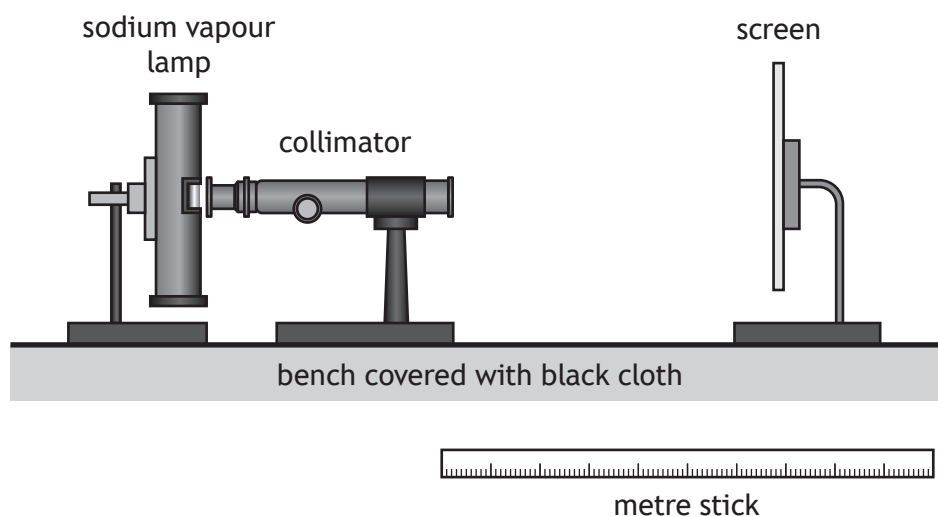


8. A student investigates light from a sodium vapour lamp. Sodium vapour lamps emit yellow light.

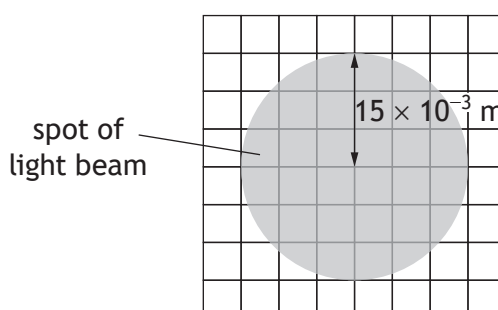
The light from the lamp is passed through a collimator. The collimator is used to produce a parallel beam of light.

The apparatus is set up in a darkened laboratory.



- (a) The parallel beam is shone onto a screen. The distance between the end of the collimator and the screen is 0.40 m.

The beam produces a uniformly lit spot of radius 15×10^{-3} m as shown.



8. (a) (continued)

- (i) The irradiance of the spot of light on the screen is 17 W m^{-2} .

Determine the power of the beam of light.

4

Space for working and answer

- (ii) The distance between the screen and the end of the collimator is now increased.

The spot produced on the screen has the same radius as before.

Explain why this experimental setup is not suitable for investigating the inverse square law.

1

[Turn over



* X 8 5 7 7 6 0 1 2 9 *

8. (continued)

- (b) The student now looks at the beam of light through a spectroscope and views a bright yellow spectral line with a wavelength of 589.0 nm.

This light is emitted when electrons make a transition from one energy level to another within sodium atoms.

- (i) State whether electrons are moving to a higher or a lower energy level when this light is emitted.

1

- (ii) Calculate the difference in energy between the two energy levels in the sodium atoms that produce this yellow light.

5

Space for working and answer



8. (b) (continued)

- (iii) The student observes a second yellow spectral line at a wavelength of 589.6 nm.

The student observes that the line at 589.0 nm is brighter than the line at 589.6 nm.

Explain the student's observation.

2

[Turn over

