4 **(a)** State the principle of superposition.

.....

.....

..... [2]

(b) An arrangement for demonstrating the interference of light is shown in Fig. 4.1.

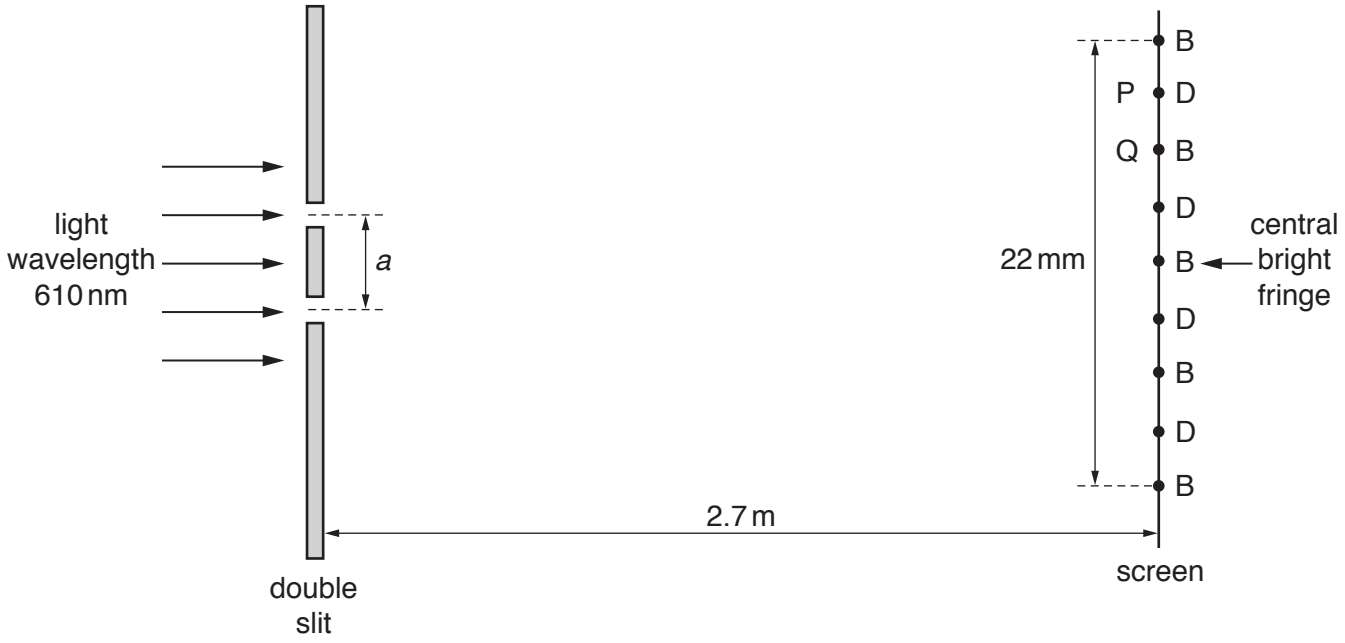

Fig. 4.1 (not to scale)

The wavelength of the light is 610 nm. The distance between the double slit and the screen is 2.7 m.

An interference pattern of bright fringes and dark fringes is observed on the screen. The centres of the bright fringes are labelled B and centres of the dark fringes are labelled D. Point P is the centre of a particular dark fringe and point Q is the centre of a particular bright fringe, as shown in Fig. 4.1. The distance across five bright fringes is 22 mm.

(i) The light waves leaving the two slits are coherent.

State what is meant by *coherent*.

.....

..... [1]

(ii) **1.** State the phase difference between the waves meeting at Q.

phase difference = ... °

2. Calculate the path difference, in nm, of the waves meeting at P.

path difference = ... nm
[2]

(iii) Determine the distance *a* between the two slits.

a = ... m [3]

(iv) A higher frequency of visible light is now used. State and explain the change to the separation of the fringes.

.....

..... [1]

(v) The intensity of the light incident on the double slit is now increased without altering its frequency. Compare the appearance of the fringes after this change with their appearance before this change.

.....

.....

.....

..... [2]

[Total: 11]