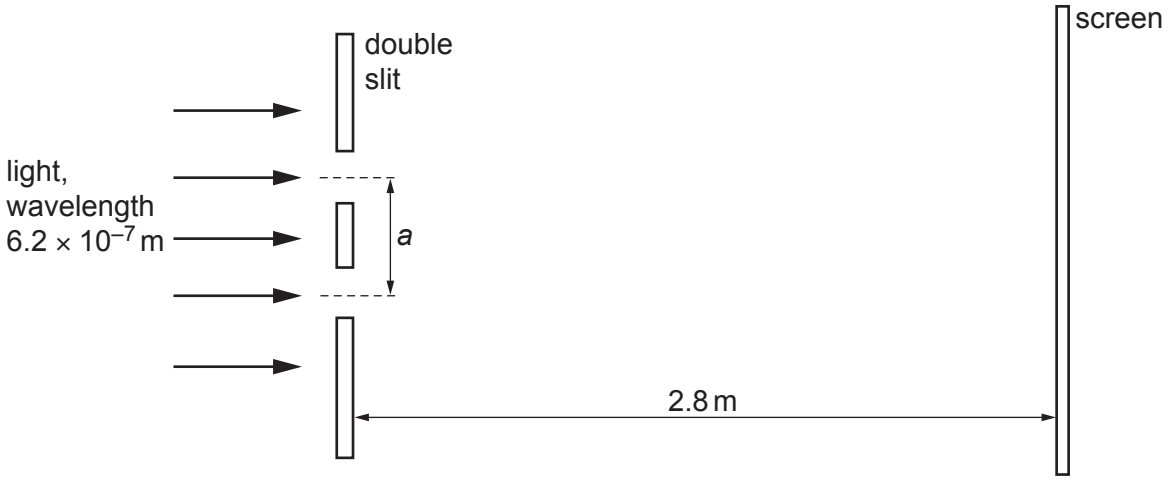

Fig. 5.1 (not to scale)

The light from the laser has a wavelength of 6.2×10^{-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.

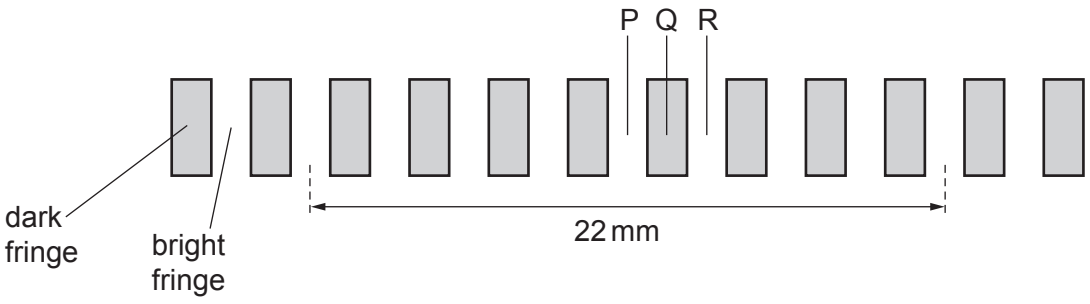

Fig. 5.2

(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 = ... m [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.

difference in the distances = ... m [1]

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

phase difference = ...° [1]

[Total: 9]