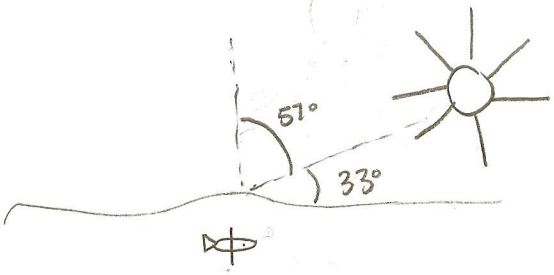
Workshop #5 :

(1.)



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

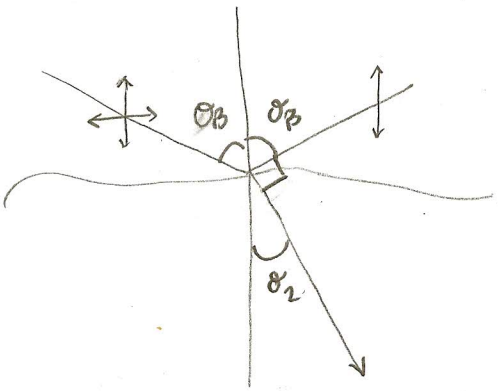
$\sin\theta_2 = \frac{n_1 \sin\theta_1}{n_2}$

$\theta_2 = \sin^{-1}\left(\frac{1 \cdot \sin 57°}{1.33}\right)$

$= 39.1°$

$90 - 39.1° = 50.9°$

(2.)

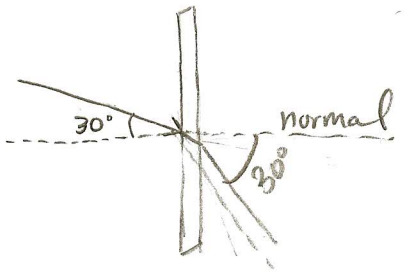


a) $\tan\theta_B = \frac{n_2}{n_1}$

$\arctan^{-1}\left(\frac{1.333}{1}\right) = 53.2°$

b) $\arctan^{-1}\left(\frac{1.309}{1}\right) = 52.6°$

(3)



a) $\sin^{-1}\left(\frac{1 \cdot \sin 30°}{1.52}\right) = 19.2°$

Slow -> fast : down
Away from the normal

fast -> slow : up
(towards the normal)

(4) a) $\sin\theta_1 = 0.25$

$\sin\theta_2 = 0.4$

$\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1} \Rightarrow n_1 = 1.6$

$\frac{\sin\theta_2 \cdot n_2}{\sin\theta_1}$

b) $f = \frac{v}{\lambda} = \frac{3E8\ m/s}{645E{-}7m} \approx 0.5E^{15} = 4.65E14$

↳ time works the same no matter the medium

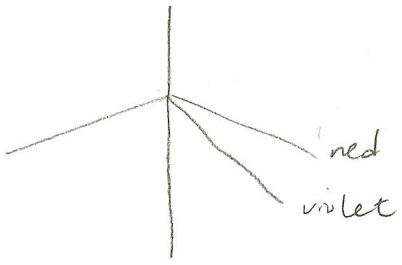
wavelength in glass:

$$4.65E14 = \frac{1.88E8}{\lambda} \Rightarrow \lambda = 4.03E{-}7\ m$$

Speed in glass

$$v = c/n = 3E8\ m/s \,/\, 1.6 = 1.88E8$$

c)



d) $\sin\theta_c = \frac{n_2}{n_1} \Rightarrow \sin^{-1}\left(\frac{1}{1.66}\right) = 37.0°$

V.

$n_a < n_b$

$n_b > n_c$

$n_c > n_d$

$n_d > n_b > n_a > n_c$

V.

change	no change
wavelength	frequency
speed	
direction	

5. a) real

b) $\frac{1}{d_i} + \frac{1}{d_o} = \frac{1}{f} \Rightarrow \frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{20cm} - \frac{1}{60cm} = \frac{1}{30cm} \Rightarrow d_i = 30cm$

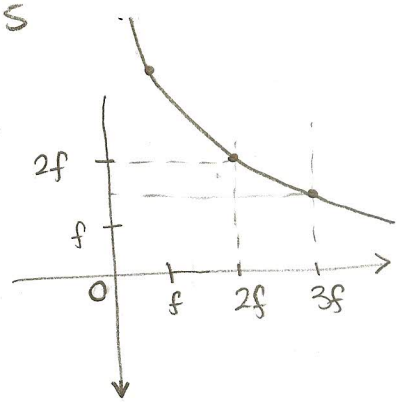
c) $m = -\frac{d_i}{d_o} = -\frac{30cm}{60cm} = -0.5$

d)

$3f \Rightarrow d_i = 30cm$

$2f \Rightarrow d_i = 40cm$

$f \Rightarrow d_i = \text{undef}$

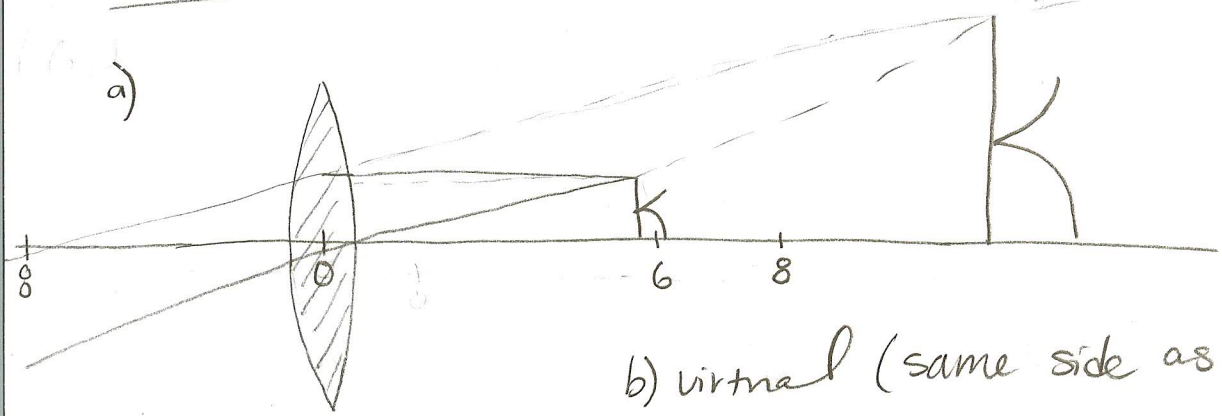


e) pulling the beams tighter $\Rightarrow$ f will decrease

6. Thin Converging lens:

*should be on other side

a)



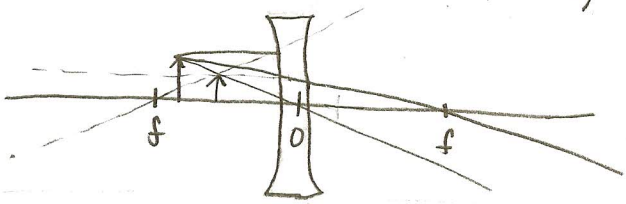
b) virtual (same side as object)

c) $\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{8cm} - \frac{1}{6cm} \Rightarrow d_i = -24cm$

d) $m = -\frac{d_i}{d_o} = (4x)$

Concave Lens:

a)



b) virtual (same side as object)

c) $\frac{1}{f} - \frac{1}{d_o} = \frac{1}{-8cm} - \frac{1}{6cm} = -3.43cm$

d) $m = 0.57x$