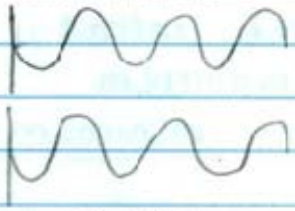
Interference of Light

- Superposition
- Constructive Interference → Brighter light
- Destructive Interference → no light.

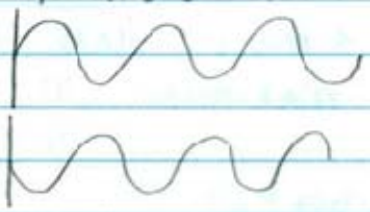
- Sound: all wavelengths travel at the same speed
  NOT TRUE FOR LIGHT!

- Constructive Interference



* in phase with one another

- Total Destructive Interference



* phase difference of half a wavelength ($\frac{1}{2}\lambda, 1\frac{1}{2}\lambda$ etc)

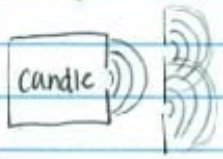
* Phase difference of one wavelength

- Diffraction: waves go out in all directions when going through an opening that is about the wavelength of the way.
- Coherence: two light sources in phase with one another
- mono-chromatic light: one wavelength or one color

Thomas Young's Double Slit Experiment: 1801

An interference pattern

Light is a wave



Constructive Interference

an interference maximum (singular)

interference maxima (plural)

central maximum ⇒ middle one

phase difference of one wavelength

central maximum = 0

first order maximum = 1

2nd order maximum = 2

⋮

Bright Fringe

$d\sin\theta = m\lambda$

$m = 0, \pm 1, \pm 1, \pm 3$

m ⇒ order number

θ = angle between the ray & normal

d = distance between the 2 slits. "slit separation"

Destructive Interference

an interference minimum (singular)

interference minima (plural)

Dark Fringe

phase difference of $\frac{1}{2}\lambda$

$m = 0, \pm 1, \pm 2$

$d\sin\theta = \left(m + \frac{1}{2}\right)\lambda$

* the 1st dark fringe above the central maximum $m = 0 \Rightarrow$ zeroth minimum

$m = 1 \Rightarrow$ 1st order minimum

p.604 #2

$d = 0.25$ mm $\quad \theta = ?$ $\quad d = 0.250 \times 10^{-3}$ m

$\lambda = 546.1$ Nm $\quad m = 1$ $\quad \lambda = 546.1 \times 10^{-9}$ m

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

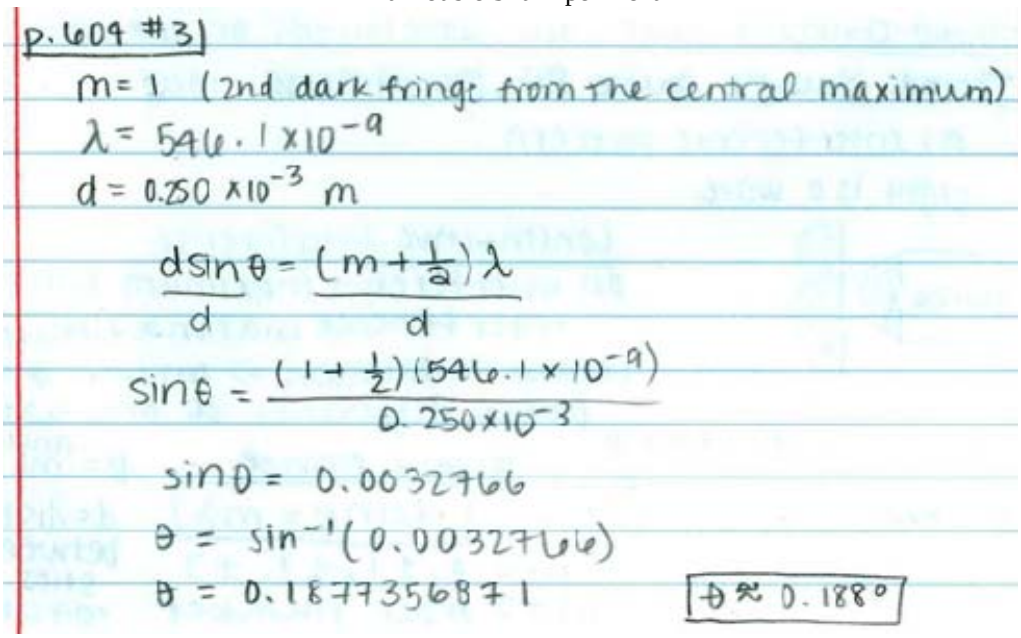
$$\sin\theta = \frac{m\lambda}{d}$$

$$\theta = \sin^{-1}\left(\frac{m\lambda}{d}\right)$$

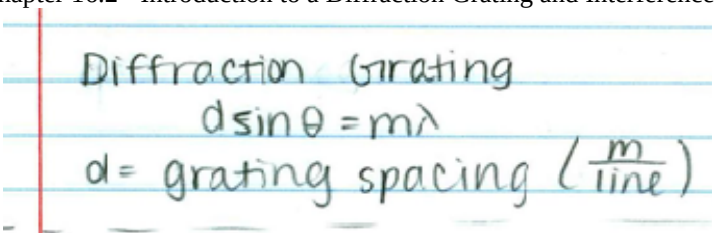
$$\theta = \sin^{-1}\left(\frac{1 \cdot 546.1 \times 10^{-9}}{0.250 \times 10^{-3}}\right)$$

$\theta = 0.125157\ldots^\circ$ $\quad \theta \approx 0.125^\circ$

Video Lecture #5 – Chapter 16.1 - Page 604 #3 A Problem - Finding the Angle for an Interference Minimum in a Double Slit Experiment



Video Lecture #6 – Chapter 16.2 - Introduction to a Diffraction Grating and Interference Maxima and Minima



Video Lecture #7 – Chapter 16.2 - Page 611 #1 A Problem - Determining the Number of Lines per Centimeter on a Diffraction Grating