

Chap 9 #16, 18, 19, 20

16

$$\begin{aligned} E &= \frac{F \cos \theta_1}{4\pi r_1^2} + \frac{g F \cos \theta_2}{4\pi r_2^2} \\ &= \frac{1200 \cos 0}{4\pi (40)^2} + \frac{(0.92)1200 \cos 0}{4\pi (3)^2} \\ &= 596.8 + 9.76 = 606.56 \text{ lux} \end{aligned}$$

18

$$a) \lambda_{\text{medium}} = \frac{\lambda_{\text{air}}}{n} = \frac{600 \text{ nm}}{1.458} = 411.5 \text{ nm}$$

$$b) \lambda = \frac{\lambda_{\text{air}}}{n} = \frac{600 \text{ nm}}{n} \quad c = \lambda f$$

$$f_{\text{air}} = \frac{c}{\lambda_{\text{air}}} = \frac{3 \times 10^8 \text{ m/s}}{600 \text{ nm}} = 5 \times 10^{14} \text{ Hz}$$

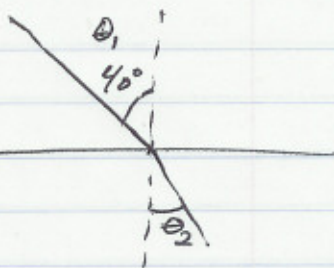
$$f_{\text{quartz}} = \frac{3 \times 10^8 \text{ m/s}}{411.5 \text{ nm}} = 7.29 \times 10^{14} \text{ Hz}$$

this is what we expect  $n_1 = n_2$  because  
the angle is at the same type interface  
(between air and quartz)

19

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

air  
 $n_1$   
glass  
 $n_2$

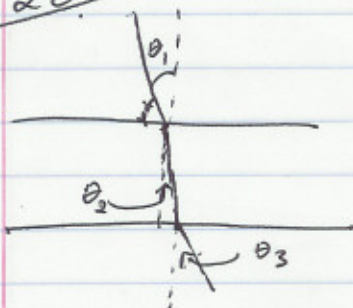


$$1.000293 \sin 40^\circ = 1.52 \sin \theta_2$$

$$\sin \theta_2 = \frac{1.000293 \sin 40^\circ}{1.52} = 0.423$$

$$\theta_2 = 25.02^\circ$$

20



a)  $\theta_1 = 20^\circ$   $n_1 = 1.000293 \approx 1$   
 $n_2 = 1.52$

$$\sin \theta_2 = \frac{\sin 20^\circ}{1.52} = 0.225$$

$$\theta_2 = 13^\circ$$

b)  $\theta_2 = 13^\circ$   $n_2 = 1.52$   
 $\theta_3 = ?$   $n_3 \approx 1$

$$\sin \theta_3 = \frac{\sin 13^\circ (1.52)}{1} = 0.342$$

$$\theta_3 = 20^\circ$$

this is what we expect  $\theta_1 = \theta_3$  because the angle is at the same type interface (between air and glass)