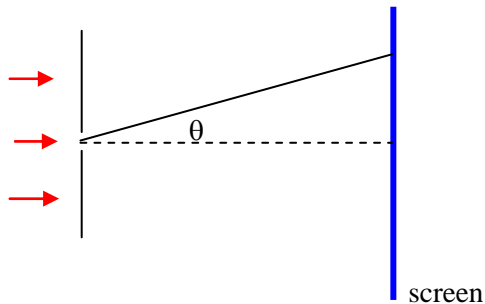


Extension Worksheet – Topic 4, Worksheet 5

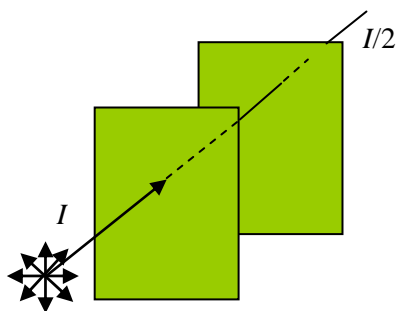
- 1 Two dots of red ink are placed on white paper. The dots are 2.0 mm apart.
- a Calculate the maximum distance from a person at which the two dots will appear as separate. Take the wavelength of red light to be 700 nm and the diameter of the iris to be 3.0 mm. [2]
- b State and explain how your answer would change if the dots were made of blue ink. [2]
- 2 Waves of wavelength λ are incident normally on a rectangular slit of width b . Show that the angle to the direction of the incident light, in radians, at which the first diffraction minimum is observed is given by $\theta \approx \frac{\lambda}{b}$. [3]

- 3 The diagram shows coherent light incident on a rectangular slit. The light is observed on a screen far from the slit.



- a Draw the graph showing the variation with angle θ of the intensity of light due to single slit diffraction. [2]
- b State two changes that will come about to this intensity pattern if the slit width is made thinner. [2]

- 4 Unpolarised light of intensity I is incident on a polariser with a vertical transmission axis. The transmitted light is incident on a sheet of plastic behind the polariser.



- The intensity of the light transmitted through the sheet of plastic is $\frac{I}{2}$. It may be concluded that the sheet of plastic
- A **must** be ordinary plastic.
- B **could be** ordinary plastic or a polariser with a vertical transmission axis.
- C **could be** ordinary plastic or a polariser with a horizontal transmission axis.
- D **must be** a polariser with a vertical transmission axis. [1]
- 5 Two polarisers are placed parallel to each other. Unpolarised light of intensity I is incident on the first polariser. The intensity of the light transmitted through the second polariser is $\frac{I}{8}$. Calculate the angle between the polariser transmission axes. [2]
- 6 Light is incident on a horizontal plastic surface. The reflected light is observed through a polariser with a vertical transmission axis. At a particular angle of incidence θ the intensity of the light transmitted through the polariser is zero.
- a Explain this observation. [2]
- b The value of θ is 52° . Calculate the refractive index of the plastic. [2]
- 7 A source of light produces unpolarised light and another produces polarised light. A piece of plastic is a polariser and another is plain plastic. Discuss how you would determine which source produces polarised light and which piece of plastic is a polariser. [2]