Score: / 50

Names: ____

Group #__________

Period #__________

Diffraction Lab

Your group will conduct an experiment that predicts the wavelength of a laser based on its diffraction pattern when the beam is shined through a double slit apparatus. All parts of all the lab report must be uploaded to the proper pages in the One Note collaboration section. For all data, you must use the standard metric system with values rounded off to the precision of the instruments used. Calculations based on these measurements must be rounded off according to the standard significant figure rounding rules.

OBJECTIVE

- Observe the diffraction pattern produced when a laser beam shines through two small slits.
- Calculate the wavelength of the laser.

MATERIALS

Vernier track

Diffraction Apparatus (from Vernier Diffraction Apparatus Kit)

Laser (from Vernier DAK)

Screen (from Vernier DAK)

Meterstick

INITIAL SETUP

1. Place the laser near the 5 cm mark on the track. Record its exact location (to nearest mm) on the track.
2. Place the slit apparatus near the 20 cm mark on the track. Record its exact location (to nearest mm) on the track.
3. Place the screen near the opposite end of the track. Record its exact location (to nearest mm) on the track.

PROCEDURE

1. Turn on the laser and observe the diffraction pattern.

2. Take a picture of the screen showing the diffraction pattern and include it in your data section.

3. Measure d, w, and L. Record those values in your data section.

4. Measure the distance from the central bright spot to one of the bright spots in the diffraction pattern. Record this information on the data table in your data section.

5. Repeat step 4 for a total of 6 bright spots (3 on the left and 3 on the right of the central bright spot).

DATA

1. Picture of your screen with the diffraction pattern

2. Record the color of your laser (red or green). This stays constant throughout the experiment.

3. Record d (the separation distance between the slits). This stays constant throughout the experiment.

4. Record w (the width of each one of the slits). This stays constant throughout the experiment.

5. Record L (the distance from the slits to the screen). This stays constant throughout the experiment.

6. Make a data table listing X_m for the first three orders of the diffraction pattern. X is the distance from the central bright spot to the one you are currently measuring in the diffraction pattern, and m is the order of the diffraction (1, 2, 3, etc,). Your data table should have 6 rows (one for each bright spot) and 3 columns. You should have three bright spots on the left and three bright spots on the right of the central bright spot. You should have columns for m, X_m, and λ.

CALCULATIONS

1. Calculate the wavelength (λ) of the laser for each of the six bright spots on your data table. Record these wavelengths in the table next to their corresponding X_m's.

2. Calculate the experimental value of the wavelength of your laser by averaging the six wavelengths from your data table.

3. Ask the teacher for the theoretical value of the wavelength of your laser, then calculate your percent error.

CONCLUSION

1. List two sources of error, which could help explain why your experimental value for λ might not be the same as the theoretical value.

2. Which diffraction pattern (red or green) would you expect to have the greater space between the bright spots? Explain why this is the case (hint: Rearrange the lab equation to solve for X). Then compare your data with another group that used a different color laser than you to test your prediction.

3. Explain how the results of this experiment support the model of light being a wave rather than a stream of particles.