speed of light in medium v

fractive index is a measure of how much bending will occur for the light when it
n a medium.

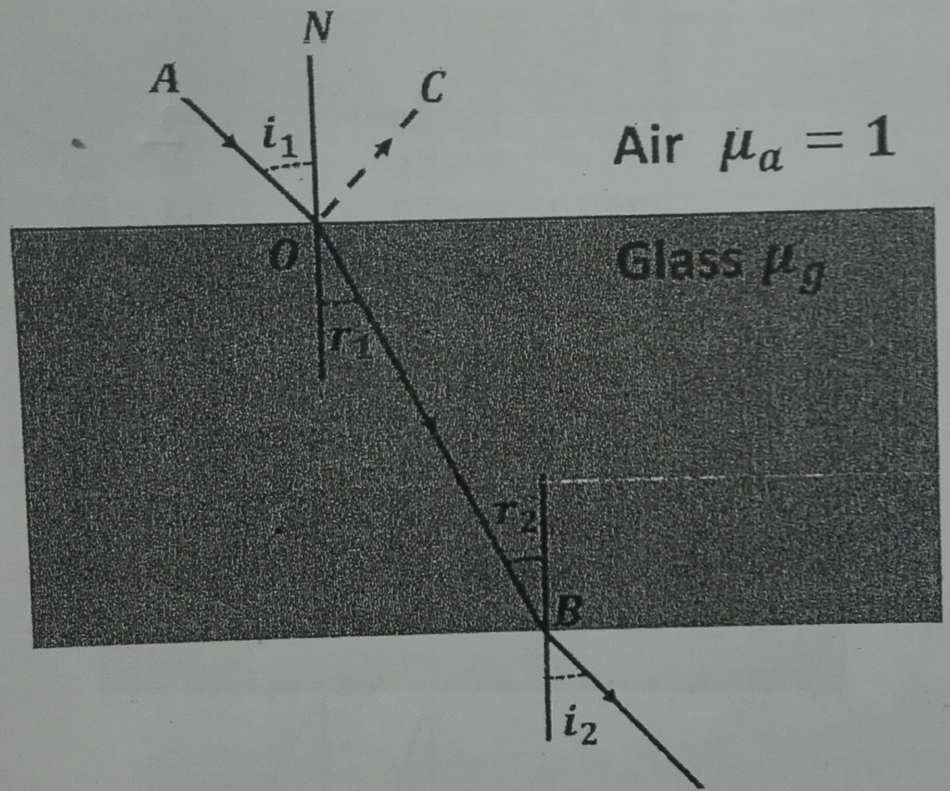
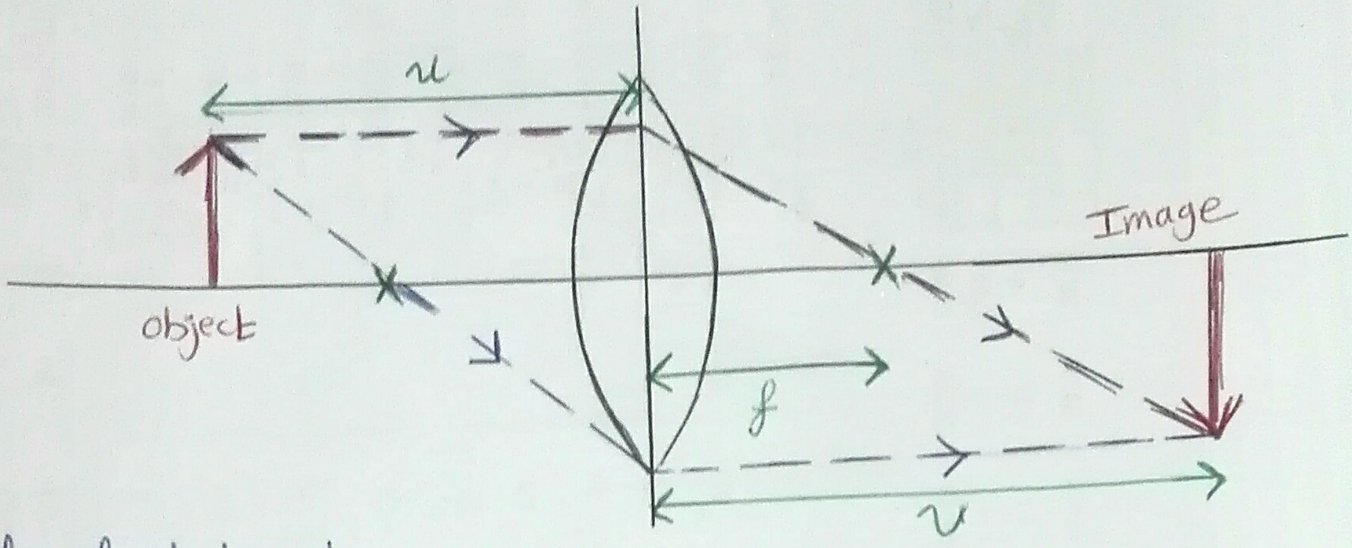


Figure 6. 1: Schematic diagram that demonstrate light refraction

Figure 6.1,a light ray falls on a block of glass from air; AO represents a ray of light

Experiment 5: Focal Length of a convex Lens



$f \equiv$ focal Length

$u \equiv$ distance between the object and the center of the Lens.

$v \equiv$ distance between the Image and the center of the Lens.

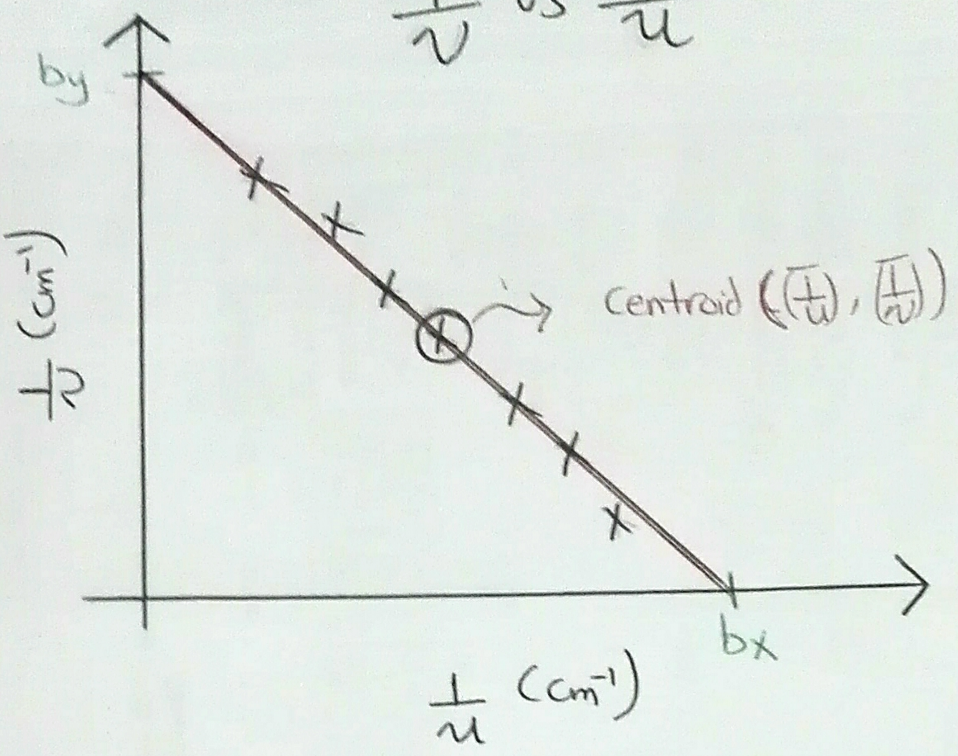
$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

⇒ Note: * $u \to \infty$, $\frac{1}{u} = 0 \to \frac{1}{v} = \frac{1}{f}$, $v = f$

* $v \to \infty$, $\frac{1}{v} = 0 \to \frac{1}{u} = \frac{1}{f}$, $u = f$

u (cm)	80.0	70.0	60.0	50.0	40.0	30.0	$\bar{u}$
v (cm)							$\bar{v}$
u^{-1} (cm^{-1})							$\overline{\left(\frac{1}{u}\right)}$
v^{-1} (cm^{-1})							$\overline{\left(\frac{1}{v}\right)}$

$\frac{1}{v}$ vs $\frac{1}{u}$

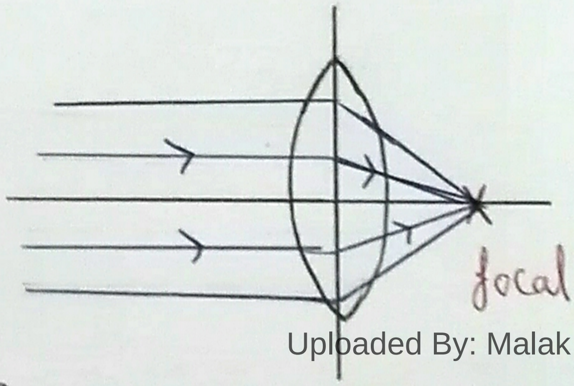


$\Rightarrow \frac{1}{v} = -\frac{1}{u} + \frac{1}{f}$ $\Rightarrow$ Slope $= -1$, $b_x = \frac{1}{f_1}$, $b_y = \frac{1}{f_2}$

$$f_{exp} = f_1 + f_2 / 2$$

$f_{exp}^{-1} = u^{-1} + v^{-1} \Rightarrow \Delta f_{exp} = f_{exp}^2 \left[\frac{\Delta u}{u^2} + \frac{\Delta v}{v^2} \right]$

$\Rightarrow f_{\text{True value}} \equiv$ Image of window



$\Rightarrow$ To find Δu and Δv

$\Rightarrow$ Let $u = 60.0$ cm and measure v sixtimes and Find σ_m for these measurements

$\Delta u \simeq \Delta v = \sigma_m$

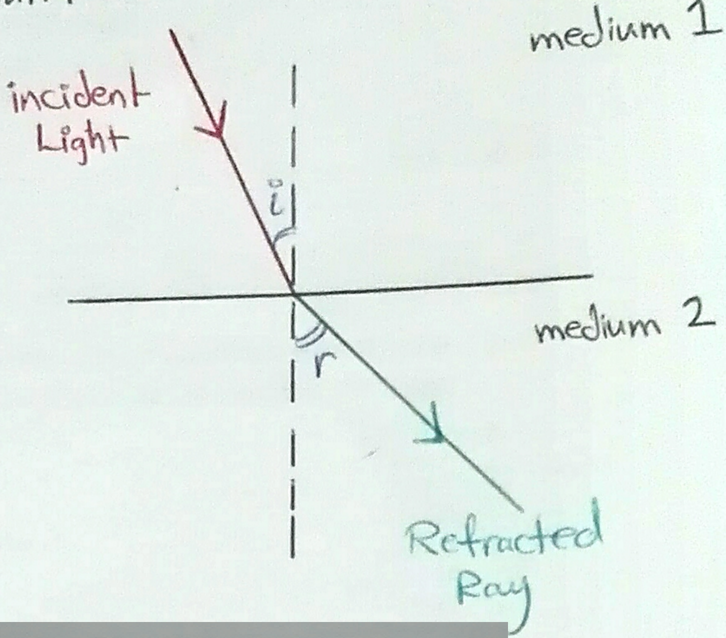
$u = 60.0$ cm

$v \Rightarrow$

Experiment 6: Index of Refraction

- $\mu \equiv$ Index of Refraction $\Rightarrow \mu = \frac{c}{v}$
  - $\Rightarrow c \equiv$ speed of Light in vacuum $= 3 \times 10^8$ m/s
  - $v \equiv$ speed of Light in medium

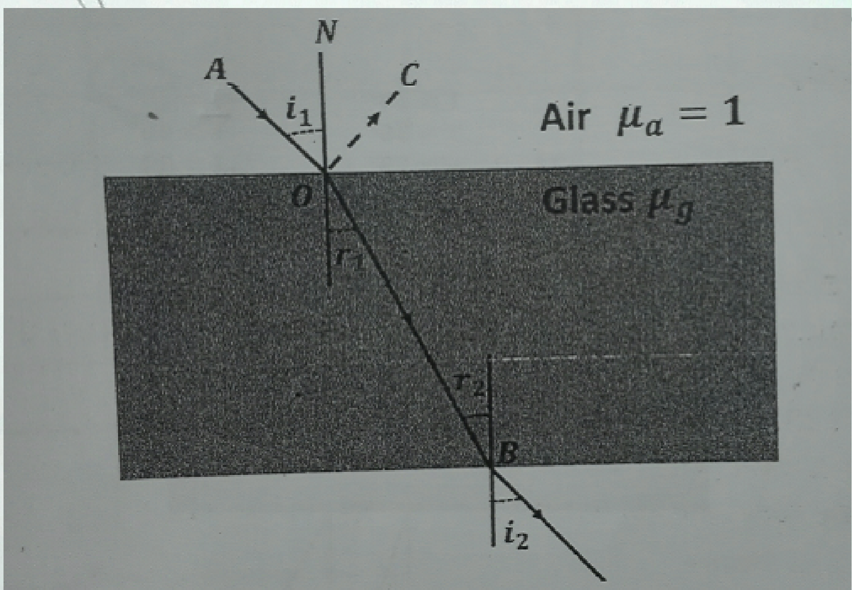
<u>Note</u> $\mu_{air} = 1$



- Snell's Law

$$\mu_1 \sin(i) = \mu_2 \sin(r)$$

- <u>Experiment</u>



$$\mu_{air} \sin(\bar{i}) = \mu_{glass} \sin(\bar{r})$$

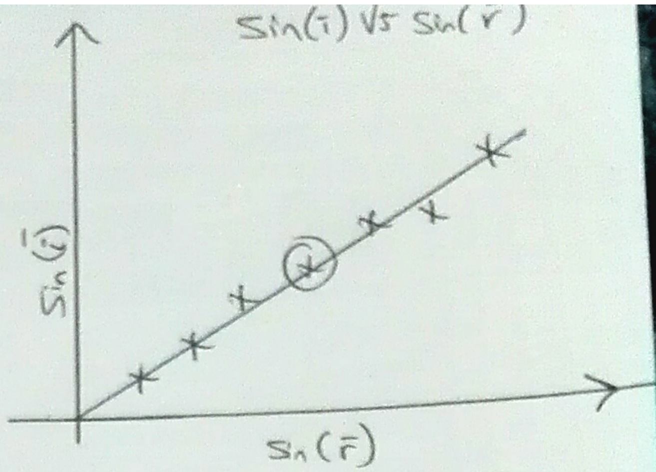
i_1	i_2	$\bar{i}$	$\sin(\bar{i})$	r_1	r_2	$\bar{r}$	$\sin(\bar{r})$
10°							
20°							
30°							
40°							
50°							
60°							

- $\mu_{air} \sin(\bar{i}) = \mu_{glass} \sin(\bar{r})$

  $1 \sin(\bar{i}) = \mu_{glass} \sin(\bar{r})$

- graph $\sin(\bar{i})$ vs $\sin(\bar{r})$

  μ_{exp} = slope

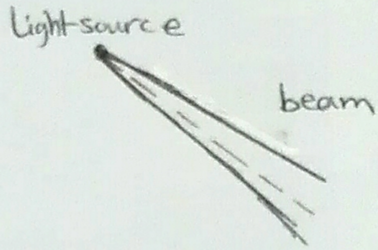


⇒ True values ⇒ $\mu_{glass} = 1.52$

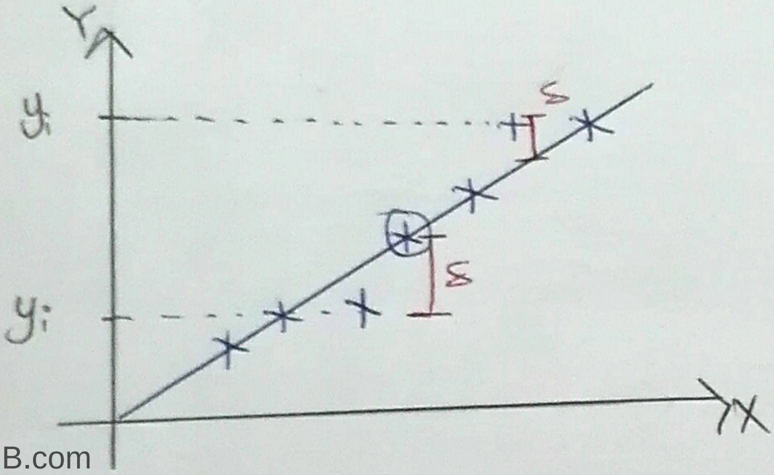
$\mu_{plastic} = 1.46$

- $\mu_{exp} = \dfrac{\sin(\bar{i})}{\sin(\bar{r})} \Rightarrow \Delta\mu_{exp} = \mu_{exp}\left[\dfrac{\cos(\bar{i})}{\sin(\bar{i})}\Delta i + \dfrac{\cos(\bar{r})}{\sin(\bar{r})}\Delta r\right]$

  - Δi and Δr by estimation (Divergence of the beam)
  - Δi and Δr must be in radians



* Least square fit method



best line equation →

$Y_i = mX_i + b$

$\sum_{i=1}^{N} (Y_i - y_i)^2 = \delta^2$ "minimization"

$\dfrac{\partial \delta^2}{\partial m} = 0, \; \dfrac{\partial \delta^2}{\partial b} = 0 \Rightarrow$ To find m, b (slope and the intercept) without graphing