

Wave Phenom #2

p 883 MC5

p 885 P 2, 4, 5

online Constive Int

p883 - Multiple Choice

5) why don't 2 flashlights 1m apart produce int?

• The light waves are not coherent

- Problems

2) green light incident double slit

$$\lambda = 540 \text{ nm}$$
$$d = .5 \text{ mm}$$

A) $f = ?$ $f = \frac{v}{\lambda} = \frac{3 \times 10^8 \text{ m/s}}{540 \times 10^{-9} \text{ m}}$
 $= 5.6 \times 10^{14} \text{ Hz}$

B) θ of first 2 maxima

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

$$\theta = \sin^{-1} \left(\frac{(1) (540 \times 10^{-9} \text{ m})}{.5 \times 10^{-3} \text{ m}} \right) = .062^\circ$$

$$\textcircled{2} \theta = \sin^{-1} \left(\frac{m \lambda}{d} \right) = \sin^{-1} \left(\frac{(2) (540 \times 10^{-9} \text{ m})}{.5 \times 10^{-3} \text{ m}} \right)$$
$$= .12^\circ$$

c) What change to double x ?

$$x = \frac{\lambda L}{d}$$

• double separation b/t slit + screen
• halve slit separation

②

4) red light
 $\lambda = 630 \text{ nm}$
 $l = 1.2 \text{ m}$
 $x_3 = .80 \text{ cm}$
 $m = 3$

a) $f = ?$

$$f = \frac{v}{\lambda} = \frac{3 \times 10^8 \text{ m/s}}{630 \times 10^{-9} \text{ m}}$$

$$f = 4.8 \times 10^{14} \text{ Hz}$$

b) $d = ?$

$$d = \frac{m\lambda L}{x} = \frac{(3)(630 \times 10^{-9} \text{ m})(1.2 \text{ m})}{.80 \times 10^{-2} \text{ m}}$$

$$d = 2.8 \times 10^{-4} \text{ m}$$

$$(.28 \text{ mm})$$

$$\lambda = \frac{xd}{L}$$

②

c) $\theta = ?$

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

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

$$= \sin^{-1} \left(\frac{3(630 \times 10^{-9} \text{ m})}{2.8 \times 10^{-4} \text{ m}} \right)$$

$$\theta = .38^\circ$$

57) monochromatic

$$x = 2 \text{ cm}$$

new x when:
simultaneous

d doubles

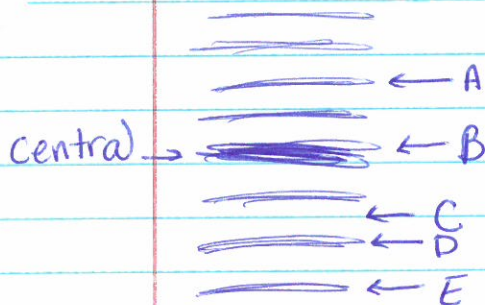
λ 30% increase

l halved

$$(1) \quad x' = \frac{m l \lambda}{d} = \frac{(1) \left(\frac{1}{2}\right) (1.3)}{2} = .325 \text{ times}$$

$$x' = (.325)(2 \text{ cm}) = .65 \text{ cm}$$

- Online Constructive Int



double slit experiment

$$\lambda = \lambda$$

A) Fringes where phase diff
is exactly 2λ

$$\Delta l = m\lambda$$

A D

$$\Delta l = 2\lambda \quad 2 \text{ bands from center}$$

(1)

B) Immerse in water, what happens?

$$x' = \frac{m l \lambda}{d} \left(\lambda_{\text{water}} = \frac{\lambda_{\text{air}}}{1.33} \right)$$

$$x' = \frac{m l \frac{\lambda_{\text{air}}}{1.33}}{d} = \frac{x_{\text{air}}}{1.33}$$

• They are
more closely
spaced by
factor of 1.33