1. $\phi = 20°$ Air → Oil

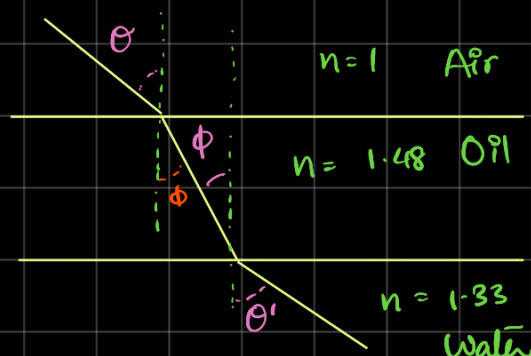$n_1 \sin\theta = n_2 \sin\phi$

$\theta = \sin^{-1}(1.48 \sin 20)$

$\theta =$

$\phi = 20°$ Oil → Water

$n_1 \sin\phi = n_2 \sin\theta'$

$\theta' = \sin^{-1}\left(\dfrac{n_2}{n_1} \sin\phi\right)$

$= \sin^{-1}\left(\dfrac{1.48}{1.33} \times \sin 20°\right)$

θ $n=1$ Air

ϕ $n = 1.48$ Oil

ϕ

θ' $n = 1.33$
       Water

3. Red light

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

$\theta_2 = \sin^{-1}\left(\dfrac{n_2}{n_1} \sin\theta_1\right)$

$= \sin^{-1}\left(\dfrac{\sin 50°}{1.455}\right) = 31.77$

Violet light

$\theta_2 = \sin^{-1}\left(\dfrac{n_2}{n_1} \sin\theta_1\right)$

$= \sin^{-1}\left(\dfrac{\sin 50°}{1.468}\right) = 31.45$

Dispersion of slab

$\angle$ Red $- \angle$ Violet

$31.77 - 31.45$

$= 0.32°$

Chapter 36

1. $p = 50$ cm

   $f = 20$ cm

   $$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

   $$\frac{1}{q} = \frac{1}{20} - \frac{1}{50}$$

   $$= 33.33 \text{ cm}$$

   $$M = \frac{-q}{p} = \frac{-(100/3)}{50} = \frac{-100}{150} = \frac{-2}{3}$$

   $q \Rightarrow +ve$ $\therefore$ Image is real

   $M \Rightarrow -ve$ $\therefore$ Image is inverted

3. $M = -4$ $|p - q| = 0.6$

a)

   $$M = -4 = \frac{-q}{p} \; ; \qquad q = 4p$$

   $$3p = 0.6$$
   $$p = 0.2$$

   $$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

   $$\frac{1}{p} + \frac{1}{4p} = \frac{1}{f}$$

   $$\frac{5}{4p} = \frac{1}{f}$$

$$\frac{4f}{5} = f$$

$$f = \frac{0.8}{5} = \underline{0.16 \text{ m}}$$

b) $M = 0.5$ $|p+q| = 0.6$

$$0.5 = -\frac{q}{p} \implies p = -2q$$

$$|-2q+q| = 0.6$$
$$q = 0.6$$

$$p = -2(0.6)$$
$$= -1.2 \text{ m}$$

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

6- $$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$ Converging

$$\frac{1}{q} = \frac{1}{8} - \frac{1}{4}$$

$$= -\frac{4}{32}$$

$$q = -\frac{32}{4}$$

$$q = -8 \text{ cm}$$

$$M = -\frac{q}{p} = \frac{8}{4} = 2$$

Diverging

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

$$\frac{1}{q} = -\frac{1}{16} - \frac{1}{14}$$

$$= \frac{1}{-16} - \frac{1}{14}$$