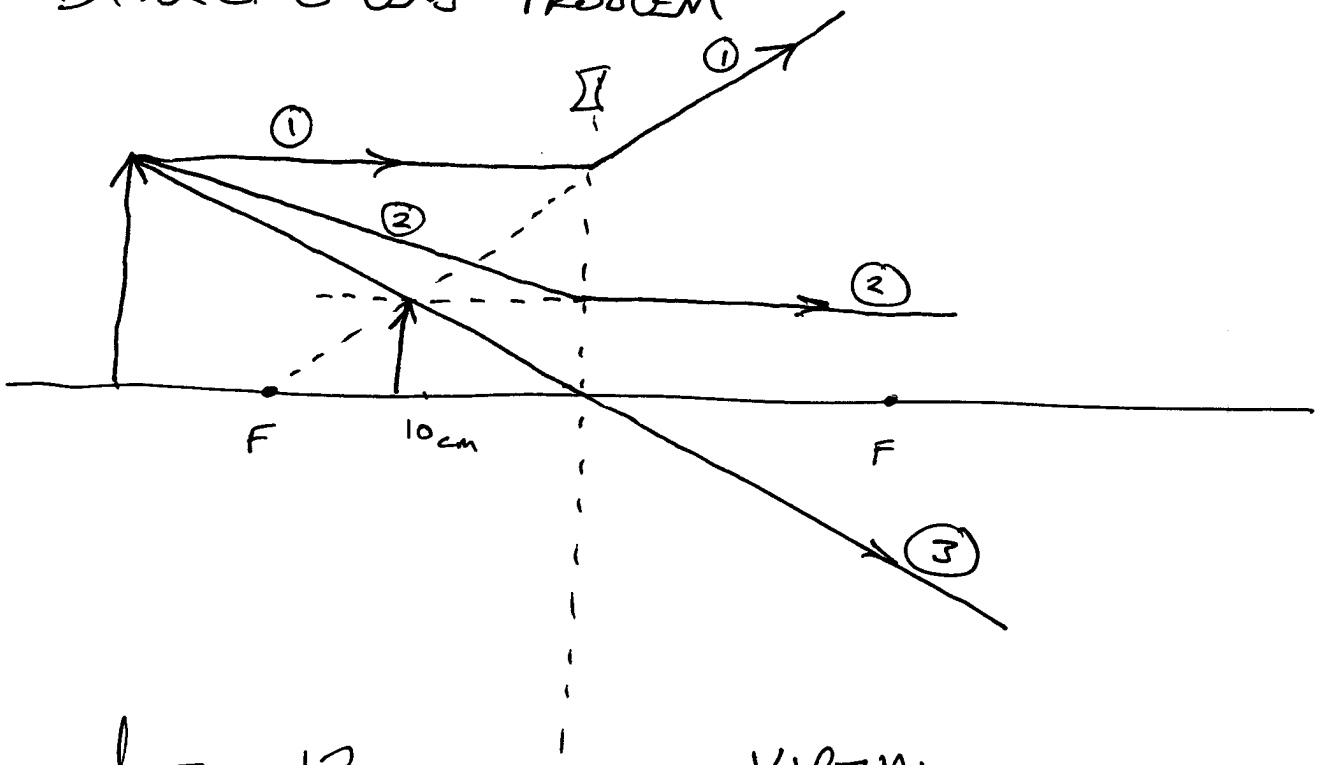
DIVERGING LENS PROBLEM



$d_i = -12\text{cm}$ VIRTUAL UPRIGHT

$$m = \frac{-d_i}{d_o} = \frac{-(-12\text{cm})}{30\text{cm}} = 0.4$$

SAME PROBLEM, THIN LENS EQUATION:

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f} \qquad \frac{1}{30\text{cm}} + \frac{1}{d_i} = \frac{1}{-20\text{cm}}$$

$$\frac{1}{d_i} = \frac{-1}{20\text{cm}} - \frac{1}{30\text{cm}} = \frac{-5}{60\text{cm}} = \frac{-1}{12\text{cm}}$$

$$d_i = -12\text{cm}$$

VIRTUAL (BECAUSE $d_i < 0$)

$$m = \frac{-d_i}{d_o} = 0.4$$

UPRIGHT (BECAUSE $m > 0$)

(GG, Ch 23, P 53)

(a)

$f = 50\,mm$ WANT d_o.

$$m = 2 = \frac{-d_i}{d_o} \Rightarrow d_i = -2d_o$$

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

$$\frac{1}{d_o} + \frac{1}{-2d_o} = \frac{1}{50\,mm}$$

$$\frac{1}{2d_o} = \frac{1}{50\,mm}$$

$\boxed{d_o = 25\,mm}$ (b)

$d_i = -50\,mm$ (VIRTUAL IMAGE)

THIS IS ACTUALLY THE ANSWER TO PART (b).

BACK TO PART (a):

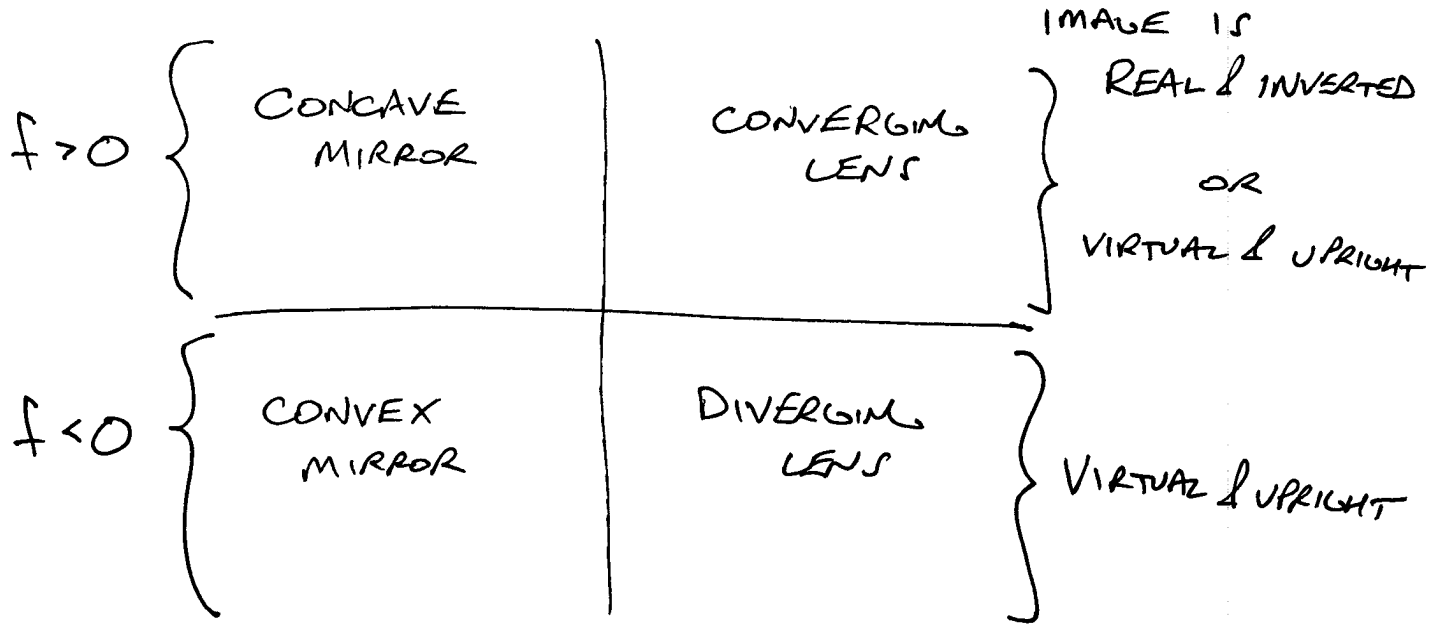
$$m = -2 = \frac{-d_i}{d_o} \Rightarrow d_i = 2d_o$$

$$\frac{1}{d_o} + \frac{1}{2d_o} = \frac{1}{50\,mm}$$

$$\frac{3}{2d_o} = \frac{1}{50\,mm}$$

$\boxed{d_o = 75\,mm}$ (a)

SUMMARY OF MIRRORS AND LENSES

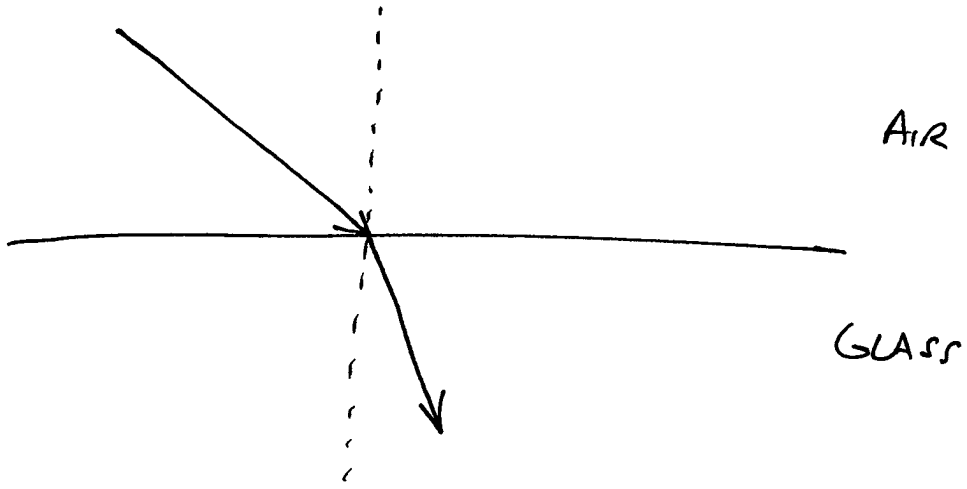


FOR CONCAVE MIRROR & CONVERGING LENS,

REAL INVERTED $\Longleftrightarrow$ OBJECT IS OUTSIDE THE FOCAL POINT

VIRTUAL UPRIGHT $\Longleftrightarrow$ OBJECT IS INSIDE THE FOCAL POINT

REFRACTION



REFRACTION IS THE BENDING OF LIGHT AT AN INTERFACE BETWEEN TWO MATERIALS.

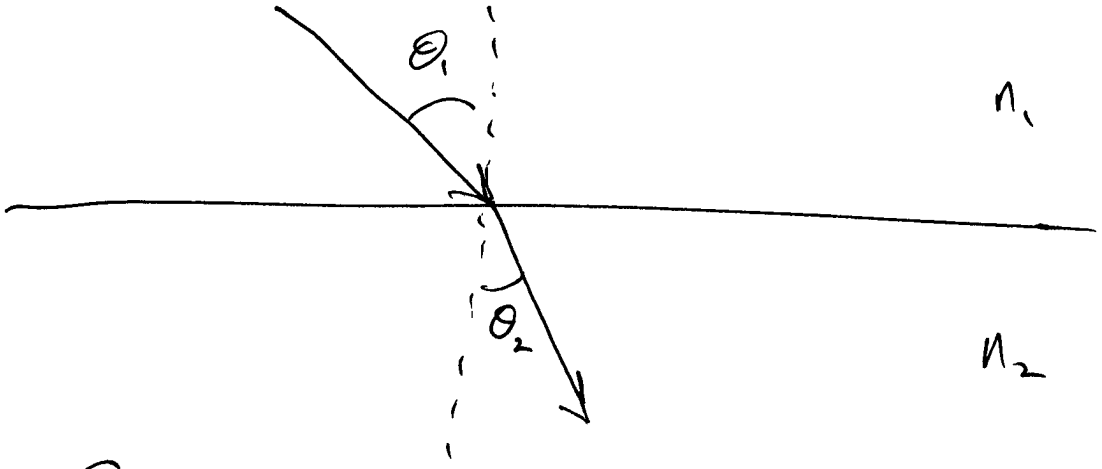
INDEX OF REFRACTION

- PROPERTY OF A MATERIAL
- SYMBOL n
- UNITS: NONE
- SLOWDOWN FACTOR

$$n = \frac{C}{V} = \frac{\text{SPEED OF LIGHT IN VACUUM}}{\text{SPEED OF LIGHT IN MATERIAL}}$$

SNELL'S LAW

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



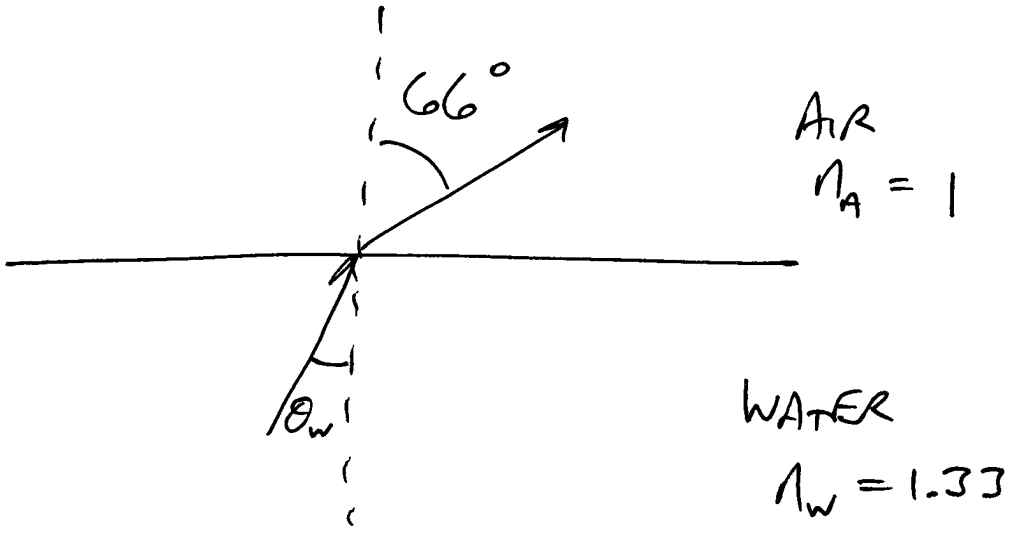
θ_1 = INCIDENT ANGLE

θ_2 = REFRACTED ANGLE

(66, Ch 23, P24)

$$n = \frac{c}{v} = \frac{3 \times 10^8 \text{ m/s}}{2.29 \times 10^8 \text{ m/s}} = 1.31$$

(66, Ch 23, P28)



$$n_A \sin\theta_A = n_w \sin\theta_w$$

$$\sin\theta_w = \frac{n_A}{n_w}\sin\theta_A = \frac{1}{1.33}\sin 66°$$

$$\theta_w = 43°$$