**4**

**(a)**

A beam of light from a sodium lamp passes through a pair of narrow slits $S_1$ and $S_2$ producing a pattern on a screen as shown in Fig. 4.1. The pattern on the screen consists of regularly spaced bright and dark fringes, as shown in Fig. 4.2.

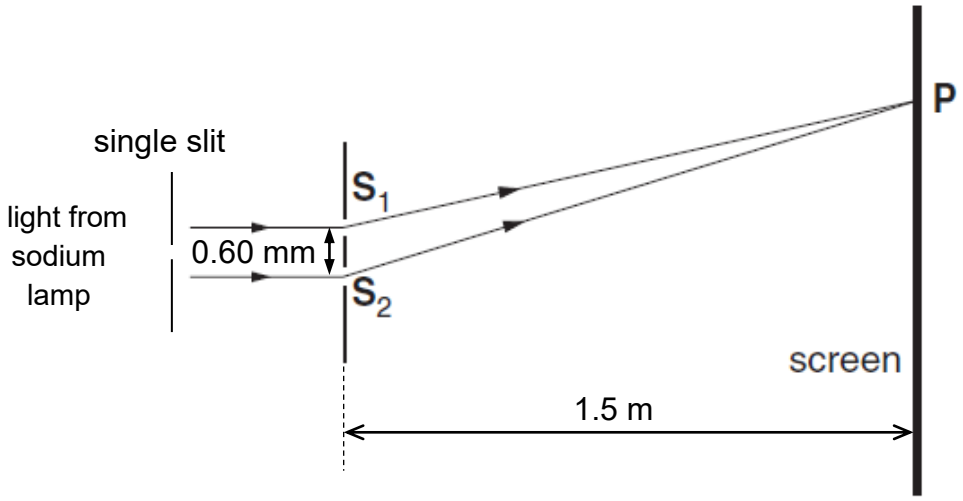


**Fig. 4.1** (not to scale)

**(i)**

State and explain the conditions necessary for the light from the two slits $S_1$ and $S_2$ to produce a visible pattern on the screen.

……..……..

……..……..

……....

……..……..

……..……..

……....

[3]

**(i)**

Explain the condition for a bright fringe to appear on the screen at P in Fig. 4.1.

……..……..

……..……..

……...

……..……..

……..……..

……...

[3]

**(b)** Fig. 4.2 shows the central part of the fringe pattern on the screen from the slits $S_1$ and $S_2$. The fringe separation $x$, the wavelength $\lambda$ of the yellow light.

**(c)** The light from the sodium lamp is analysed using an instrument containing a diffraction grating. The diffraction grating has

**(i)** Calculate the angle of diffraction of the spectral line in the second order spectrum.

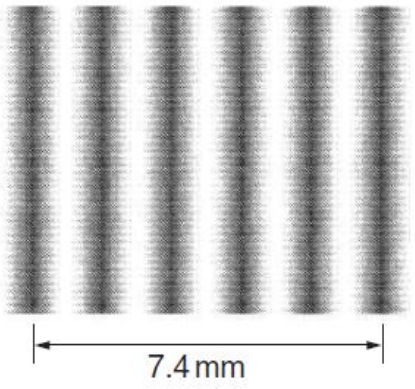


**Fig. 4.2**

$x$ = ..... mm

[1]

**(ii)** Calculate the wavelength $\lambda$ of the yellow light.

$\lambda$ = ..... m

[2]

angle = ..... $^0$

[2]

**(c)** The light from the sodium lamp is analysed using an instrument containing a diffraction grating. The diffraction grating has 500 lines per millimeter.

**(i)** Calculate the angle of diffraction of the spectral line in the second order spectrum.

angle = ..... $^0$

[2]

**(ii)** The light from the sodium lamp is analysed using an instrument containing a diffraction grating. The diffraction grating has 500 lines per millimeter. $\lambda$ = ..... m