

# Wave Nature of Light Lab

Group members: \_\_\_\_\_

## Part I: Preliminary Calculations and Set-Up

**Equipment:** Laser, Optical bench, Single and double slit slide and diffraction gratings

1. Calculate the distance between the slits of the diffraction grating using the fact that there are 13,400 slits per inch (Ignore the width of the slits). Use the conversion 1 in = 25.4 mm. You'll have to think about this!!!

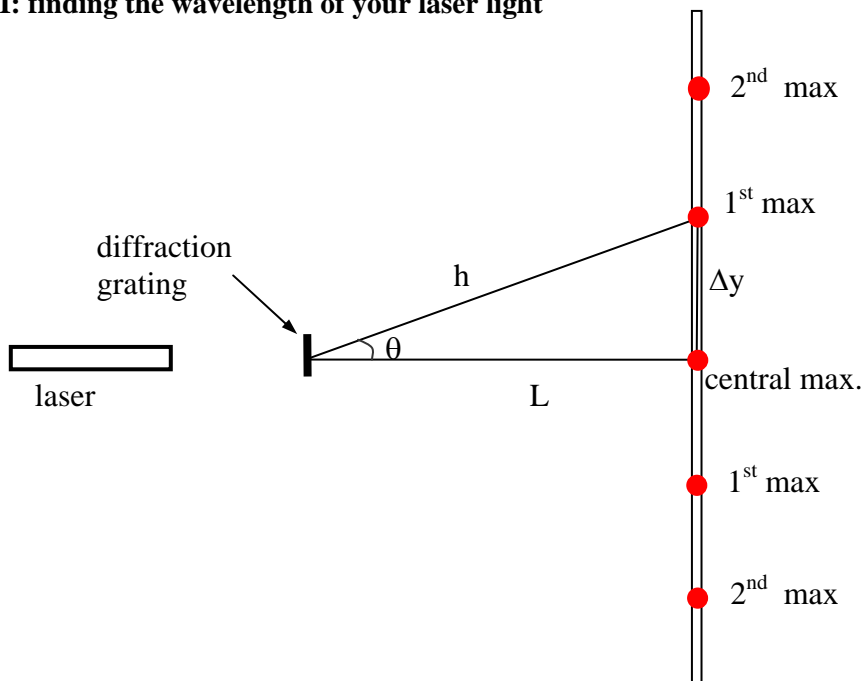
distance between slits:

d = \_\_\_\_\_ mm

## Part II: Investigate

1. Investigate the diffraction pattern of a double slit and a diffraction grating.
  - a) Focus your laser to a point and send it through the diffraction grating so that a pattern of dots appears on the screen. Sketch what you see on the screen. You may have to experiment with the position of the screen.

## Part III: finding the wavelength of your laser light



Recall that for constructive interference, we require a path difference of  $n\lambda = d \sin \theta$

where...

$d$  = spacing of slits

$n$  = number of maximum (i.e.  $n=0$  is the central maximum,  $n=1$  is the 1<sup>st</sup> maximum and thus the first dot to the right and left of the center, etc.)

$L$  = distance from diffraction grating to screen

$\Delta y$  = distance from  $n^{\text{th}}$  spot out from the center (if  $n = 1$  then it is the 1<sup>st</sup> spot).

**Definitions:**

Maximum = place where waves **constructively** interfere

Minimum = place where waves **destructively** interfere

Measure the distance from the diffraction grating to the screen.

$L =$  \_\_\_\_\_

Measure the distance between the central maximum and the first maximum.

for  $n = 1$ ,  $\Delta y_1 =$  \_\_\_\_\_

Measure the distance between the central maximum and the second maximum for

for  $n=2$ ,  $\Delta y_2 =$  \_\_\_\_\_

Calculate the angle for  $n=1$  ( $\theta_1$ ) ( $\theta_1$  is the angle made by the laser light going straight through *and* the laser light going to the first maximum; it is also the angle used for the path difference calculation.)

$\theta_1 =$  \_\_\_\_\_

1. Using the fact that  $n\lambda = d \sin \theta$  for constructive interference, calculate the wavelength  $\lambda$  of the laser light. (Hint: pay close attention to units) Note that you found  $d$ , the distance between slits on the diffraction grating in Part I.

$\lambda =$  \_\_\_\_\_ nm (remember  $1 \text{ nm} = 10^{-9} \text{ m} = 10^{-6} \text{ mm}$ )

2. Now check the above measurement using the  $n = 2$  maximum.

$\lambda =$  \_\_\_\_\_ nm

3. Take the average of the two wavelengths.

$\lambda_{\text{avg.}} =$  \_\_\_\_\_ nm

4. The true value of  $\lambda$  is somewhere between 630 and 670 nm. Calculate the percent difference using the average value for  $\lambda$  and 650 nm for the true value,

Percent difference = \_\_\_\_\_