**5 (a)** Two light sources that produce light with the same wavelength are placed at position A and B respectively as shown in Fig. 5.1.

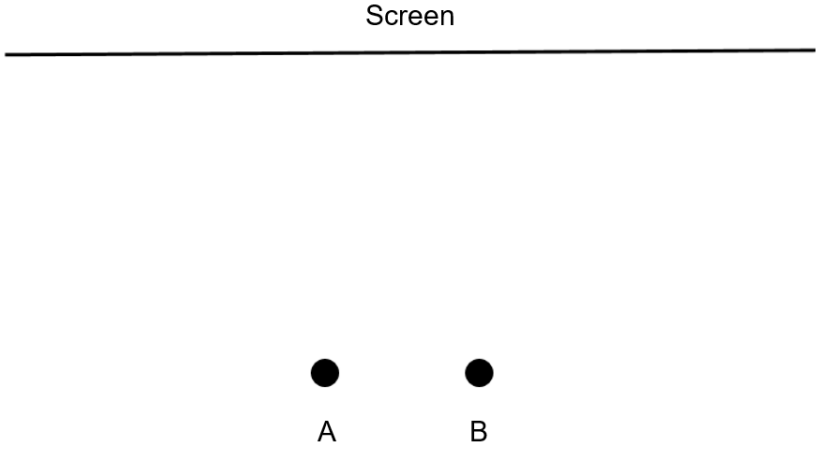


**Fig. 5.1**

The light from the light sources meet on the screen and a steady interference pattern is formed on the screen.

State two other conditions required for the interference pattern to be observable.

**1.** .....

.....[1]

**2.** .....

.....[1]

**(b)** When a distant streetlight, which is behaving as a point source of light of wavelength $4.5 \times 10^{-7}$ m, is viewed through a nylon net curtain, the diffraction pattern of the light projected on a screen is shown in Fig. 5.2. The screen is 3.0 m away from the nylon net curtain.

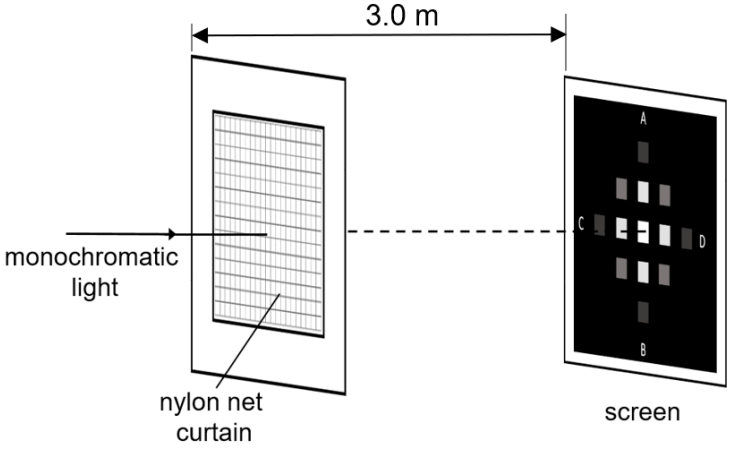


**Fig. 5.2**

The full-scale diagram of the diffraction pattern is shown in Fig. 5.3.

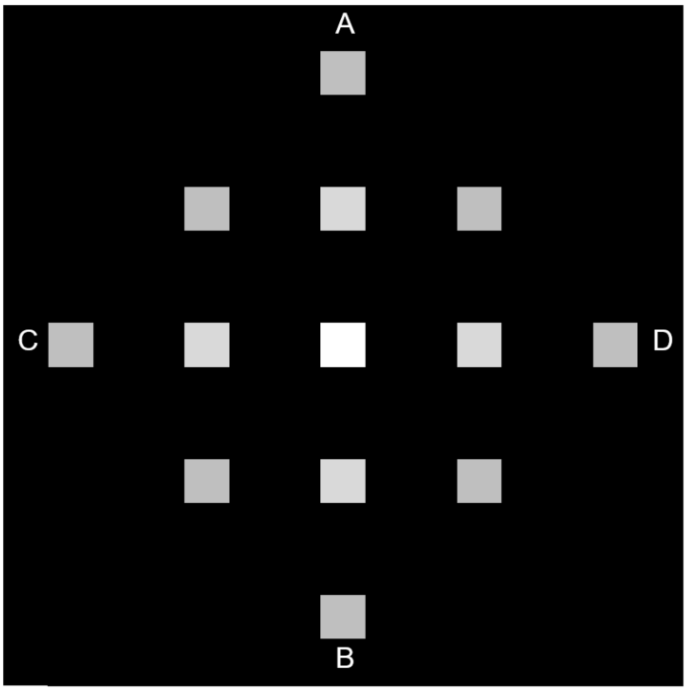


**Fig. 5.3**

The main feature of this pattern is two lines (AB and CD) of bright images.

**(i)** Calculate the angle, in radians, between the orders of the diffracted light.

angle = ..... rad [2]

**(ii)** Using your answer to **(b)(i)**, determine the number of nylon threads per millimetre of the mesh.

number = ..... $mm^{-1}$ [2]

**(c)** A long horizontal tube, containing fine powder, is closed at one end. A loudspeaker, connected to a signal generator, is positioned at the other end as shown in Fig. 5.4.

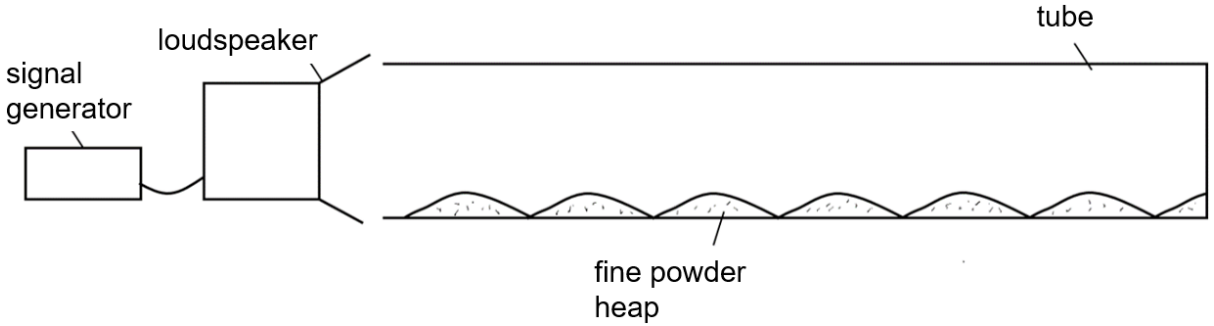


**Fig. 5.4**

At a particular frequency, a stationary wave is set up inside the tube and the powder forms heaps as shown. The speed of sound is 330 m $s^{-1}$.

**(i)** On Fig. 5.4, mark out 2 points where displacement nodes are and label them as N. [1]

**(ii)** Determine the distance between adjacent heaps if the signal generator is producing a signal with frequency of 3.5 kHz.

spacing = ..... m [2]

[Total: 9]