Ch #23
H.w. solution

#13. $h_i = 3h_o$

$d_o = 1.3\,m$

$$\frac{h_i}{h_o} = \frac{d_i}{d_o}$$

$$\frac{3h_o}{h_o} = \frac{d_i}{1.3}$$

$d_i = -3.9\,m$, the minus signe is because the image is virtual.

~~Radius of curvature =~~

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$$\frac{1}{1.3} - \frac{1}{3.9} = \frac{1}{f}$$

$$\therefore \frac{1}{f} = 0.51$$

$$f = 1.96$$

$$R = 2f$$

$$= 3.92\,m.$$

#18 This must be a convex mirror.

$d_o \approx \infty$ far

$d_i = 14.0$ cm

$f = 14$ cm

$R = 2 \times 14$

$= 28$ cm.

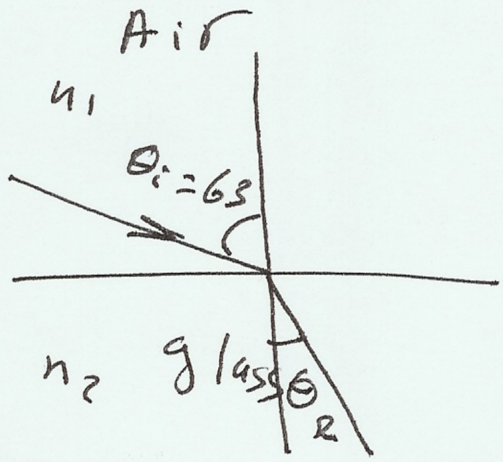
#27

$$n = \frac{c}{v}$$

$$= \frac{3. \times 10^8}{2.29 \times 10^8}$$

$$n = 1.31$$

#30



$n_1 = 1$

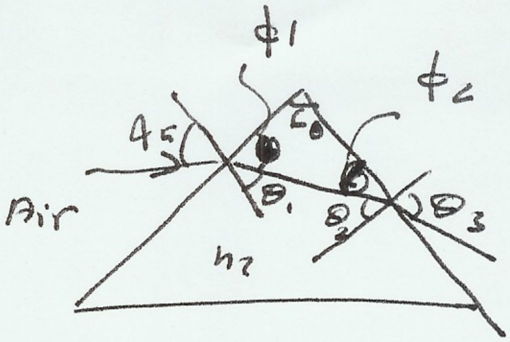
$n_2 = 1.5$

$$n_1 \sin\theta_i = n_2 \sin\theta_R$$

$$\sin\theta_R = \frac{\sin 63^\circ}{1.5} = 0.59$$

$$\theta_R = 36.4^\circ.$$

#34



$$n_1 \sin 45 = n_2 \sin\theta_1$$

$$\sin(\theta_1) = \frac{\sin 45}{1.52} = 0.46$$

$$\theta_1 = 27.7^\circ.$$

$$\phi_1 = 90 - \theta_1 = 90 - 27.7 = 62.3^\circ$$

$$\phi_2 = 180 - 60 - \phi_1$$
$$= 180 - 60 - 62.$$
$$= 58^\circ$$

$$\cancel{Az}\ \theta_2 = 90 - 58$$
$$= 32^\circ$$

~~$n_2 si$~~

$$n_2 \sin 32 = \sin\theta_3$$

$$1.52 \times \sin 32 = \sin\theta_3$$

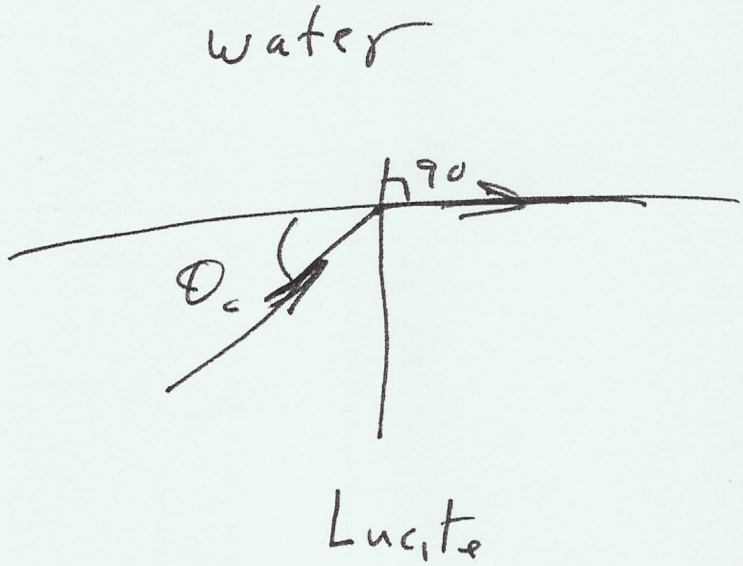
$$\therefore \sin\theta_3 = 0.8$$

$$\theta_3 = 53.6^\circ.$$

\# 40 . Index of refraction for water $n_w = 1.33$

" " " " Lucite $n_L = 1.52$

for the light to be totaly reflected back, it must come from Lucite to water



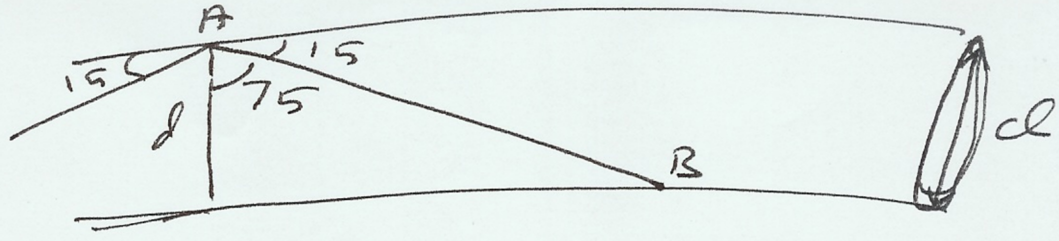
$$n_L \sin\theta_c = n_w \sin 90$$

or $$\sin\theta_c = \frac{n_w}{n_L} = \frac{1.33}{1.52}$$

$$= 0.87$$

$$\theta_c = 61.0^\circ.$$

43



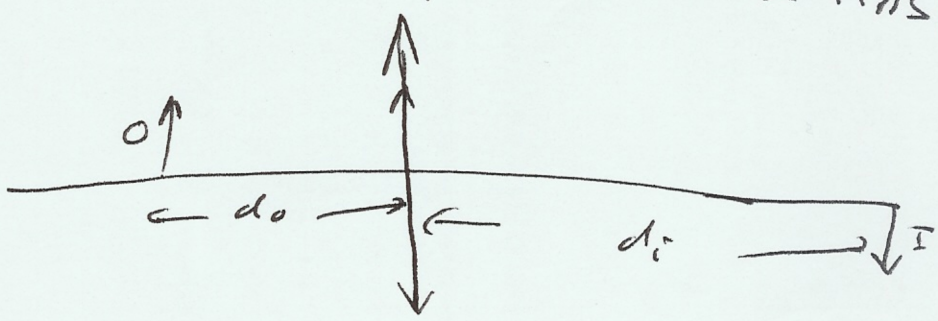
$$\frac{d}{AB} = \cos 75$$

$$AB = \frac{d}{\cos 75} = \frac{10^{-4}}{\cos 75}$$

$$= 3.86 \times 10^{-4} \text{ m.}$$

50

This must be a convex lense.



$$\frac{1}{d_0} + \frac{1}{d_i} = \frac{1}{f}$$

$$\frac{1}{2.25} + \frac{1}{48.3} = \frac{1}{f}$$

$$f = 2.14 \text{ cm.}$$

The image is real.