5 Light from a laser is used to produce an interference pattern on a screen, as shown in Fig. 5.1.

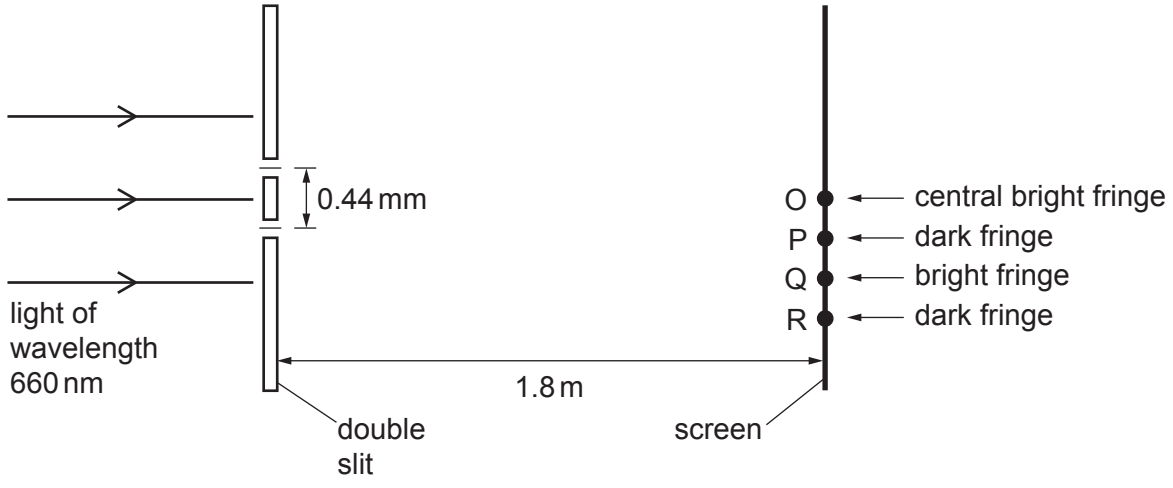

Fig. 5.1 (not to scale)

The light of wavelength 660 nm is incident normally on two slits that have a separation of 0.44 mm. The double slit is parallel to the screen. The perpendicular distance between the double slit and the screen is 1.8 m.

The central bright fringe on the screen is formed at point O. The next dark fringe below point O is formed at point P. The next bright fringe and the next dark fringe below point P are formed at points Q and R respectively.

(a) The light waves from the two slits are coherent.

State what is meant by coherent.

.....

..... [1]

(b) For the two light waves superposing at R, calculate:

(i) the difference in their path lengths, in nm, from the slits

path difference = ... nm [1]

(ii) their phase difference.

phase difference = ... ° [1]

(c) Calculate the distance OQ.

distance OQ = ... m [3]

(d) The intensity of the light incident on the double slit is increased without changing the frequency.

Describe how the appearance of the fringes after this change is different from, and similar to, their appearance before the change.

.....

.....

.....

.....

..... [3]

(e) The light of wavelength 660 nm is now replaced by blue light from a laser.

State and explain the change, if any, that must be made to the separation of the two slits so that the fringe separation on the screen is the same as it was for light of wavelength 660 nm.

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..... [2]

[Total: 11]