

Name: _____ **Period:** _____ **Due Date:** _____
Lab Partners: _____

FIND THE WAVELENGTH OF A HeNe LASER

Purpose: To verify the wavelength of the light emitted by our HeNe lasers. Here we will anticipate a result that we will later investigate more thoroughly; in the section on Diffraction Gratings. A diffraction grating consists of numerous narrow, closely spaced slits (called lines). The diffraction pattern depends on the spacing and width of the slits. Commercial diffraction gratings have many more lines, but even these primitive gratings perform well.

First Look at Diffractions Gratings

1. Place two meter sticks end to end. Place the laser at one end and mount a screen (*3x5 card*) at the other end of the 2-meter length.
2. Mount the Slitfilm Demonstrator between the first and second meter sticks. (*The front of the laser will then be one meter from the slitfilm and the slitfilm will be one meter from the screen.*)
3. Shine the laser through one of the diffraction gratings in Column C on the slide. (*Use a separate 3x5 card for each grating.*)
4. On the 3x5 card mark the location of as many of the equally spaced dots as possible. Then, measure the locations of the marks and calculate the average separation (h_{ave} in m).
5. Repeat the procedure for all the gratings in Column C on the slide.
6. Complete the Table below using the equation

$$n \lambda = s \sin \theta$$

Where s is the center-to-center distance between the slits, n is 1, because we only measured the first-order separation of the lines, and θ is the divergence angle to the first maximum; $\theta = \tan^{-1}(h_{ave} / 1.000)$.

6. Calculate $\sin \theta$ and complete the table to determine the wavelength of light: $\sin \theta = \sin(\tan^{-1}(h_{ave} / 1.000))$

	h_{ave} (meters)	s (meters)	$\sin \theta$	Wavelength = λ in meters & nm
Trial-C-5	_____ x 10 ⁻³	_____ x 10 ⁻⁶	_____ x 10 ⁻³	_____ x 10 ⁻⁷ m = _____ nm
Trial-C-4	_____ x 10 ⁻³	_____ x 10 ⁻⁶	_____ x 10 ⁻³	_____ x 10 ⁻⁷ m = _____ nm
Trial-C-3	_____ x 10 ⁻³	_____ x 10 ⁻⁶	_____ x 10 ⁻³	_____ x 10 ⁻⁷ m = _____ nm
Trial-C-2	_____ x 10 ⁻³	_____ x 10 ⁻⁶	_____ x 10 ⁻³	_____ x 10 ⁻⁷ m = _____ nm
Trial-C-1	_____ x 10 ⁻³	_____ x 10 ⁻⁶	_____ x 10 ⁻³	_____ x 10 ⁻⁷ m = _____ nm

Average value of $\lambda = \lambda_{ave} =$ _____ nm

Correct Values: $\lambda = 6.328 \times 10^{-7} \text{ m} = 6.328 \times 10^{-5} \text{ cm} = 6.328 \times 10^{-4} \text{ mm} = 0.6328 \text{ } \mu\text{m} = 632.8 \text{ nm}$

Calculate the %Error (in λ_{ave}) = _____ % (assuming 632.8 nm is the correct wavelength)