Unit 6H
Light Diffraction & Interference
Practice Problems TEACHER

PHYSICS IN MOTION
gpb.org/physics-motion

Work each of the following problems. SHOW ALL WORK.

1. How far from above the center point of the screen will the first mimimum be when red light, with a wavelength of 7.0×10^{-7} m that passes through a single slit that is 2.0×10^{-5} m that is 0.50 m from the screen?

$$m = 1$$
$$\lambda = 7.0 \times 10^{-7}\ m$$
$$a = 2.0 \times 10^{-5}\ m$$
$$L = 0.50\ m$$
$$y = \frac{m\lambda L}{a}$$
$$y = \frac{(1)(7.0 \times 10^{-7}\ m)(0.50\ m)}{(2.0 \times 10^{-5}\ m)}$$
$$y = 0.0175\ m$$

2. The first minimum line is 5.0×10^{-4} m above the center of the screen when blue light, with a wavelength of 4.5×10^{-7} m, is shown upon a single slit that is 4.0×10^{-4} m wide. How far is the screen from the slit?

$$m = 1$$
$$\lambda = 4.5 \times 10^{-7}\ m$$
$$a = 4.0 \times 10^{-4}\ m$$
$$y = 5.0 \times 10^{-4}\ m$$
$$y = \frac{m\lambda L}{a}$$
$$(5.0 \times 10^{-4}\ m) = \frac{(1)(4.5 \times 10^{-7}\ m)L}{(4.0 \times 10^{-4}\ m)}$$
$$L = 0.44\ m$$

3. What is the wavelength of light that is shown upon a single slit that is 6.0×10^{-5} m wide and is 1.0×10^{-1} m from a screen on which the third minimum is 2.0×10^{-3} m below the central maximum?

$$m = 3$$
$$a = 6.0 \times 10^{-5}\ m$$
$$y = 2.0 \times 10^{-3}\ m$$
$$L = 1.0 \times 10^{-1} m$$
$$y = \frac{m\lambda L}{a}$$
$$(2.0 \times 10^{-3}\ m) = \frac{(3)\lambda(1.0 \times 10^{-1}\ m)}{(6.0 \times 10^{-5}\ m)}$$
$$\lambda = 4.0 \times 10^{-7}\ m$$

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4. **Which minimum is located 0.09 m above the center of the screen that is located 0.6 m from a single slit that is 1.0 x 10⁻⁵ m wide for light with a wavelength of 5.0 x 10⁻⁷ m?**

$$a = 1.0 \times 10^{-5}\ m$$
$$y = 0.09\ m$$
$$L = 0.6\ m$$
$$\lambda = 5.0 \times 10^{-7}\ m$$

$$y = \frac{m\lambda L}{a}$$

$$(0.09\ m) = \frac{m(5.0 \times 10^{-7}\ m)(0.6\ m)}{(1.0 \times 10^{-5}\ m)}$$

$$m = 3$$

5. **How far above the center point of the screen will the second bright spot be when green light, with a wavelength of 5.0 x 10⁻⁷ m that passes through two slits that are 7.5 x 10⁻⁵ m apart shines on a screen that is 0.10 m from the slits?**

$$b = 7.5 \times 10^{-5}\ m$$
$$L = 0.10\ m$$
$$\lambda = 5.0 \times 10^{-7}\ m$$
$$m = 2$$

$$y = \frac{m\lambda L}{b}$$

$$y = \frac{(2)(5.0 \times 10^{-7}\ m)(0.10\ m)}{(7.5 \times 10^{-5}\ m)}$$

$$y = 1.33 \times 10^{-3}\ m$$

6. **The first maximum line is 2.5 x 10⁻⁵ m above the center of a screen when orange light, with a wavelength of 6.0 x 10⁻⁷ m, is shown upon two slits that are 5.0 x 10⁻⁴ m apart. How far is the screen from the slits?**

$$b = 5.0 \times 10^{-4}\ m$$
$$y = 2.5 \times 10^{-5}\ m$$
$$\lambda = 6.0 \times 10^{-7}\ m$$
$$m = 1$$

$$y = \frac{m\lambda L}{b}$$

$$2.5 \times 10^{-5}\ m = \frac{(1)(6.0 \times 10^{-7}\ m)L}{(5.0 \times 10^{-4}\ m)}$$

$$L = 2.08 \times 10^{-2}\ m$$

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7. A screen is located 0.30 m from a barrier with two slits. Violet light, with a wavelength of 4.0 x 10^{-7} m, is shown upon the barrier. If the third maximum is 0.06 m above the center of the screen, how far apart are the two slits from each other?

$$L = 0.30\,m$$
$$y = 0.06\,m$$
$$\lambda = 4.0 \times 10^{-7}\,m$$
$$m = 3$$
$$y = \frac{m\lambda L}{b}$$
$$0.06\,m = \frac{(3)(4.0 \times 10^{-7}\,m)(0.30\,m)}{b}$$
$$b = 6.0 \times 10^{-6}\,m$$

8. Which maximum is located 0.04 m above the center of the screen that is located 0.34 m from a barrier with two slits that are separated by 2.0 x 10^{-5} m when yellow light, with a wavelength of 5.8 x 10^{-7} m?

$$L = 0.34\,m$$
$$y = 0.04\,m$$
$$\lambda = 5.8 \times 10^{-7}\,m$$
$$b = 2.0 \times 10^{-5}\,m$$
$$y = \frac{m\lambda L}{b}$$
$$0.04\,m = \frac{m(5.8 \times 10^{-7}\,m)(0.34\,m)}{2.0 \times 10^{-5}\,m}$$
$$m = 4.06$$

9. Where will the first minimum be located when green light, with a wavelength of 5.5 x 10^{-7} m, is shown upon a barrier with two slits separated by 2.5 x 10^{-5} m upon a screen that is 0.75 m from the barrier?

$$L = 0.75\,m$$
$$m = 0.5$$
$$\lambda = 5.5 \times 10^{-7}\,m$$
$$b = 2.5 \times 10^{-5}\,m$$
$$y = \frac{m\lambda L}{b}$$
$$y = \frac{(0.5)(5.5 \times 10^{-7}\,m)(0.75\,m)}{2.5 \times 10^{-5}\,m}$$
$$y = 8.25 \times 10^{-3}\,m$$