HW 25

1

$h = 11$ cm

$d = 27.5$ cm

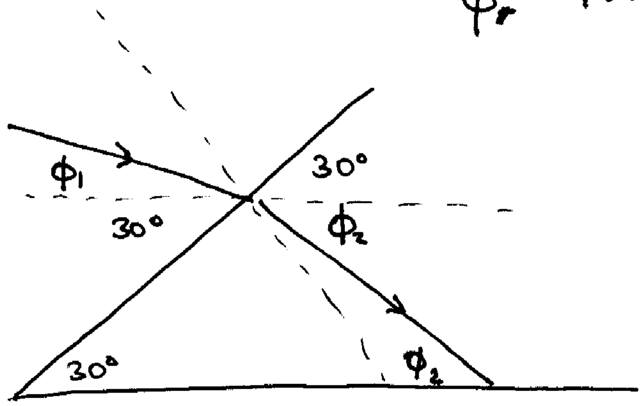
$d = d_1 + d_2$

$d_1 = \dfrac{h}{\tan 30^\circ}$ & $d_2 = \dfrac{h}{\tan \phi_2}$

$$\tan \phi_2 = \frac{1}{\frac{d}{h} - \frac{1}{\tan 30^\circ}} \Rightarrow \boxed{\phi_2 \doteq 52.5^\circ}$$

$\phi_r = 47.9^\circ$

2



$\theta_1 = 90^\circ - 30^\circ - \phi_1$

$\theta_2 = 90^\circ - 30^\circ - \phi_2$

$\sin \theta_1 = n \cdot \sin \theta_2$

$$n = \frac{\sin \theta_1}{\sin \theta_2} = \frac{\sin(60^\circ - \phi_1)}{\sin(60^\circ - \phi_2)} \Rightarrow \boxed{n = 1.6}$$

3

$n \cdot \sin(90^\circ - \phi_2) = \sin(90^\circ - \phi_3)$

$n \cdot \cos \phi_2 = \cos \phi_3$

$\phi_3 = \arccos\left(n \cdot \cos \phi_2\right) \doteq \underline{\underline{12.7^\circ}}$

HW 25

(4)

~~$\sin(90° - \phi_{3H}) = n \sin(90° - \phi)$~~

(1) $1 = n \cdot \sin(90° - \phi_{2H}) = n \cdot \cos \phi_{2H}$

(2) $\sin(90° - 30° - \phi_{1M}) = n \cdot \sin(90° - 30° - \phi_{2H})$

$\sin(60° - \phi_{1M}) = n \cdot \sin(60° - \phi_{2H})$

$\phi_{1M} = 60° - \arcsin\left(n \cdot \sin(60° - \phi_{2H})\right)$

$\boxed{\phi_{1M} \doteq 46.02°}$

(5) $\boxed{d_{VIOLET} < d}$

A smaller angle of refraction will increase ϕ_2, thereby decreasing the distance d!

(6) $\varphi_{1V} = 60° \Rightarrow \boxed{\varphi_{3V} \doteq 31.24°}$

The calculation is the same except it uses

$n = 1.71$