

Class 21 ch 36 19, 21, 22

18. Small angle should be OK  $\theta = \frac{.9 \times 10^{-3}}{.75} = 1.2 \times 10^{-3} \text{ rad} = .0687^\circ$

$$\frac{\beta}{2} = \frac{\pi a \sin \theta}{\lambda} = 2.88 \quad \frac{\sin \beta/2}{\beta/2} = 8.96 \times 10^{-2}$$

$a = 434 \mu\text{m}$   
 $\lambda = .568 \times 10^{-6}$

$$\frac{\phi}{2} = \frac{\pi d \sin \theta}{\lambda} = 4.247 \quad \cos \frac{\phi}{2} = -.448$$

$d = 640 \mu\text{m}$

$$I = I_0 \left( \frac{\sin \beta/2}{\beta/2} \cos \frac{\phi}{2} \right)^2 = 8.06 \times 10^{-7} \frac{\text{W}}{\text{m}^2}$$

$I_0 = 5 \times 10^{-4}$

21.  $d \sin \theta = m \lambda$       $\sin \theta = m \frac{.58 \mu\text{m}}{530 \mu\text{m}} = m=1 \ 1.05 \times 10^{-3} \text{ r} = .0627^\circ$   
 $m=2 \ 2.1 \times 10^{-3} \text{ r} = .125^\circ$

↳ at these angles  $\cos \phi/2 = \pm 1$  so just  $\beta$  term.

$$I = I_0 \left( \frac{\sin \beta/2}{\beta/2} \right)^2 \quad \frac{\beta}{2} = \frac{\pi a \sin \theta}{\lambda} = m=1 \ 1.90 \text{ r}$$

$a = 320 \mu\text{m}$   
 $m=2 \ 3.79 \text{ r}$

↳  $m=2 \ .026$   
 $m=1 \ .25$

22. Small angle should be OK     max @

we know that at  $\theta = \frac{3}{90}$       $\frac{\beta}{2} = \pi$   
 ( cuz have zero of single slit)

so  $a \sin \theta = \lambda \Rightarrow a = 15 \mu\text{m}$

$\uparrow$   $\frac{3}{90}$       $\uparrow$   $.5 \mu\text{m}$

$d \sin \theta = \lambda$   
 $\uparrow$  ?      $\uparrow$   $.5 \mu\text{m}$   
 $\uparrow$   $\frac{1}{90}$  radians

$d = 90 (.5) = 45 \mu\text{m}$