

Answer on Question #58618, Physics / Optics

Ordinary white passes through a diffraction grating having 10,000 slits per centimeter, i.e. a slit separation of $d = 1.00 \times 10^{-6}$ m, and casts a diffraction pattern on a screen. You measure the angular separation between the central white fringe and the blue stripe in the first ($m = 1$) rainbow as 23.6 degrees. From this information, calculate the wavelength of blue light.

Solution:

The condition for maximum (bright spot) is

$$d \sin \theta = m\lambda$$

where $m = 1$ is order of interference, $d = 1 \times 10^{-6}$ m.

Thus,

$$\lambda = \frac{d \sin \theta}{m} = \frac{1 \cdot 10^{-6} \cdot \sin 23.6^\circ}{1} = 4 \cdot 10^{-7} \text{ m} = 400 \cdot 10^{-9} \text{ m} = 400 \text{ nm}$$

Answer: $400 \cdot 10^{-9}$ m = 400 nm