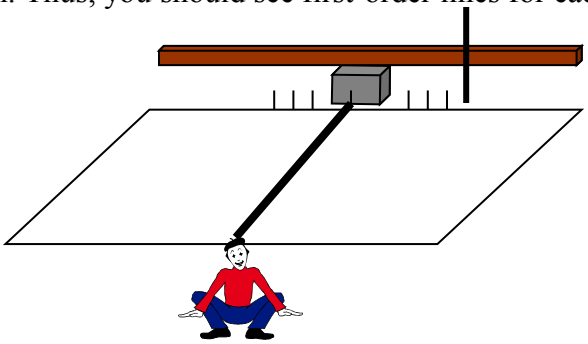
Young's Double Slit Experiment

Name_____ Date performed_____

Using the information discovered in Thomas Young's double slit experiment, you will be calculating the wavelengths of the various colored lights comprising a mercury vapor lamp, a hydrogen or water vapor source, or an ordinary white light source. Since each wavelength of the source undergoes its own diffraction, each sets up its own interference pattern. Thus, you should see first-order lines for each comprising wavelength.



$$\frac{\lambda}{d} = \frac{x}{L}$$

PROCEDURES:

1. Set up the equipment as shown with the **mercury vapor lamp** as the source.

2. In order to find the variable **d** (distance separating any two gratings) you will need to take the number of lines/mm (use the 600 lines/mm window for best results) , convert to lines/meter, and then take the reciprocal (leaving you with meters/line; which is **d**). This value remains the same for the rest of the lab.

3. Hold the diffraction grating up to your eye with at the edge of the tabletop. As you look through the grating you should see the original mercury source as a light blue but you should also see first-order lines for each comprising wavelength to the right and left of the source. Note the positions (**in meters**) of the right and left first-order lines for each color in **Table 1**.

4. Move to the set up with the **hydrogen or helium tube** as the source and record the positions to the right and left of the first-order lines for the 4 prominent spectral lines.

5. Place the **light bulb** behind the slit and observe the continuous spectrum. Locate the positions of the following parts of the spectrum:
   a) the shortest wavelength visible
   b) the division between blue and green.
   c) The division between green and yellow.
   d) The division between yellow and orange.
   e) The division between orange and red.
   f) The longest wavelength possible.

   Record your results in TABLE 3.

6. The distance from grating to source (this is **L**). **L = 1.00 m**

7. Use Young's double slit equation to determine the wavelength of each color (use avg. x value). Show a sample calculation.

8. What are the **accepted wavelengths** for each visible color? (Refer to reference tables for frequencies and use them to calculate the wavelengths). Show how each wavelength corresponds to these ranges.

CALCULATIONS & RESULTS:

Table 1. MERCURY

COLOR	**x (left)**	**x (right)**	**Avg. x (m)**	**d (m/line)**	**Wavelength (m)**	**Was it within the range?**

Table 2. HYDROGEN or HELIUM (brightest 4 lines)

COLOR	**x (left)**	**x (right)**	**Avg. x (m)**	**d (m/line)**	**Wavelength (m)**	**Was it within the range?**

Table 3. WHITE LIGHT

COLOR	**x (left)**	**x (right)**	**Avg. x (m)**	**d (m/line)**	**Wavelength (m)**
shortest λ					
division blue/green					
division green/yellow					
division yellow/orange					
division red/orange					
longest λ					

9. How would your values of x change if the grating with 300 lines/mm were used instead of the 600 lines/mm? HINT: This change would make d larger...