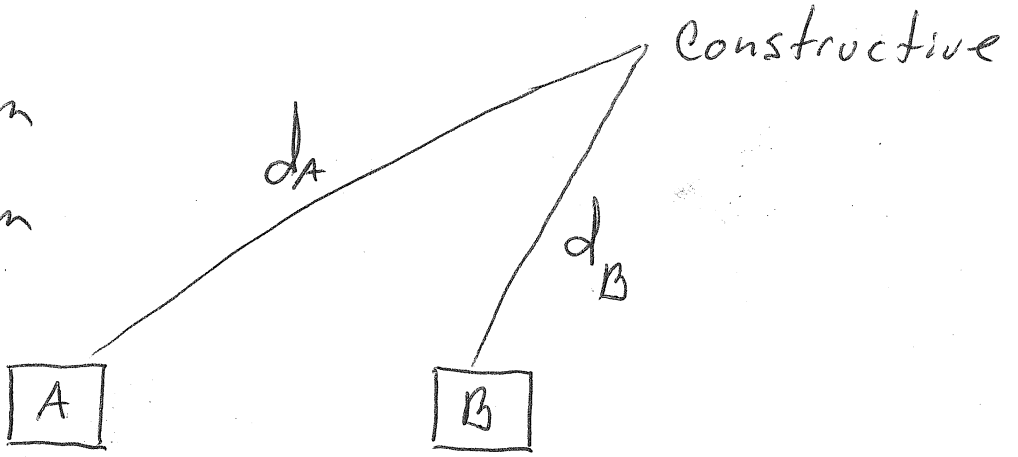
3

$d_A = 295m$

$d_B = 161m$

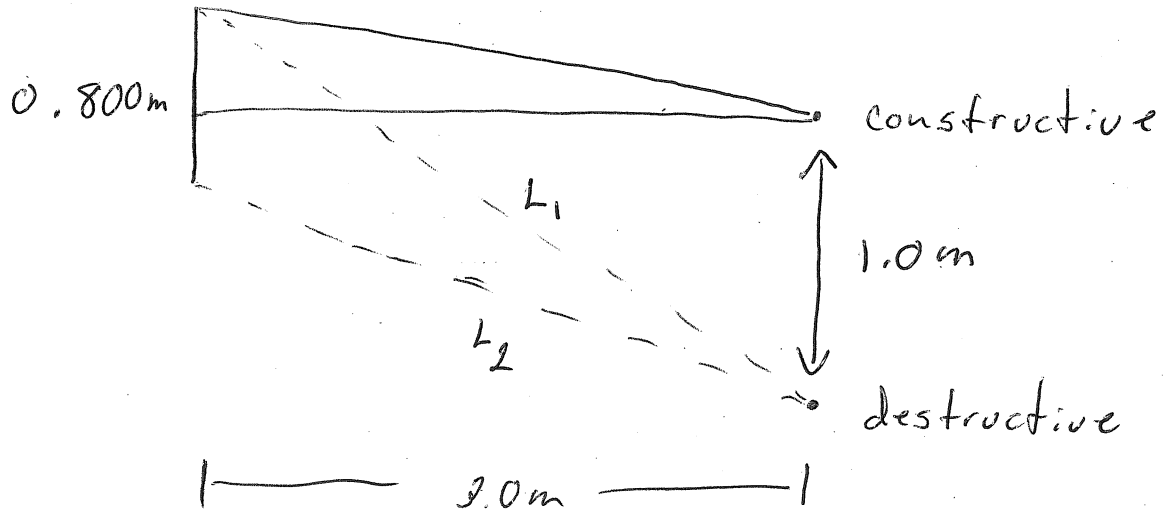


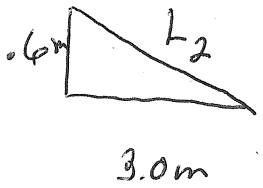
$d_A - d_B = \frac{1}{2}\lambda$ largest destructive

$= \lambda$ largest constructive

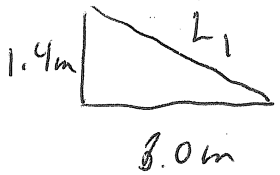
$295m - 161m = \boxed{134m}$

9





$$L_2 = \sqrt{(.6m)^2 + (3.0m)^2} = 3.059_m$$



$$L_1 = \sqrt{(1.4m)^2 + (3.0m)^2} = 3.311m$$

$$L_1 - L_2 = 0.252\,m$$

lowest destructive occurs when $\Delta L = \frac{1}{2}\lambda$

2nd lowest " " " $\Delta L = \frac{3}{2}\lambda$

$\frac{1}{2}\lambda = \cancel{0.52m} = 0.252m \qquad \lambda = 0.504m$

$\frac{3}{2}\lambda = \cancel{0.52m} = 0.252m \qquad \lambda = 0.168m$

$v = f\lambda$

$v = 343 m/s$ in air @ STP

$f = \frac{v}{\lambda}$

$\frac{343 m/s}{0.504m} = 6.81E2$ **681 Hz**

$\frac{343 m/s}{0.168m} = 2.04E3$ **2.04 kHz**

15

$d = 48.0E\text{-}5\ m$ $\qquad d \sin\theta = n\lambda$

$\theta_2 = 0.0990^\circ$

a) $\lambda = ?$

b) $\uparrow d \quad \theta_2 = \text{same} \quad \lambda\ ?$

c) $d = 68.0E\text{-}5m \quad \lambda = ?$

a)

$$\lambda = \frac{d \sin\theta}{n} = \frac{(48.0E\text{-}5m)\ \sin(0.0990^\circ)}{2}$$

$$= 415nm$$

b) $\lambda \uparrow$ since the numerator increases only

c) $\lambda = \frac{d \sin\theta}{n} = \frac{68.0E\text{-}5m \ \sin(0.09909)}{2}$

$= \boxed{587nm}$

19

$d = 0.230E\text{-}3m$

$L = 2.50m$

$y = 7.15E\text{-}3m$

$\lambda = ?$

$d \sin\theta = n\lambda$

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

$y = L \tan\theta$

$$\theta = \tan^{-1}\left(\frac{y}{L}\right)$$

$$\theta = \tan^{-1}\left(\frac{7.15E\text{-}3m}{2.50m}\right)$$

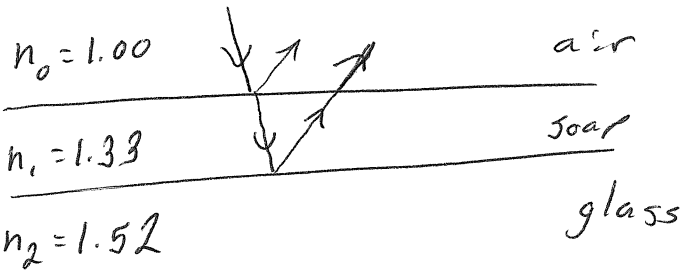
$= 0.164$

$$\lambda = \frac{(0.230E\text{-}3m)\sin(0.164)}{1}$$

$= \boxed{658nm}$

27

$t = 272\ nm$



Constructive interference

$$t_{min} = \frac{\lambda}{2 n_1} \qquad \text{(even \# of } \tfrac{1}{2}\lambda\text{)}$$

$\frac{1}{2}\lambda, \lambda, 1.5\lambda, 2\lambda, \ldots$

$$2 n_1 t = \lambda = 2.05E\text{-}6\ m$$

$$\frac{n_1 t}{1} = \lambda = 1.03E\text{-}6\ m$$

} not visible

$$\frac{n_1 t}{1.5} = \lambda = 6.85E\text{-}7\ m$$

$$\frac{n_1 t}{2} = \lambda = 5.13E\text{-}7\ m$$

$$\frac{n_1 t}{2.5} = \lambda = 4.11E\text{-}7\ m$$

} visible

33

$n_0 = 1.00$

$n_1 = 1.38$

$n_2 = 1.61$

$\lambda = 565\,nm$

↑ eliminate/reduce reflection of this

$$t_{min} = \frac{\lambda}{4 n_1}$$

$$= \frac{565E\text{-}9\,m}{4(1.38)} = \boxed{1.02E\text{-}7\,m}$$

$\uparrow f \rightarrow \downarrow \lambda$

If $\lambda \downarrow$ then t_{min} also $\downarrow$

39

$\lambda = 546\text{nm}$

Central max width = 2.50cm

$L = 1.60\text{ m}$

$d = ?$

$d \sin\theta = n\lambda$

$y = L \tan\theta$

$2y_1$ = Central max width

$y_1 = 1.25\text{cm}$

$$\theta = \tan^{-1}\left(\frac{y}{L}\right) = \tan^{-1}\left(\frac{1.25\text{E-}2\text{m}}{1.60\text{m}}\right) = 0.448$$

$$d = \frac{n\lambda}{\sin\theta} = \frac{1\,(546\text{E-}9\text{m})}{\sin 0.448} = \boxed{6.98\text{E-}5\text{m}}$$

43

$\lambda = 553\,nm$

$d = 8.00\,\mu m$

$d \sin\theta = n\lambda$

to see fringes $\theta < 90$

$\sin 90^{\circ}$ limit of visibility of fringes.

$d = n\lambda$

$$n = \frac{d}{\lambda} = \frac{8.00E\text{-}6m}{553E\text{-}9m}$$

$= 14.5$

14

* you can't see fractions of fringes

59

$n = 2$

$N = 560 \frac{\text{lines}}{\text{cm}}$

$\theta_2 = 3.1^\circ$

a) $\lambda = ?$

b) $\uparrow N \quad \theta_2 = ?$

$d \sin\theta = n\lambda$

$d = \frac{1}{N}$

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

$$\lambda = \frac{\sin(3.1^\circ)}{2\left(560 \frac{\text{lines}}{\text{cm}}\right)} = 4.83E-5 \text{ cm}$$

$$\boxed{483 \text{ nm}}$$

If $\uparrow N$ then by

$$\sin\theta = \frac{n\lambda}{D} = nN\lambda$$

$$\theta = \sin^{-1}(nN\lambda)$$

θ increases

65

$\lambda = 465nm$

$d \sin\theta = n\lambda$

$n=1$ visible

$n=2$ not visible

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

$\frac{n\lambda}{d} > 1$ for $n=2$

boundary occurs when $\frac{n\lambda}{d} = 1$

$n\lambda = d$

$2(465E\text{-}9m) = \boxed{9.3E\text{->}m}$