## DIFFRACTION






## Nodal and Antinodal regions

## bright fringes

The interference occurs because each point on the screen is not the same distance from both slits. Depending on the path length difference, the wave can interfere constructively (bright spot) or destructively (dark spot).


## $m \lambda=d \sin \theta$



## Practice $m \lambda=d \sin \theta$

* How many lines per centimeter does a grating have if the third-order bright fringe occurs at an $18.0^{\circ}$ angle for a beam of red $(630 \mathrm{~nm})$ light?
$\mathbf{m}=3$
$\lambda=630 \times 10^{-9} \mathrm{~m}$
$\Theta=18.0^{\circ}$


## Practice

 $m \lambda=d \sin \theta$How many lines per centimeter does a grating have if the third-order bright fringe occurs at an $18.0^{\circ}$ angle for 630 nm light?
$\mathrm{m}=3$
$\lambda=630 \times 10^{-9} \mathrm{~m}$
$\theta=18.0^{\circ}$

* $3(630(E E-9))=d(\sin 18)$
* $d=6.116 \times 10^{-6} \mathrm{~m}$
* $1 / 6.116 \times 10^{-6} \mathrm{~m}=163,501$ lines per meter
* 1635 lines/cm


## Lab - Emission spectrum of Hydrogen



## Lab Part 1

# Find the wavelength of our HeNe laser <br> Known Diffraction Grating 530 lines/ mm 

Solve for d
Measure \& Calculate $\boldsymbol{\Theta}$
Solve for Wavelength

$$
d=\frac{1}{\text { lines } / m} \quad \tan ^{-1} \frac{y}{x}
$$

## Lab Part 2

# Find the grating separation (d)of the grating spectrometer 




## Lab Results



## Energy in a Wave

## $h c$


$\lambda$
$c=3.0 \times 10^{8} \mathrm{~m} / \mathrm{s}$
$h=4.136 \times 10^{-15} \mathrm{eVs}$
1 electron volt $=1.602 \times 10^{-19}$ Joules

## Energy Levels in the Hydrogen Atom



## Energy in the Electron Shells



## Binding Energy $\mathrm{E}=13.6 \mathrm{eV} / \mathrm{n}^{\mathbf{2}}$

Determine what shells are involved in the release of the three photons (as determined on the first page).


