3 Fig. 3.1 shows two slits S_1 and S_2, separated by distance a, illuminated by a point source of light producing coherent light of wavelength 750 nm. The light source is equidistant from both slits.

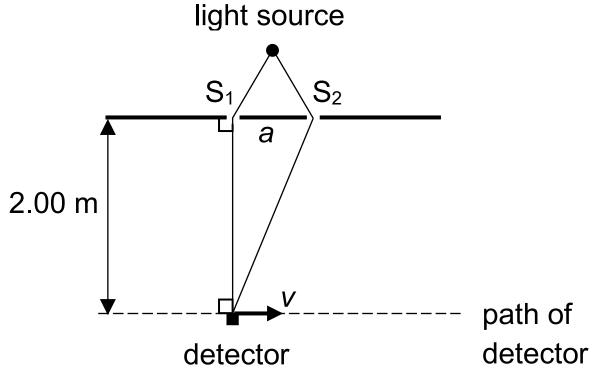

Fig. 3.1 (not to scale)

A light detector, 2.00 m below the slits, is moving to the right at a uniform speed v, in the direction shown.

(a) When the detector is directly below S_1, the detector records a minimum intensity reading.

Show that the minimum value for a is 1.22 mm.

[2]

(b) The slits are now fixed at 1.22 mm apart, with the light source still equidistant from both slits.

(i) The detector detects three maxima per second while moving to the right.

Determine the speed v at which the detector is moving.

v = ... $m\ s^{-1}$ [2]

(ii) The light detector now moves with the same speed v along a diagonal path as shown in Fig. 3.2.

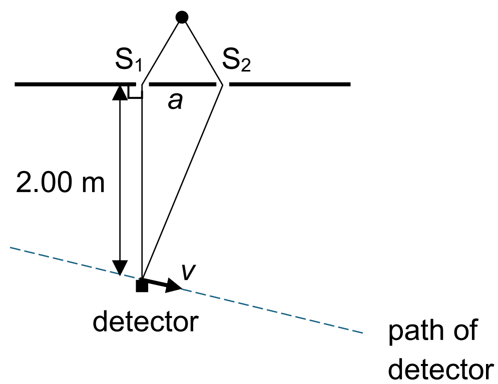

Fig. 3.2 (not to scale)

Describe and explain what happens to the frequency at which the detector detects maxima.

....

....

....

.... [2]

(c) The detector is now replaced with a camera. The camera lens is at a distance R below the two slits and is equidistant from both slits.

The camera lens has an aperture diameter of 4.0 mm.

Determine the value of R where the images of both slits are just resolved.

$R =$ .... m [2]