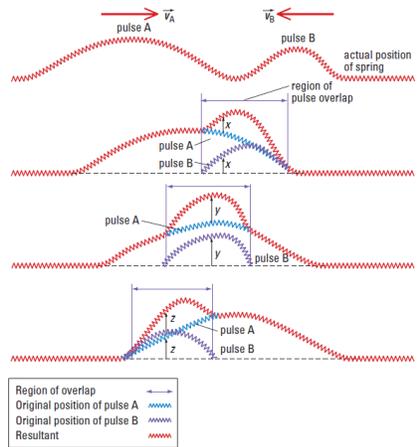
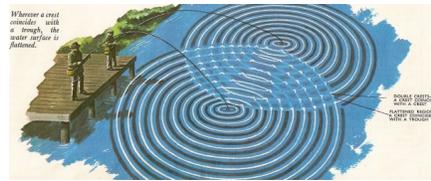
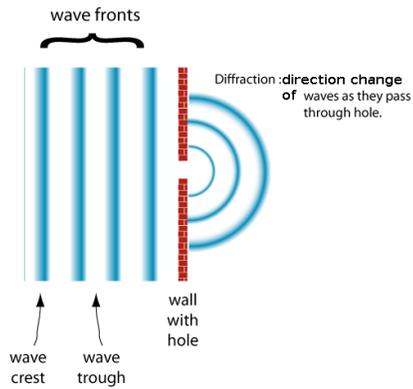
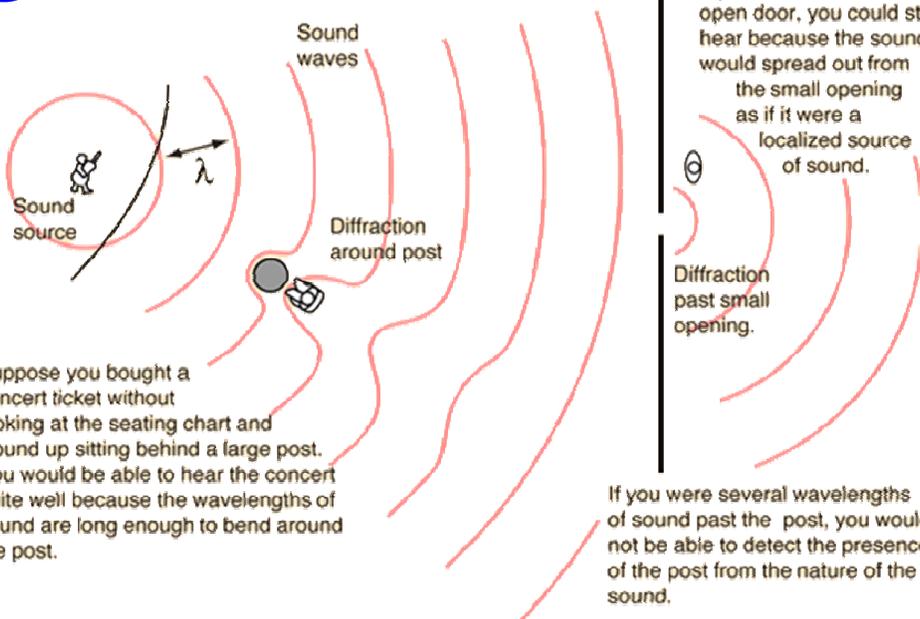


# L06 - Two Source Interference

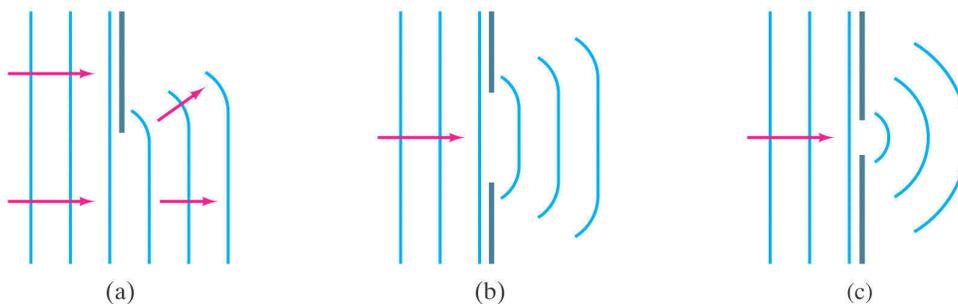
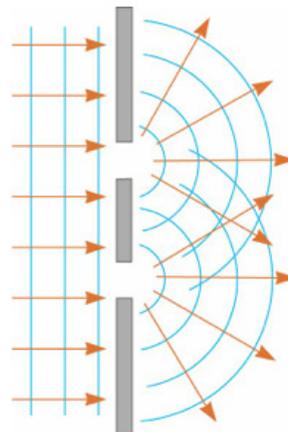
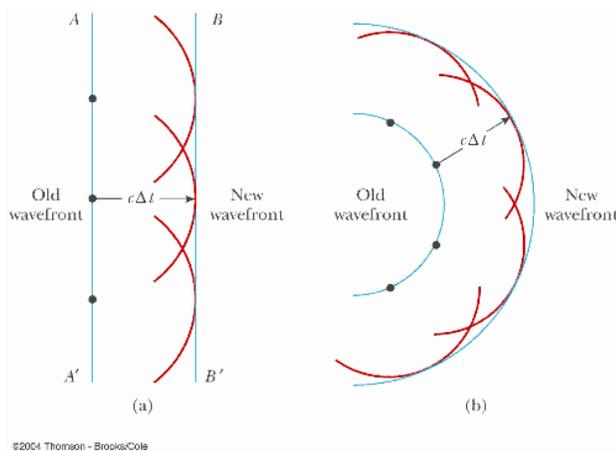


## Diffraction



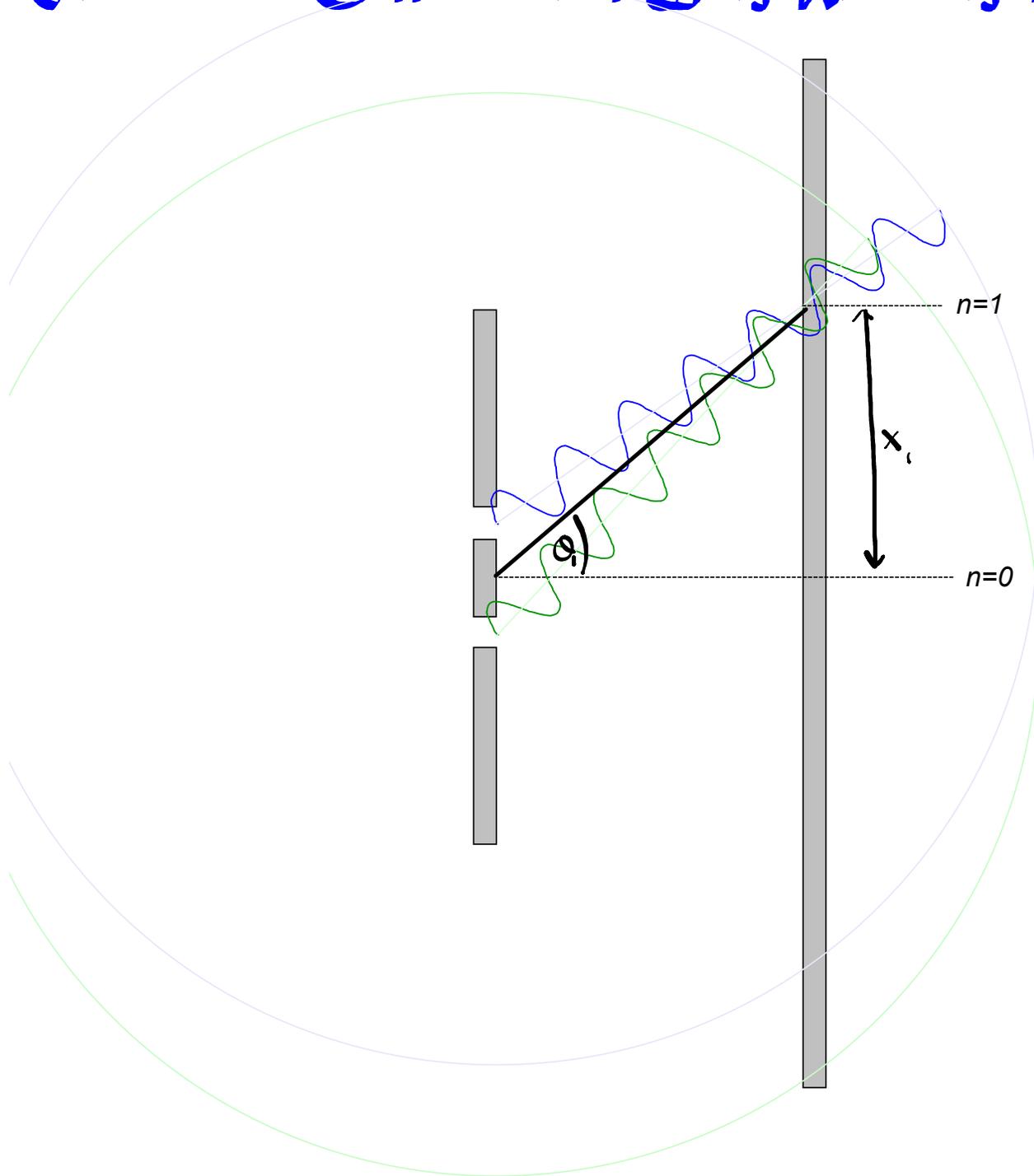
## Huygen's Principle

The Huygens-Fresnel principle states that every point on a wavefront is a source of wavelets. These wavelets spread out in the forward direction, at the same speed as the source wave. The new wavefront is a line tangent to all of the wavelets.

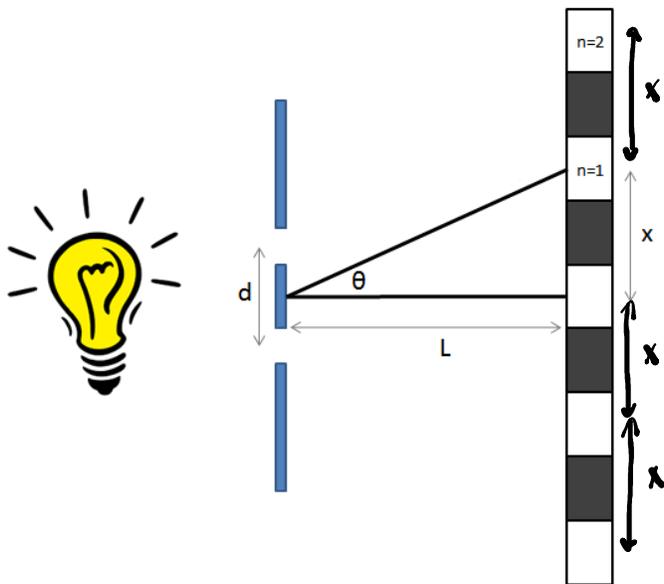




## Interactive - Diffraction of Long Wavelength



# Young's Double Slit Experiment



$d$  – distance between slits  
 $n$  – antinodal number of separation  
 $\theta$  – angle of diffraction from the bisector to the antinodal  
 $x$  – distance between antinodes (Constructive Int. (Loud, Bright))  
 $L$  – distance to the screen from the slits

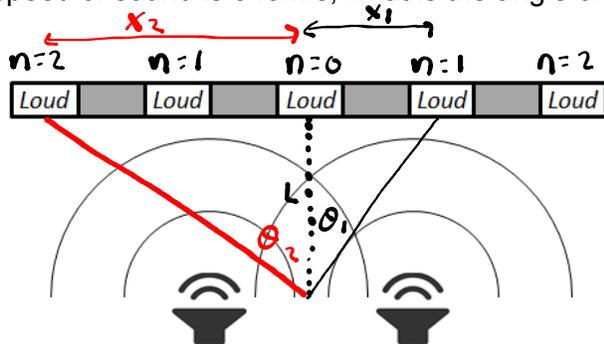
$$\lambda = \frac{d \sin \theta}{n}$$

## Reminders and Explanations

**Interference Pattern Equations** The program of studies mandates that students apply two equations for interference:  $\lambda = \frac{xd}{nL}$  and  $\lambda = \frac{d \sin \theta}{n}$ . Many students use  $\lambda = \frac{xd}{nL}$  exclusively and do not realize that it is a special-case equation which can be applied validly only when  $x \ll l$  or  $\theta < 10^\circ$ .

## Examples $\lambda = \frac{d \sin \theta}{n}$

Q1: Two Smart Board speakers, located 2.2 meters apart, are playing a 425 Hz pure tone. If the speed of sound is 343m/s, what is the angle of diffraction to the first antinode?



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

$$\lambda = \frac{(2.2) \sin \theta}{1}$$

WAVE

$$v = f \lambda$$

$$343 = (425) \lambda$$

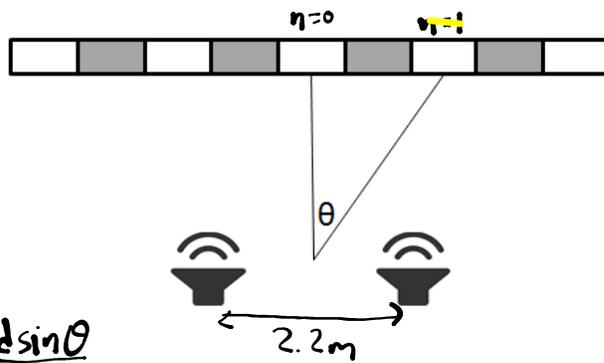
$$\lambda = 0.807 \text{ m}$$

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

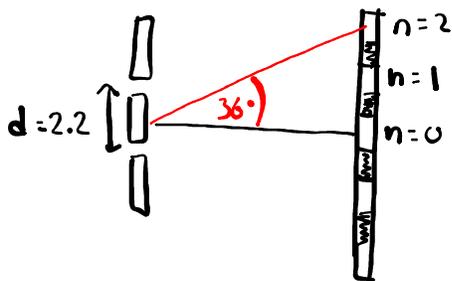
$$0.807 = \frac{(2.2) \sin \theta}{1}$$

$$\sin \theta = 0.3668$$

$$\theta = 21.5^\circ$$



Q2: What frequency would result in a 36 degree angle of diffraction to the second antinode?



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

$$\lambda = \frac{(2.2) \sin 36}{2}$$

$$\lambda = 0.64656 \text{ m}$$



$$v = f \lambda$$

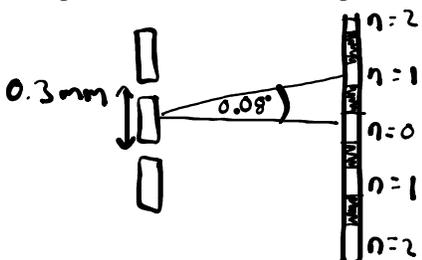
$$343 = f(0.64656)$$

$$f = 530.5 \text{ Hz}$$

**Examples**  $\lambda = \frac{d \sin \theta}{n}$

Q3: Monochromatic light is incident on two slits separated by 0.30 mm, and the first bright fringe is located at an angle of 0.080° from the central antinode. What is the wavelength?

$0.3 \times 10^{-3} \text{ m}$



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

$\lambda = \frac{(0.3 \times 10^{-3}) \sin(0.08)}{1}$

$\lambda = 4.19 \times 10^{-7} \text{ m}$  Phys 20

419 nm → Blue light Phys 30

Q4: Light passes through a double slit and produces images on a screen that is 20.0 m away. If the second-order bright image is formed at a distance of 0.720 m from the central maximum, how far from the central maximum will the third-order bright image be formed?

- a. 2.16 m
- b. 1.08 m**
- c. 0.480 m
- d. 0.240 m

