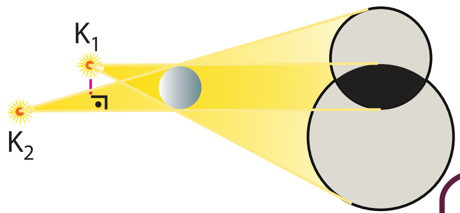
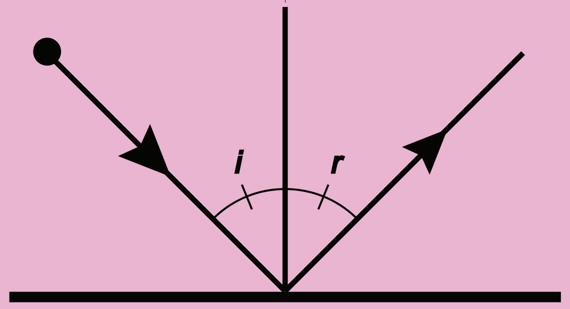


Ray Optics

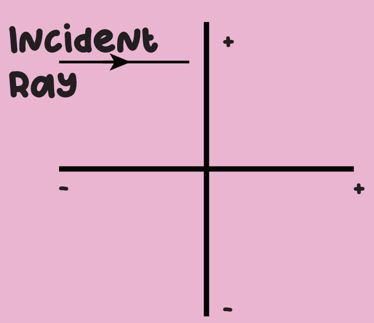
Laws of Reflection

1. The incident ray reflected ray and normal to the reflecting surface all lie in same plane.
2. Angle of reflection is always equal to angle of incidence, i.e., <i = <r



Sign Convention

1. All distances are measured from the pole and is the origin.
2. Distances measured to the right of the pole are taken as positive.
3. Distance above the principal axis are taken as positive.
4. Angle measured from the normal in the anti-clockwise direction are positive.



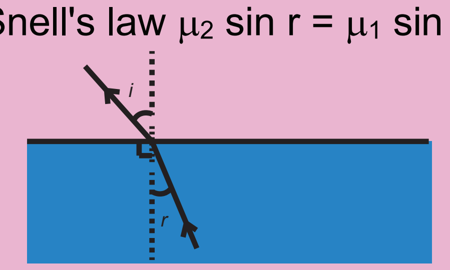
Absolute Refractive Index

It is defined as ratio of speed of light in vacuum to speed of light in medium

i.e $n = \frac{c}{v}$

Laws of Refraction

1. The incident ray, refracted ray and normal to the interface of two media all lie on the same plane.
2. Snell's law $\mu_2 \sin r = \mu_1 \sin i$

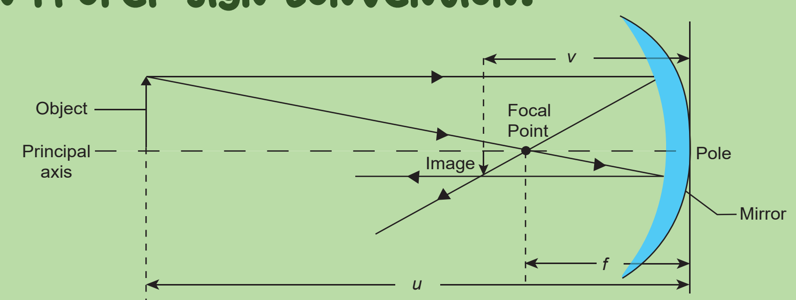


Spherical Mirrors

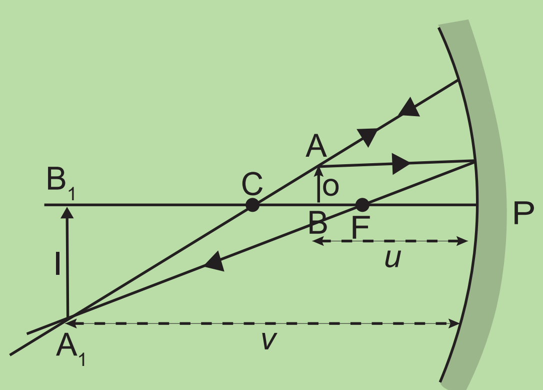
Mirror formula

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

In proper sign convention.



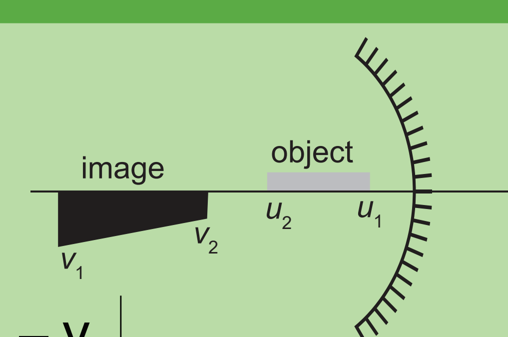
Linear magnification



$$m = \frac{I}{O} = \frac{-v}{u}$$

In proper sign convention

Longitudinal magnification



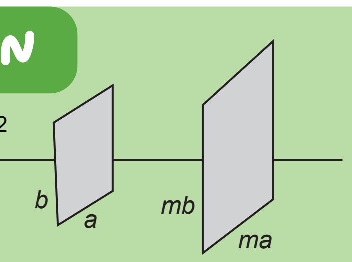
$$m_L = \left|\frac{v_2 - v_1}{u_2 - u_1}\right|$$

For small objects, $m_L = m^2$

Superficial Magnification

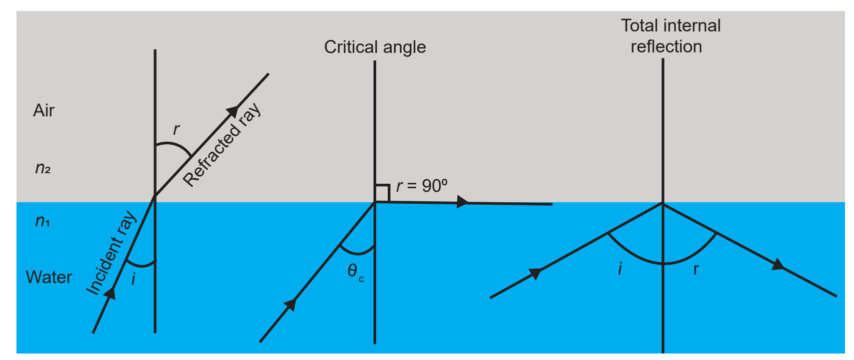
$m_s = \frac{m_a \times m_b}{a \times b}$ For small objects, $m_L = m^2$

$= m^2$



TIR

The balancing back of light ray in the same denser medium after reflection from an interface with a rarer medium is termed as boral internal reflection.



Critical Angle

It is the angle of incidence for which the angle of incidence is 90°.

$$\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right)$$

Conditions for TIR

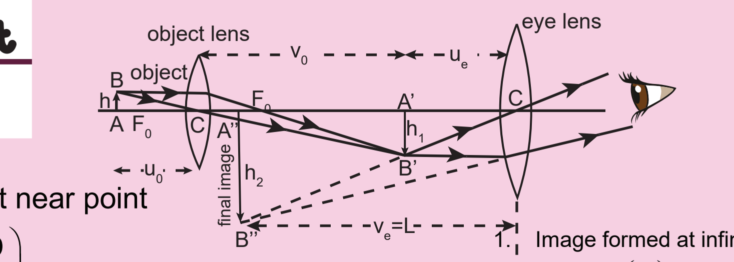
1. The light ray must travel from denser to rarer medium.
2. The angle of incidence must be greater than the critical angle.

Application of TIR

1. Sparkling of diamond
2. Optical fibre
3. Mirage and optical looming.

Optical Instrument

Compound Microscope



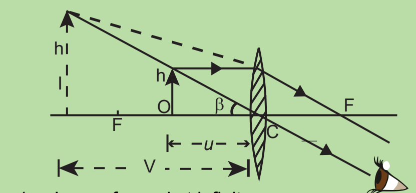
2. Image formed at near point

$cMP = \frac{-v}{u}\left(1 + \frac{D}{f_0}\right)$

Image formed at infinity

$MP = \frac{-v}{u}\left(\frac{D}{f_0}\right)$

Simple Microscope



1. Image formed at infinity

$MP = \frac{D}{f}$

2. Image formed at near point

$MP = 1 + \frac{D}{f}$

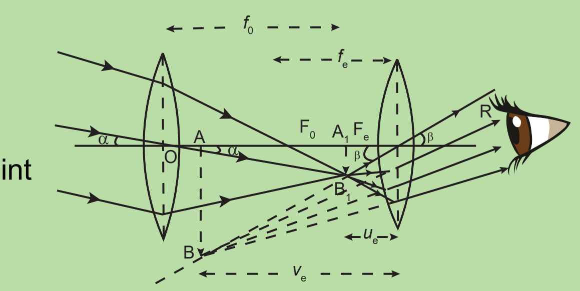
Astronomical Telescope

1. Image formed at infinity

$MP = \frac{-f_0}{u_0}$

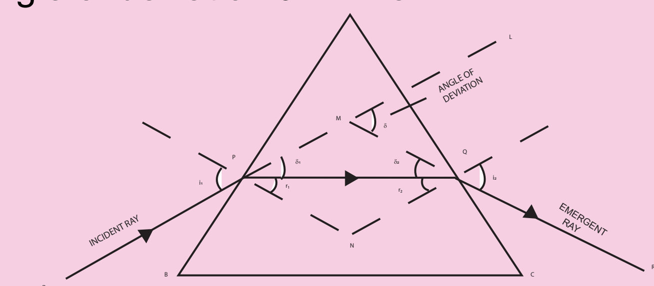
2. Image formed at near point

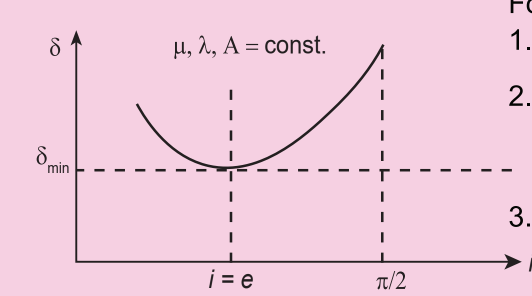
$MP = \frac{-f_0}{f_e}\left[1 + \frac{f_e}{D}\right]$



Prism

Angle of deviation $\delta = i + e - A$



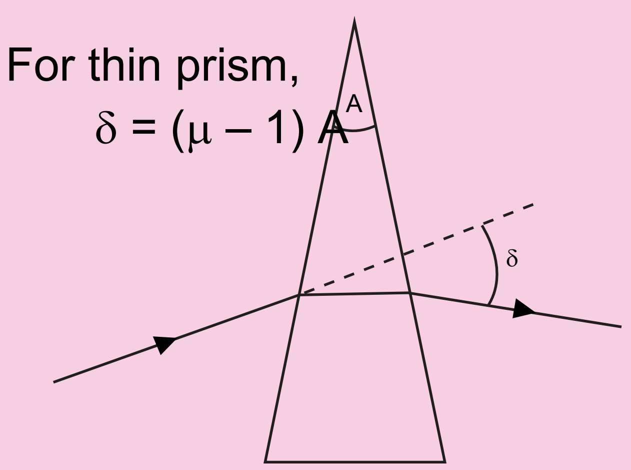


For minimum deviation

1. $i = e$
2. $r = \frac{A}{2}$
3. $\mu = \frac{\sin\left(\frac{\delta_m + A}{2}\right)}{\sin\left(\frac{A}{2}\right)}$

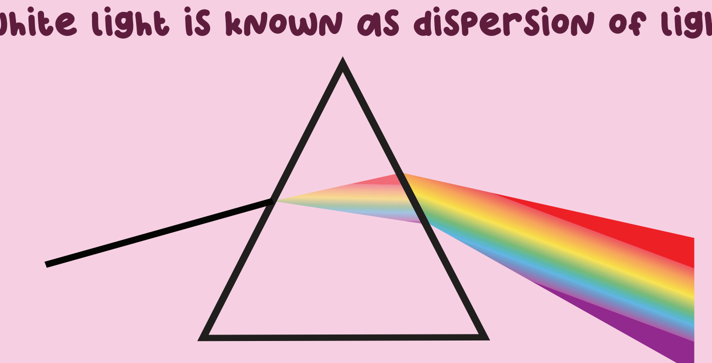
For thin prism,

$\delta = (\mu - 1) A$

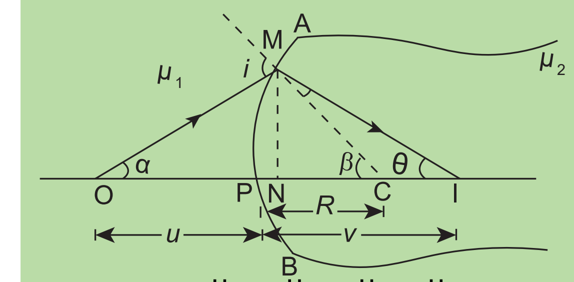


Dispersion through Prism

When white light passes through the prism, then it splits into its seven constituent colours. This phenomena of splitting of white light is known as dispersion of light.

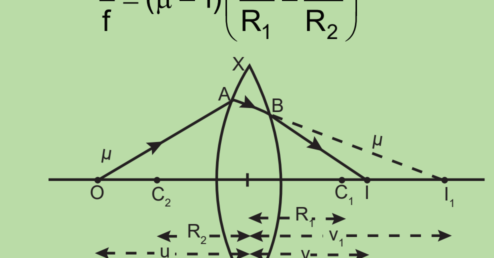


In person sign convention



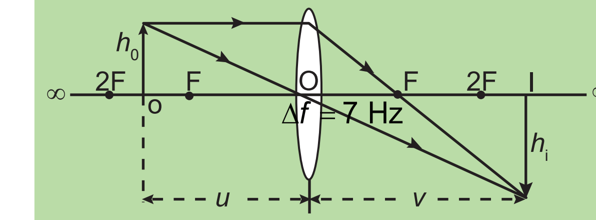
$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$



In proper sign convention

Lens formula



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

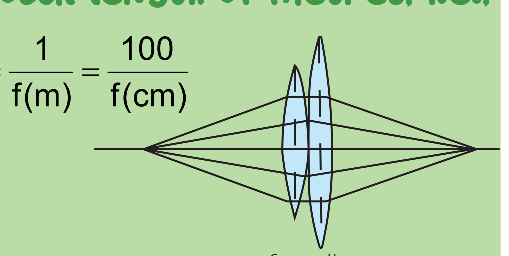
$m = \frac{h'}{h} = \frac{v}{u}$

In person sign convention

Power of lens

It is defined as the reciprocal of focal length of metres. i.e.

$P = \frac{1}{f(m)} = \frac{100}{f(cm)}$



For combination of lenses,

$P = P_1 + P_2$

$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$

In proper sign convention

Scattering

The deflection of light ray by the fine particles of matter is known as scattering of light. From Ray Leigh scattering.

$I \propto \frac{1}{\lambda^4}$

where λ is wavelength of light and I is intensity of light.