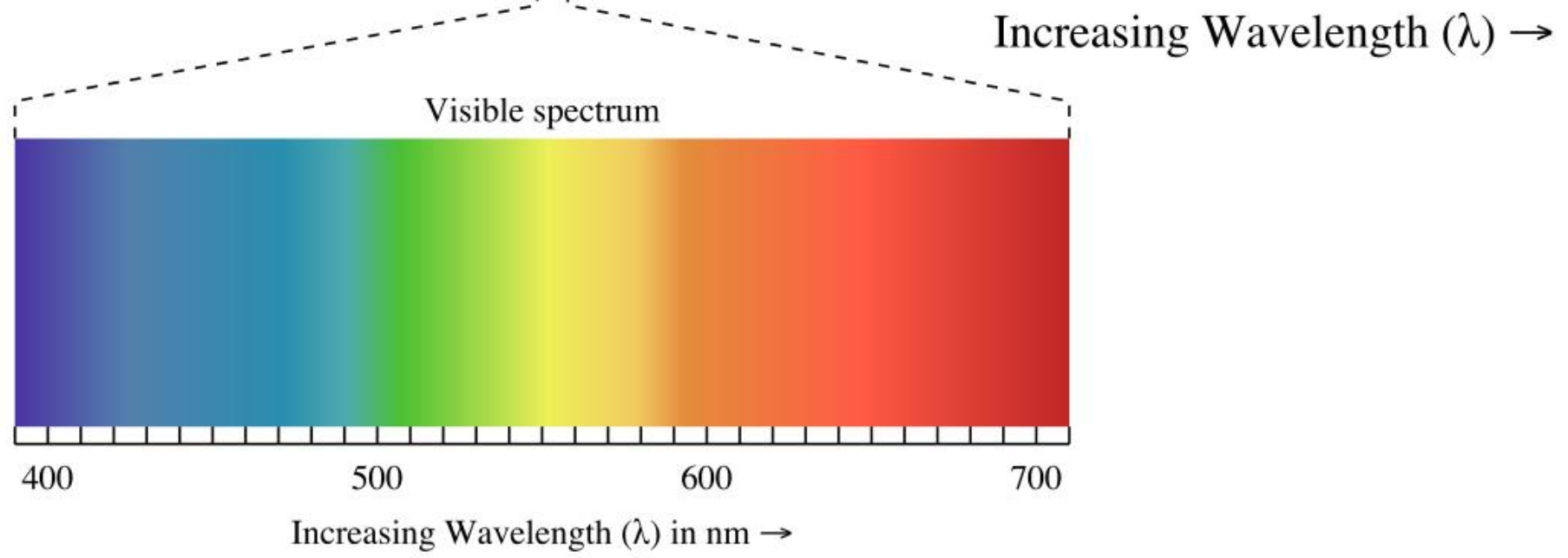
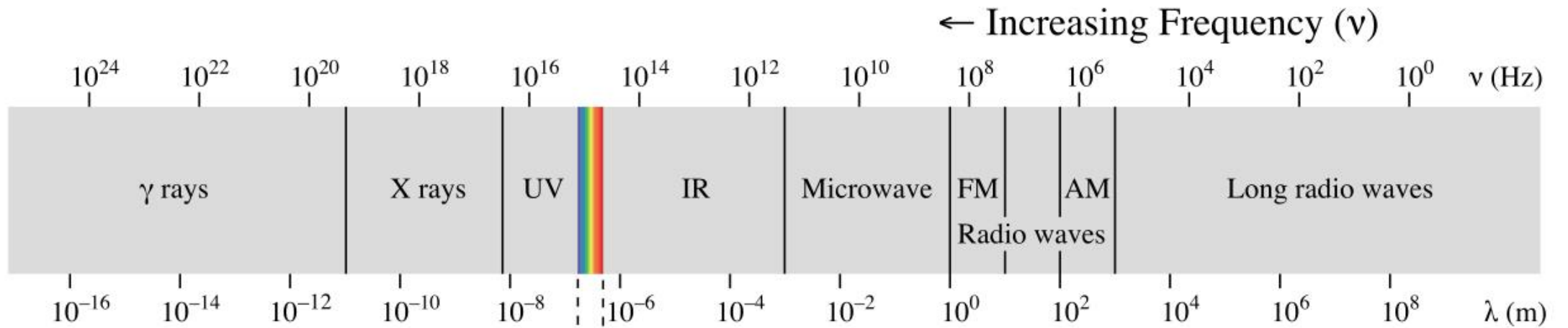


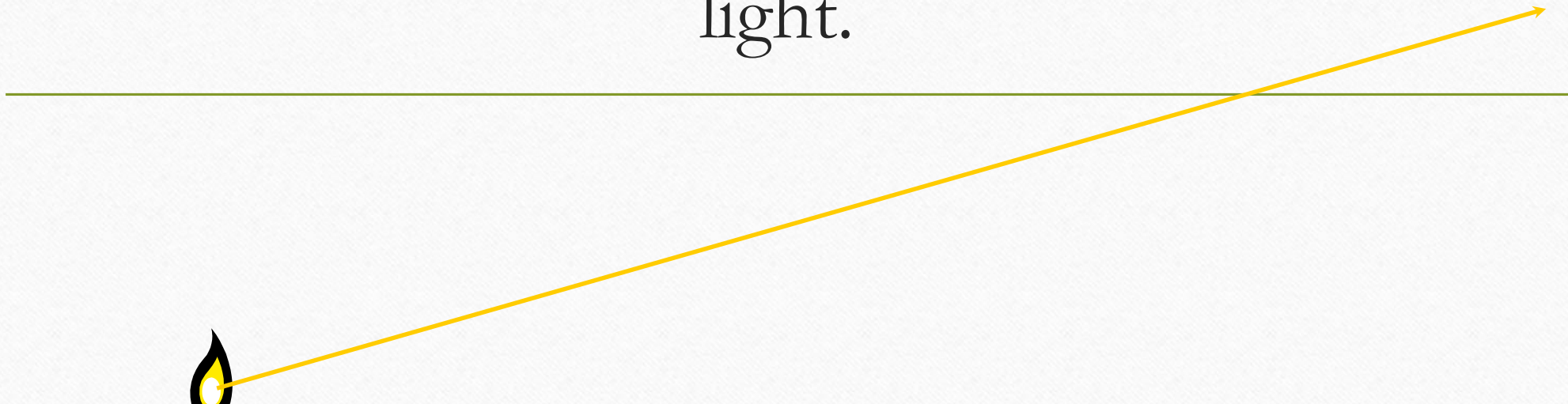
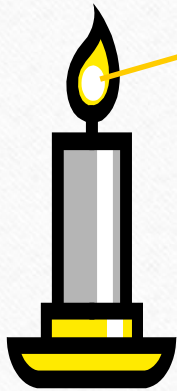
IN THE NAME OF ALLAH

Optics, Refraction and Refractive Errors

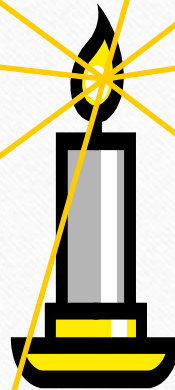
Dr m.Feizi



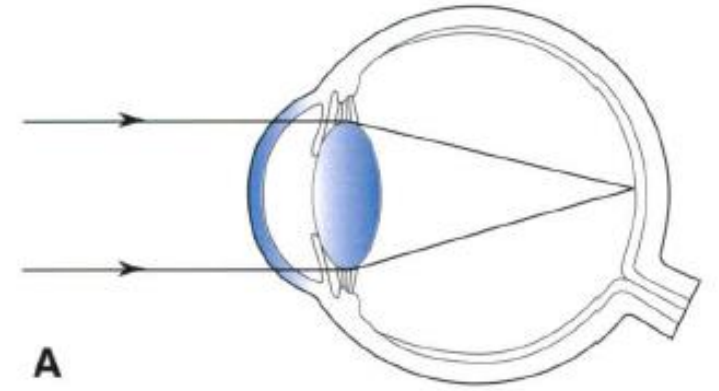
A **ray of light** is an extremely narrow beam of light.



All visible objects emit or reflect **light rays** in all directions.



Our eyes detect **light rays**.

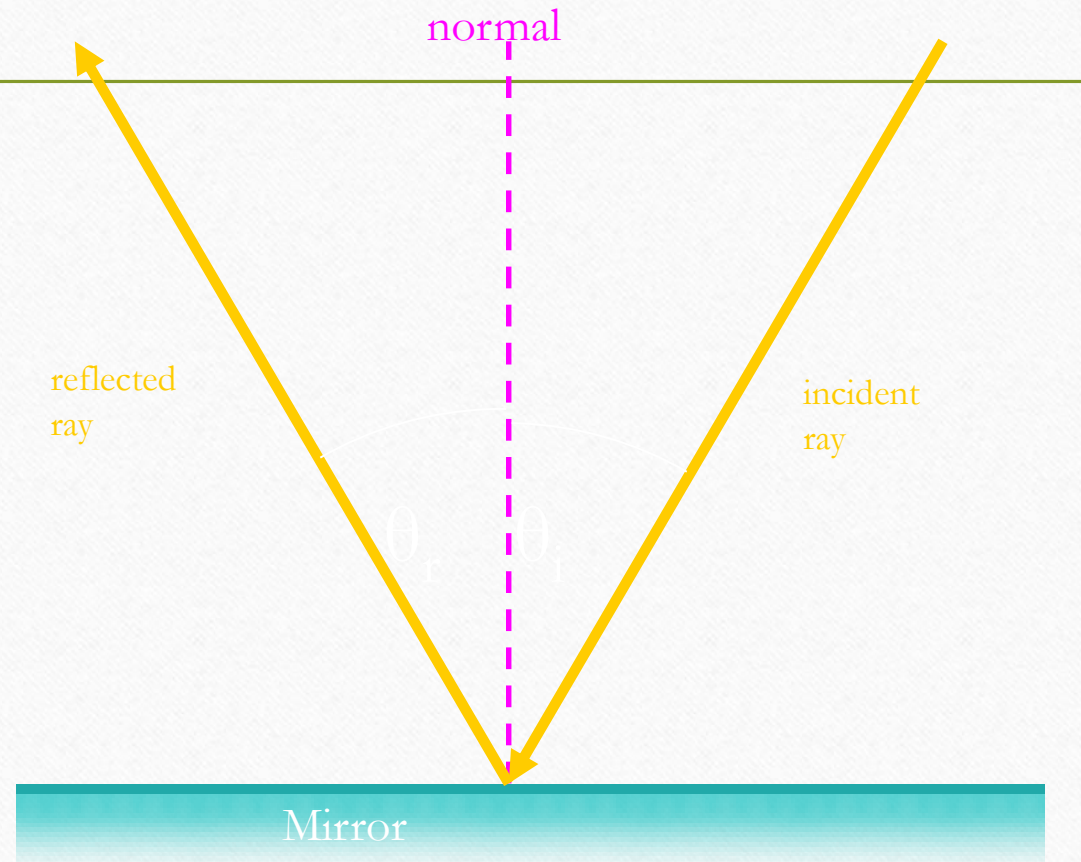


Reflection is when light changes direction by bouncing off a surface.

When light is reflected off a mirror, it hits the mirror at the same angle (θ_i , the incidence angle) as it reflects off the mirror (θ_r , the reflection angle).

The normal is an imaginary line which lies at right angles to the mirror where the ray hits it.

Reflection



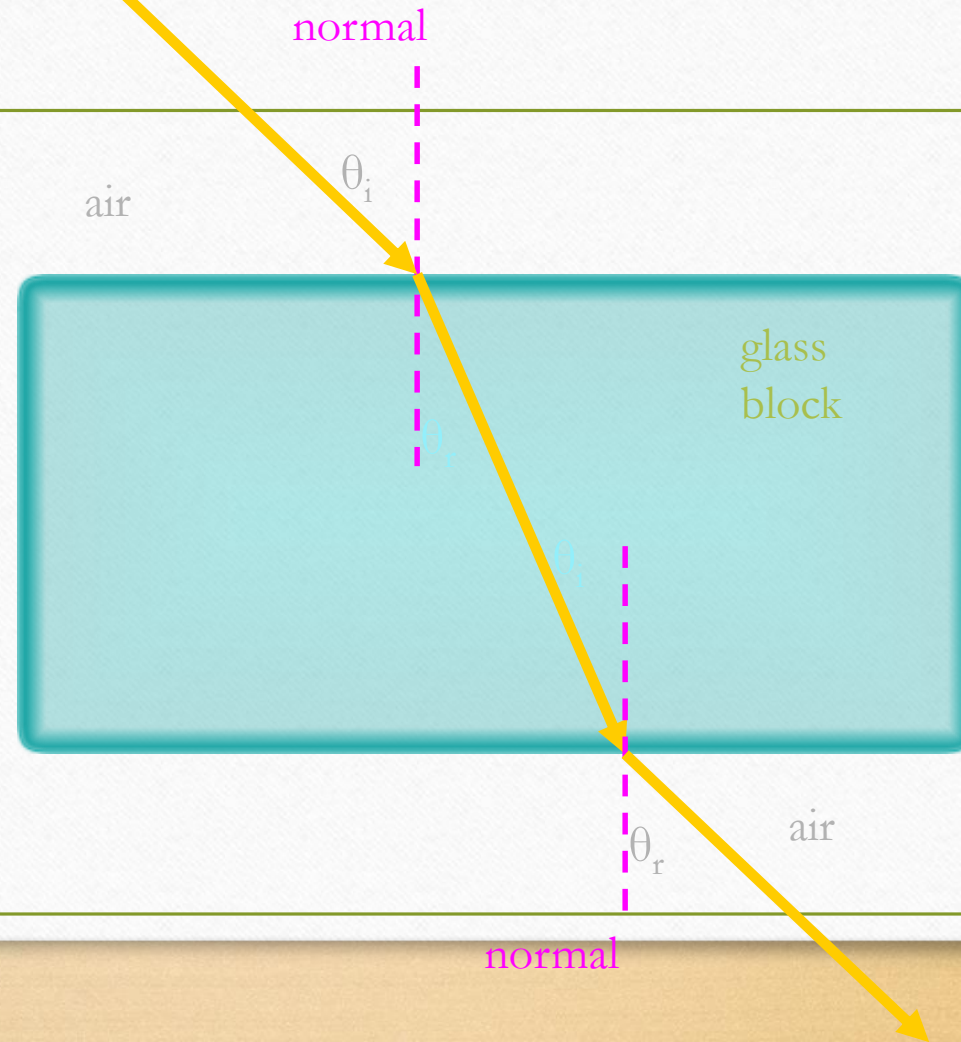
Refraction

(bending light)

Refraction is when light bends as it passes from one medium into another.

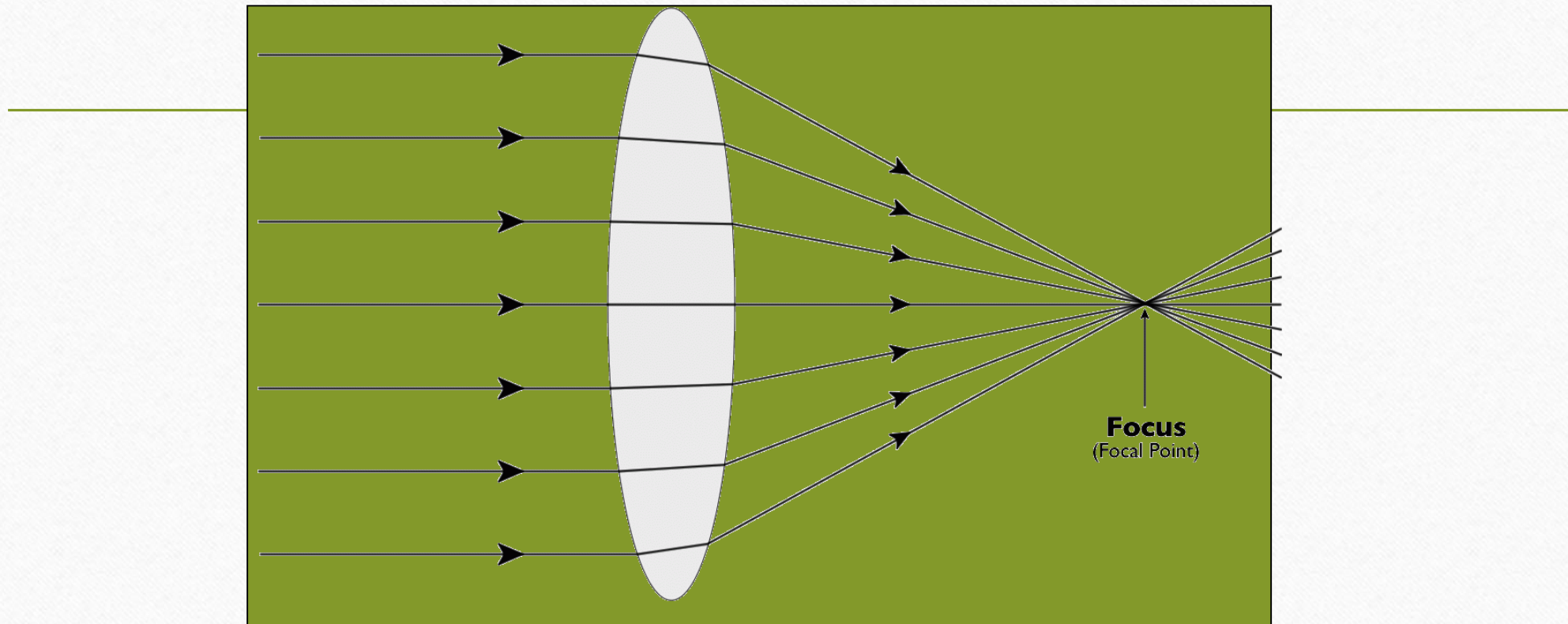
When light traveling through air passes into the glass block it is refracted towards the normal.

Refractive index =
Speed of light in vacuum
Speed of light in media



Convex lenses are thicker in the middle and focus light rays to a focal point in front of the lens.

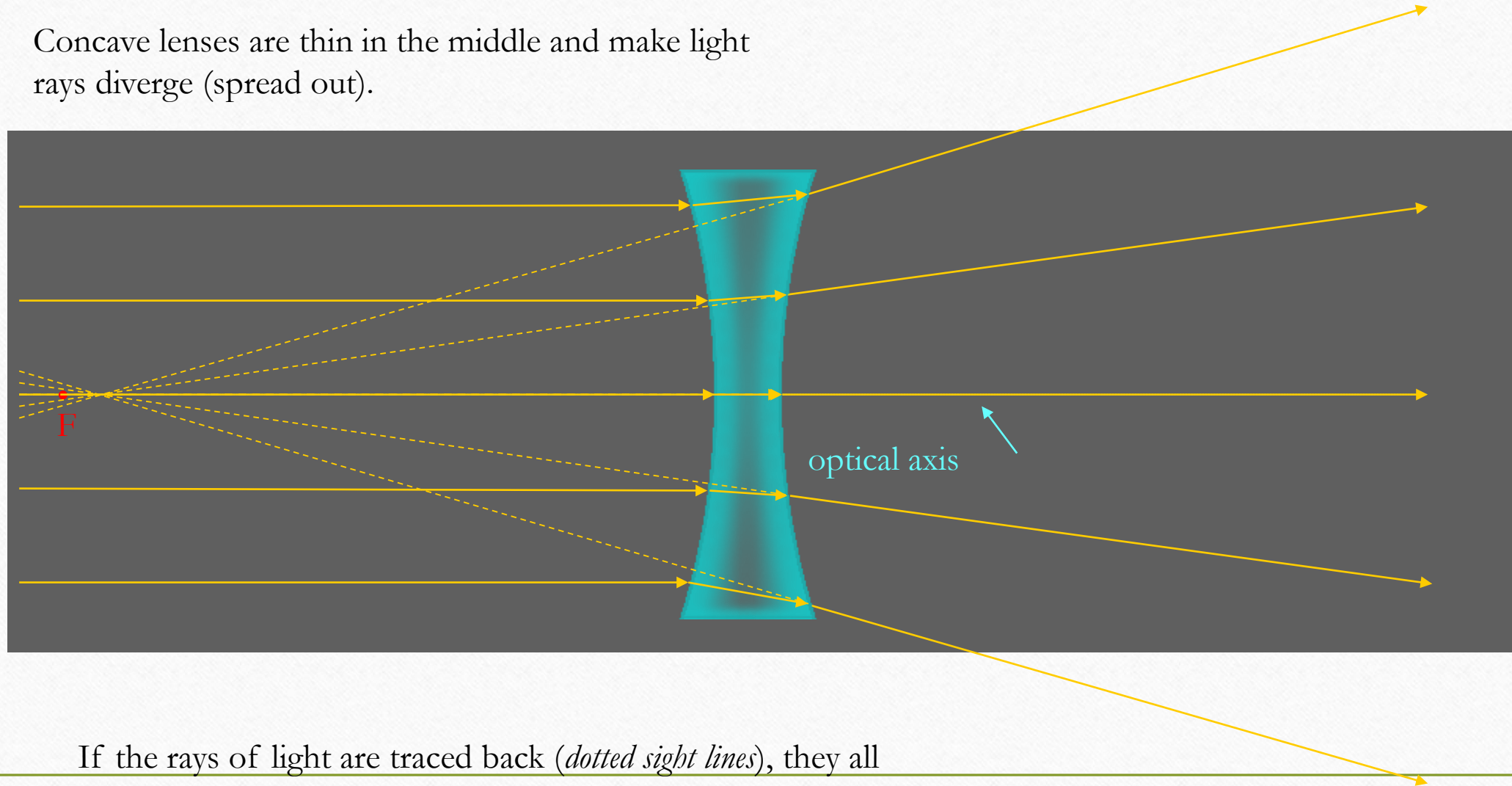
Convex Lenses



The focal length of the lens is the distance between the center of the lens and the point where the light rays are focused.

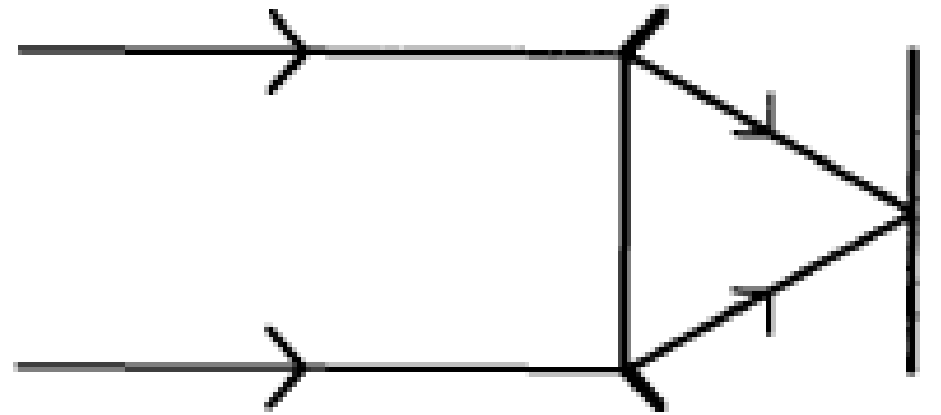
Concave Lenses

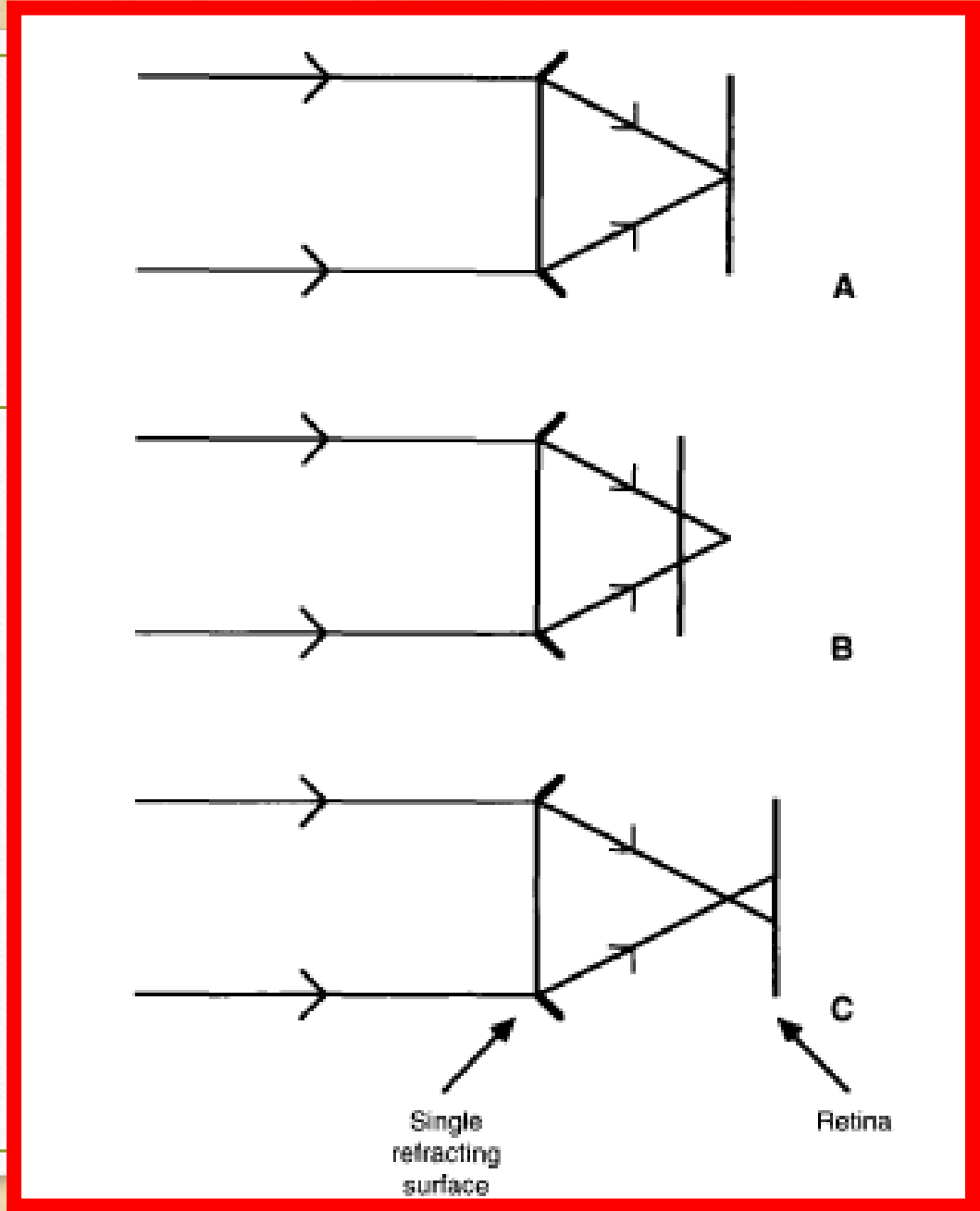
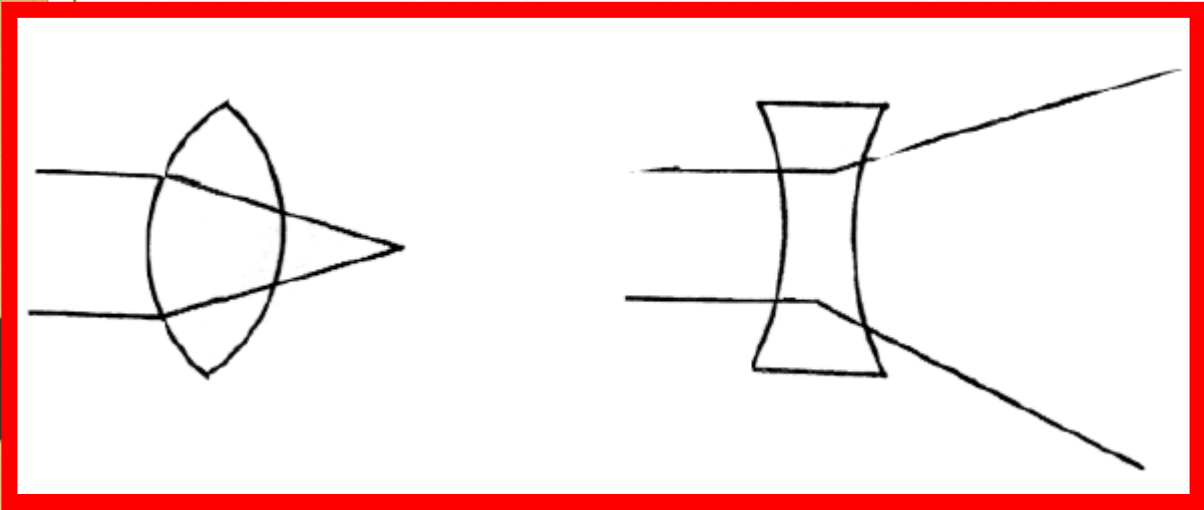
Concave lenses are thin in the middle and make light rays diverge (spread out).



If the rays of light are traced back (*dotted sight lines*), they all intersect at the focal point (F) behind the lens.

- Focal point : the point that parallel converge
- Power (diopter) = $1 / F$
(focal point)





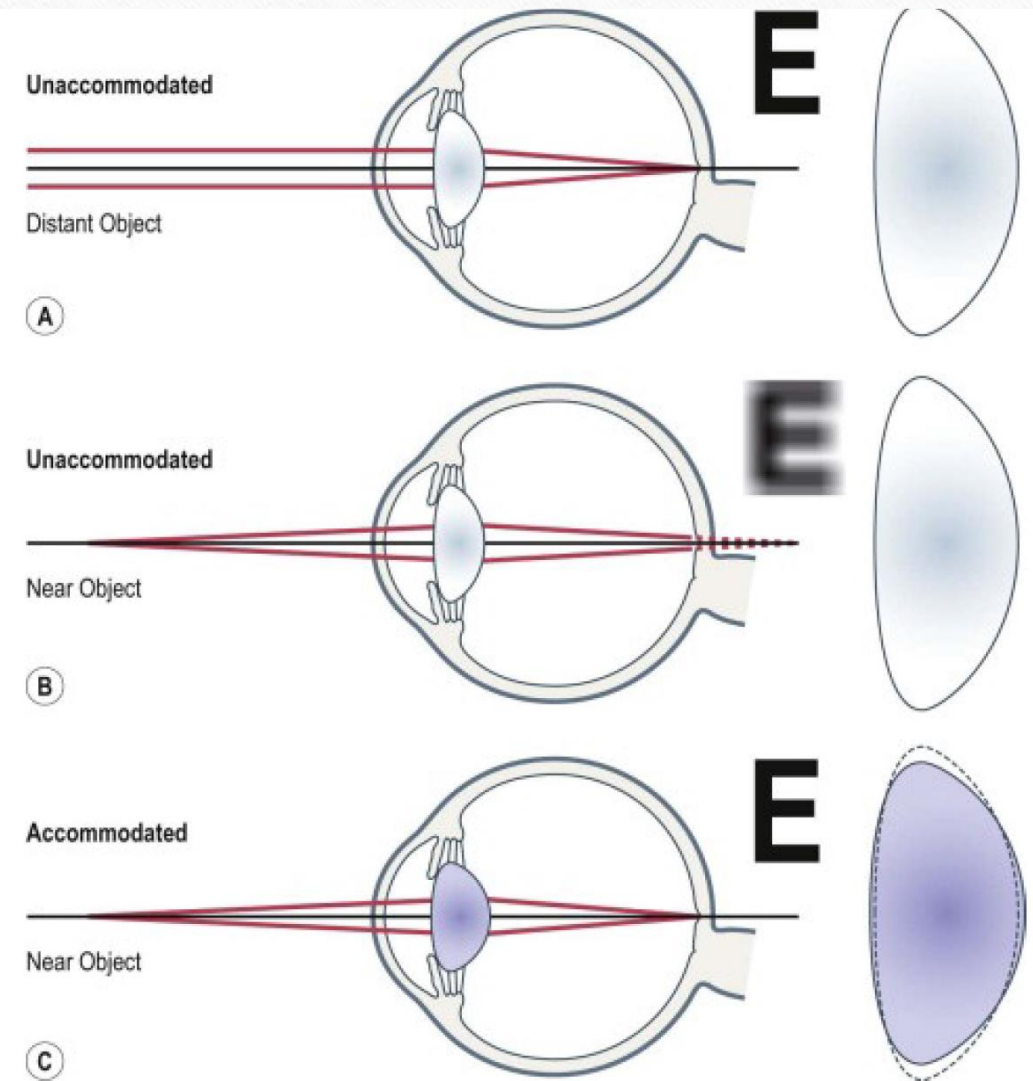
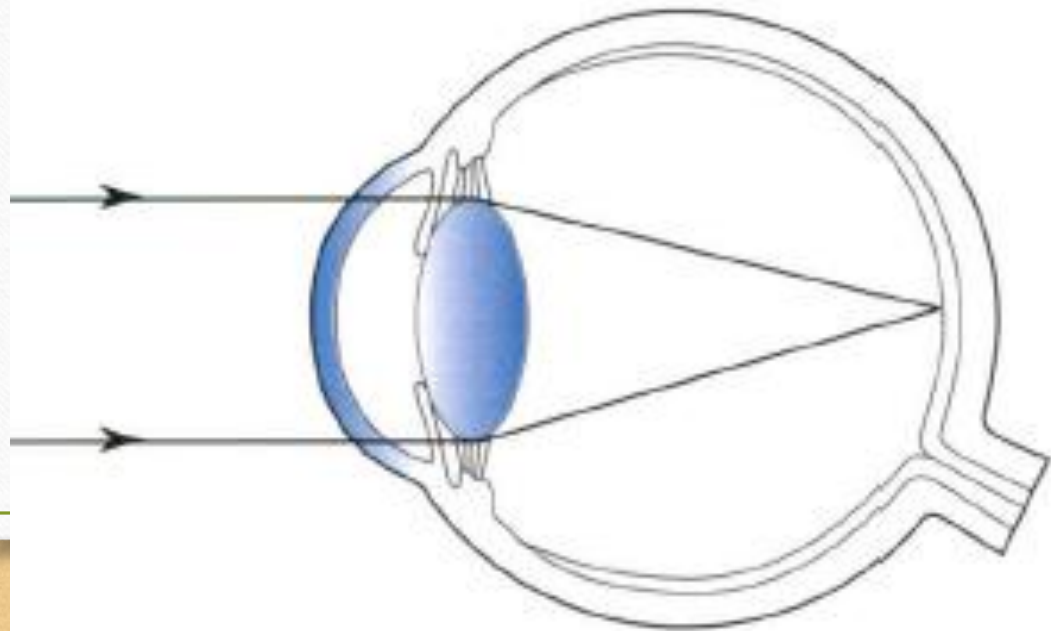
Refractive Errors

- Emmetropia
- Ametropia



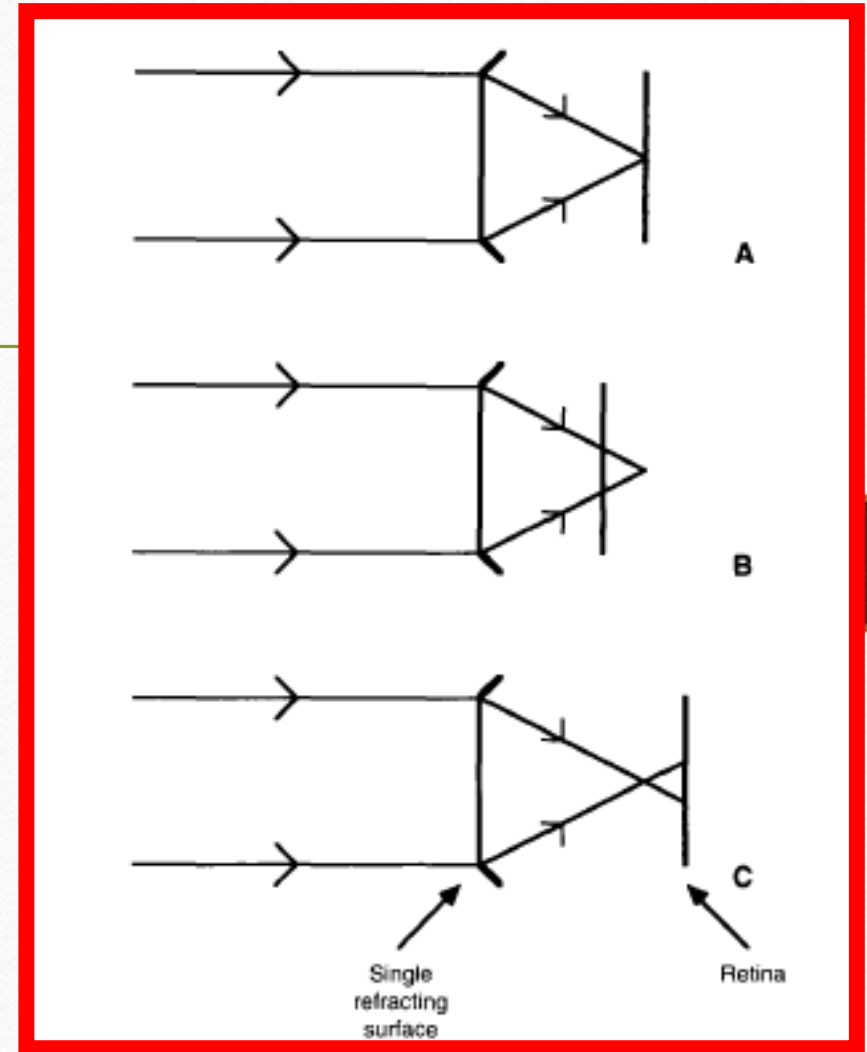
Emmetropia

- Emmetropia means no Refractive error
- It is the ideal condition in which the incident parallel rays come to a perfect focus upon the light sensitive layer of the retina, When accommodation is at rest

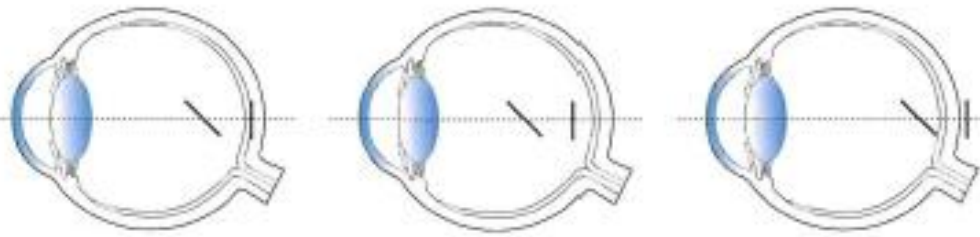
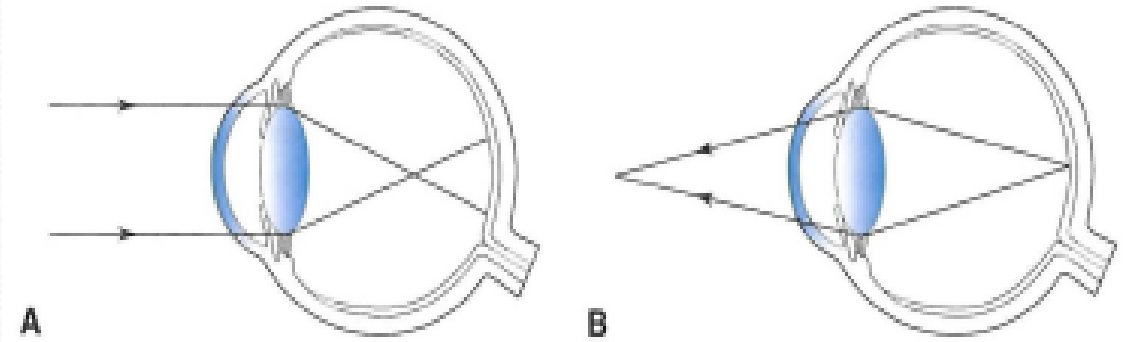


Ametropia

- Ametropia means Refractive error Eye
- It is the opposite condition , wherein the parallel rays of light are not focused exactly upon the retina , When the accommodation is at rest



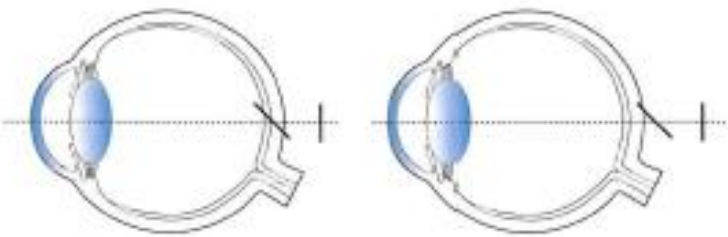
Ametropia



Simple myopic

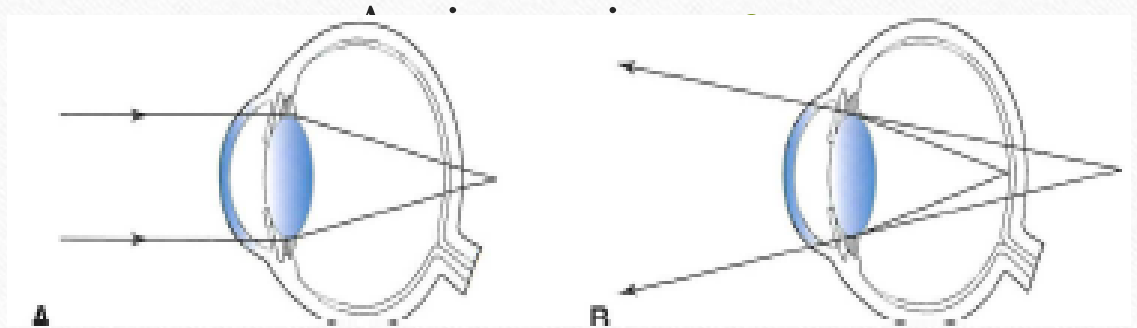
Compound myopic

Mixed



Simple hyperopic

Compound hyperopic

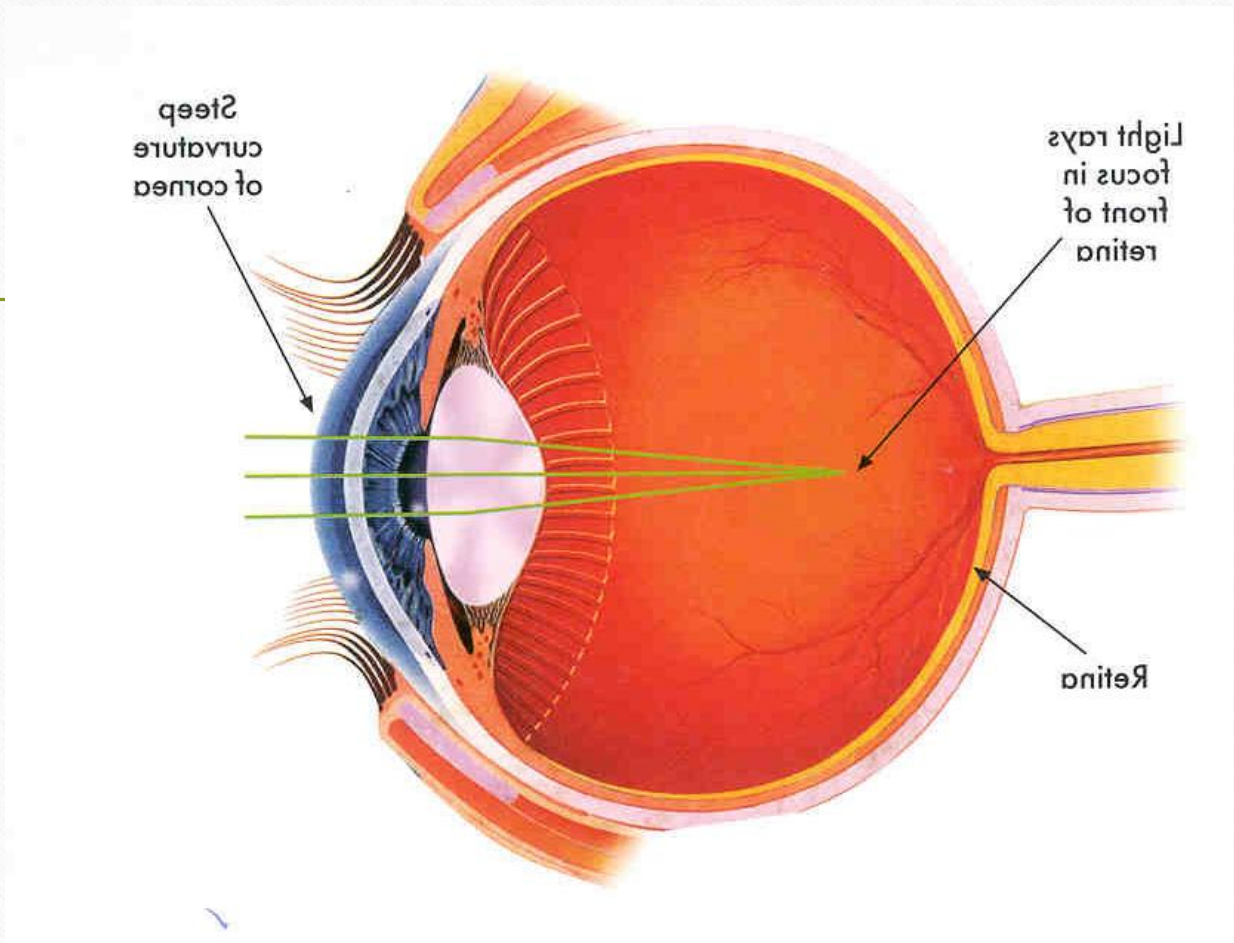


A

B

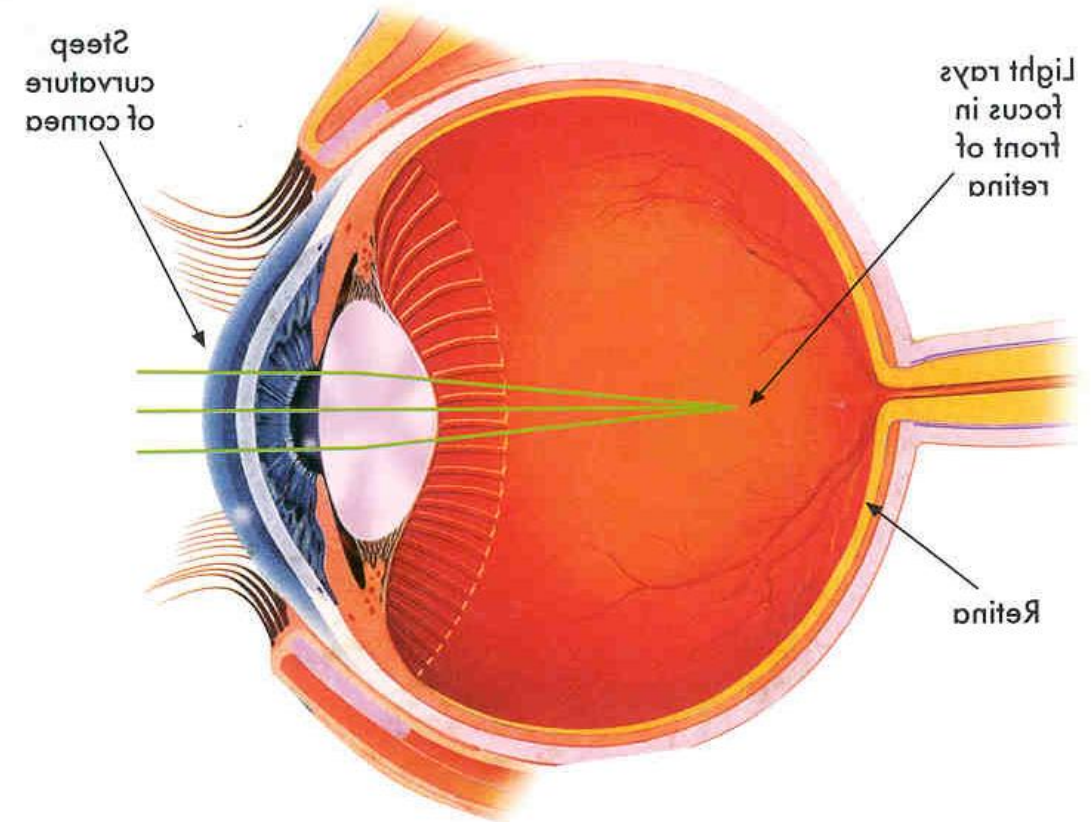
Myopia

- Principal focus is formed in front of the retina



Causes

- Axial Myopia
- Curvature Myopia
- Index Myopia
- Abnormal position of the lens



Axial Myopia

Axial myopia results from increase in anteroposterior length of the eye ball. •

Normal Axial length- 23mm to 24mm •

1mm increase in AL – 3Ds of Myopia •

Curvature Myopia

- Curvatural myopia occurs due to increased curvature of the cornea and Lens or both.
- Anterior surface of the cornea- 7.8mm
- Posterior surface of the cornea- 6.5mm
- 1mm decreases in radius of curvature results in – 6 Ds of Myopia

Index myopia

- Index myopia results from increase in the refractive index of crystalline lens.

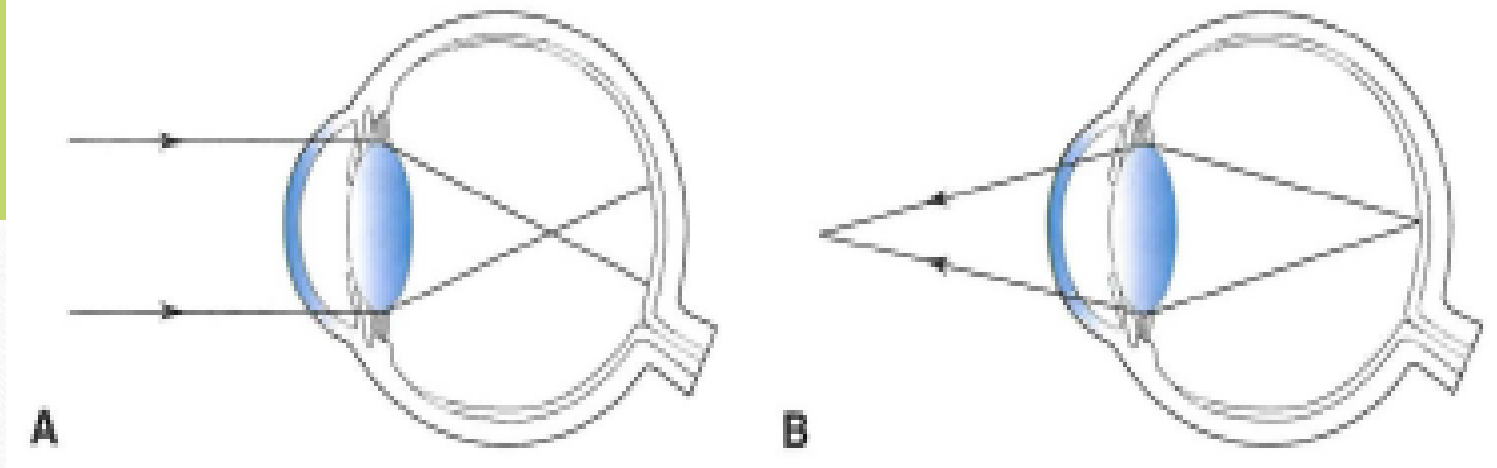
Refractive index of normal Lens - 1.42

Types

- Congenital myopia
- Simple Myopia (or) Developmental myopia
- Pathological Myopia (or) Degenerative myopia

Symptoms

- Poor vision for distance(even near)
- Asthenopic symptoms
- Exophoria

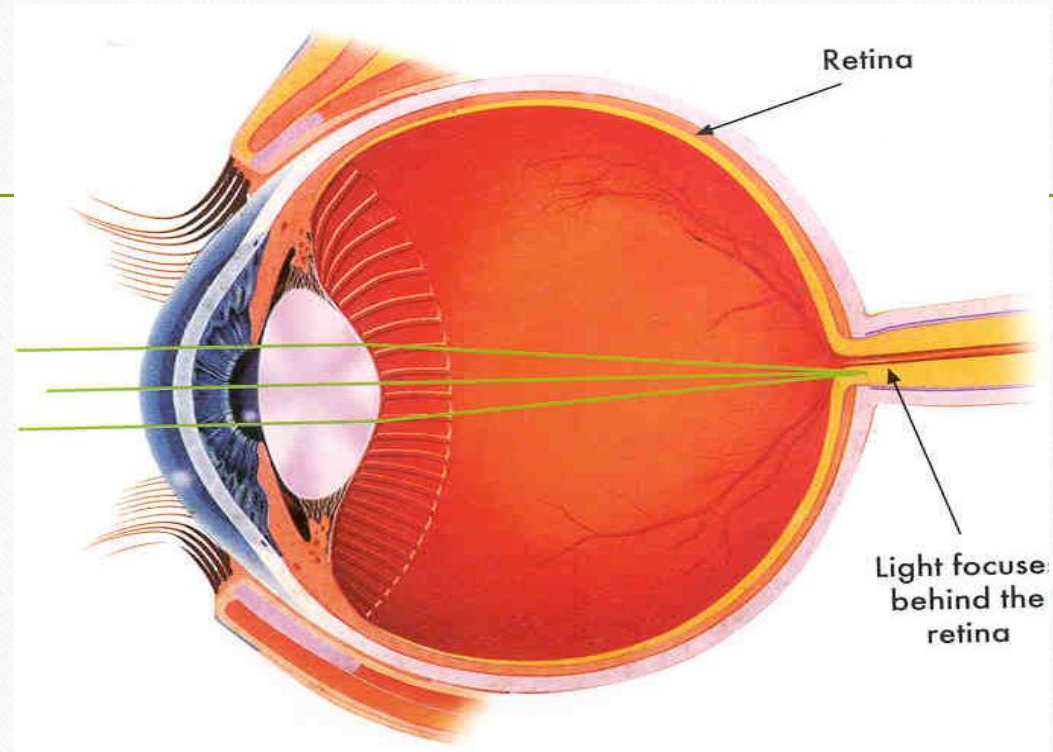


Complications

- Retinal tear – Vitreous haemorrhage
- Retinal detachment
- Degeneration of the vitreous
- Primary open angle Glaucoma
- cataract

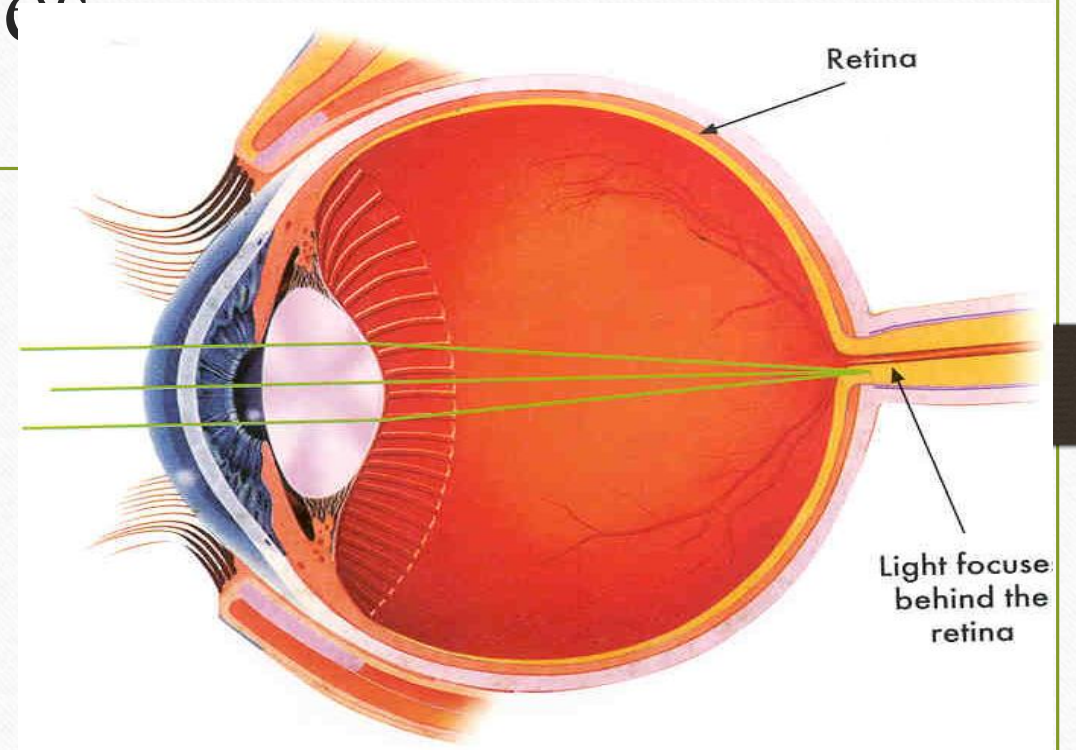
Hypermetropia

Principal focus is formed behind the retina



Cause

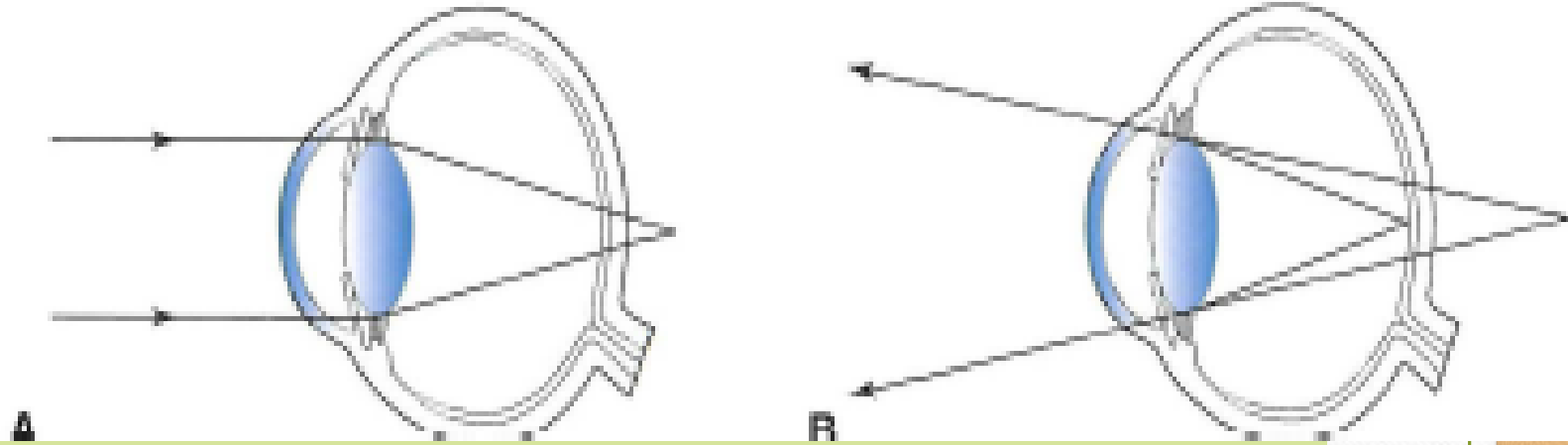
- Axial Hypermetropia
- Curvature Hypermetropia
- Index Hypermetropia
- Abnormal position of the lens



Clinical Types

- Simple hypermetropia
- Pathological hypermetropia

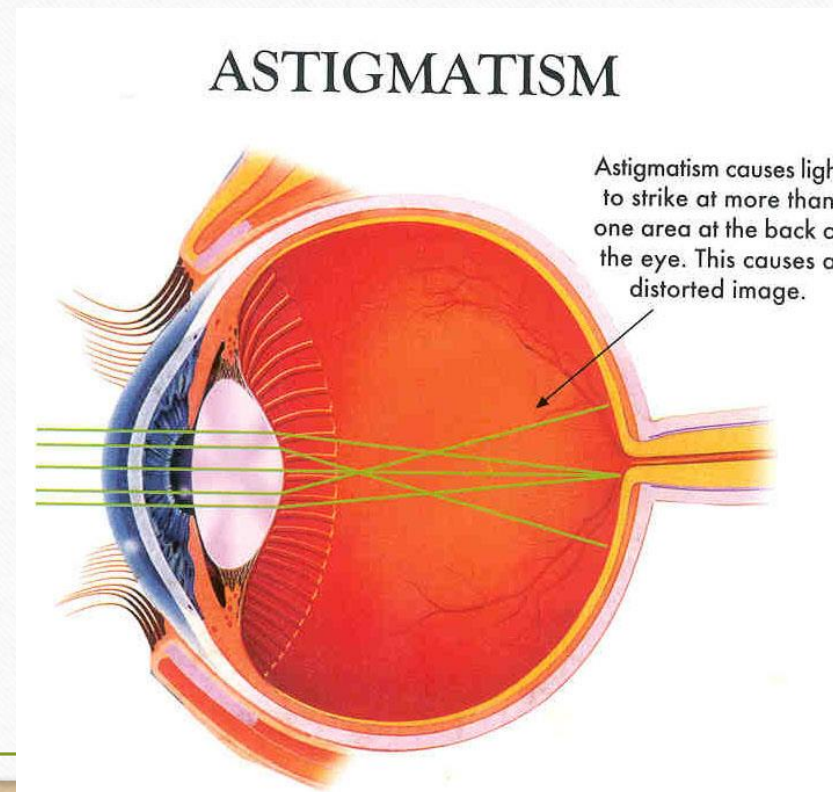
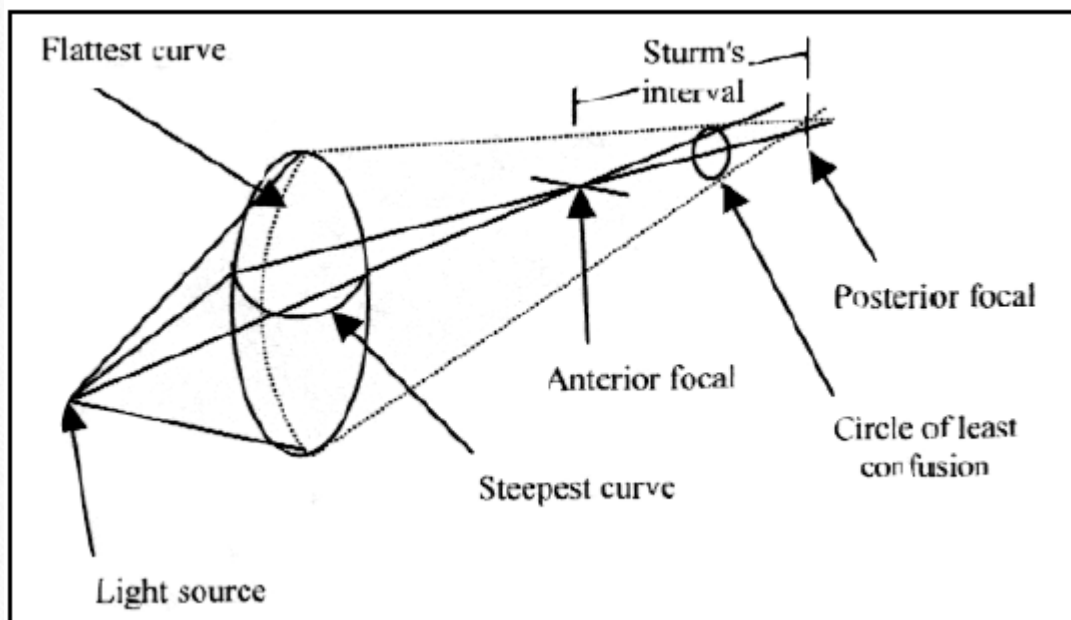
Symptoms

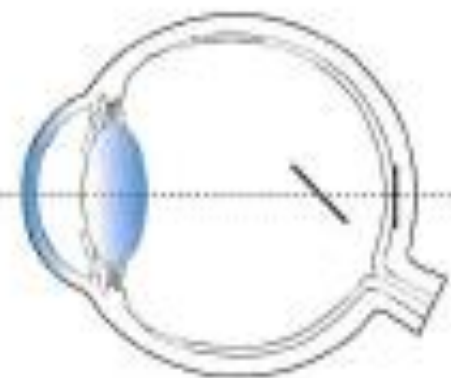


- Head ache
- Blurred vision particular near work
- Convergent squint
- Early onset of presbyopia
- Eye Strain

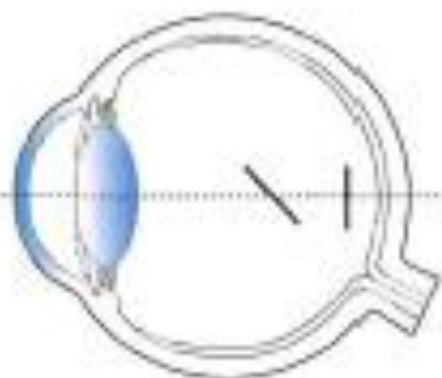
Astigmatism

Astigmatism is that condition of Refraction where there are two point focus of light

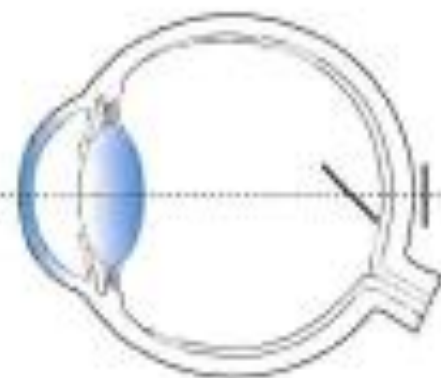




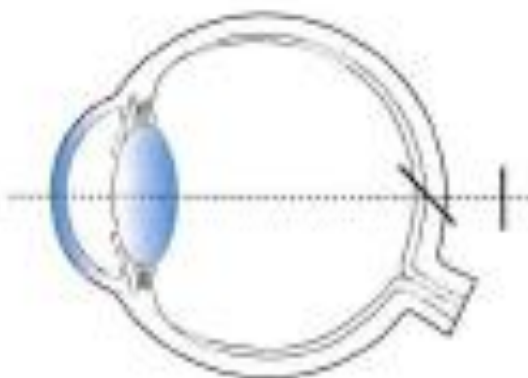
Simple myopic



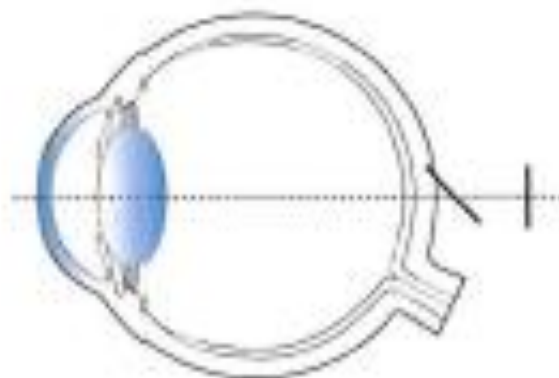
Compound myopic



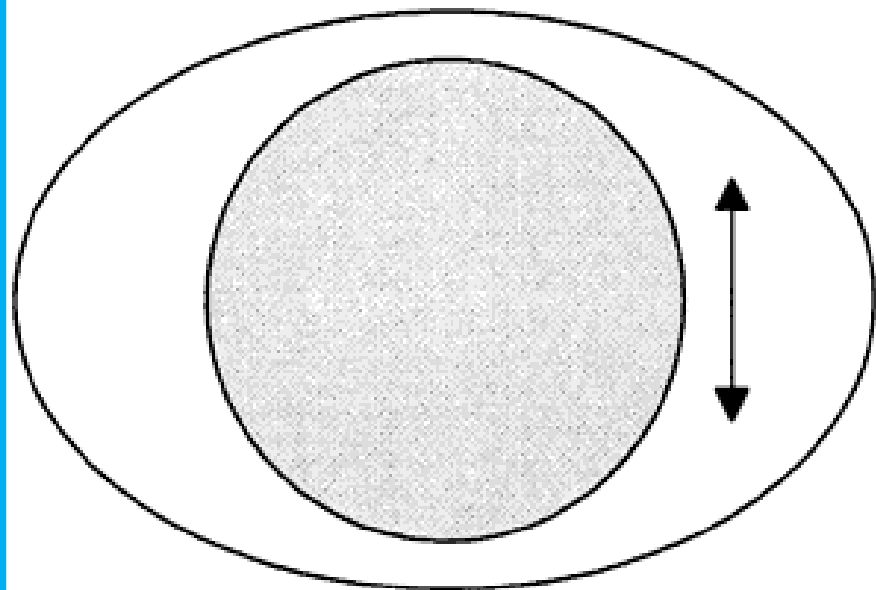
Mixed



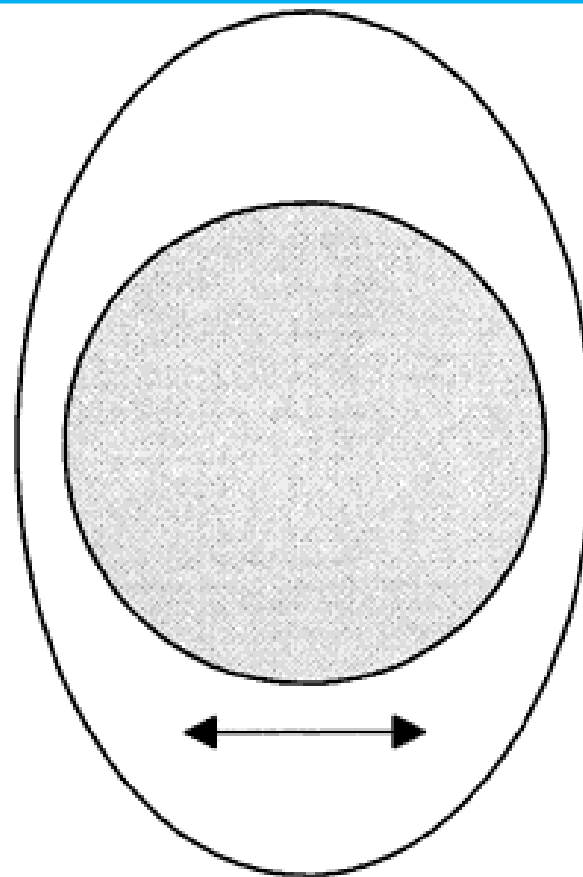
Simple hyperopic



Compound hyperopic



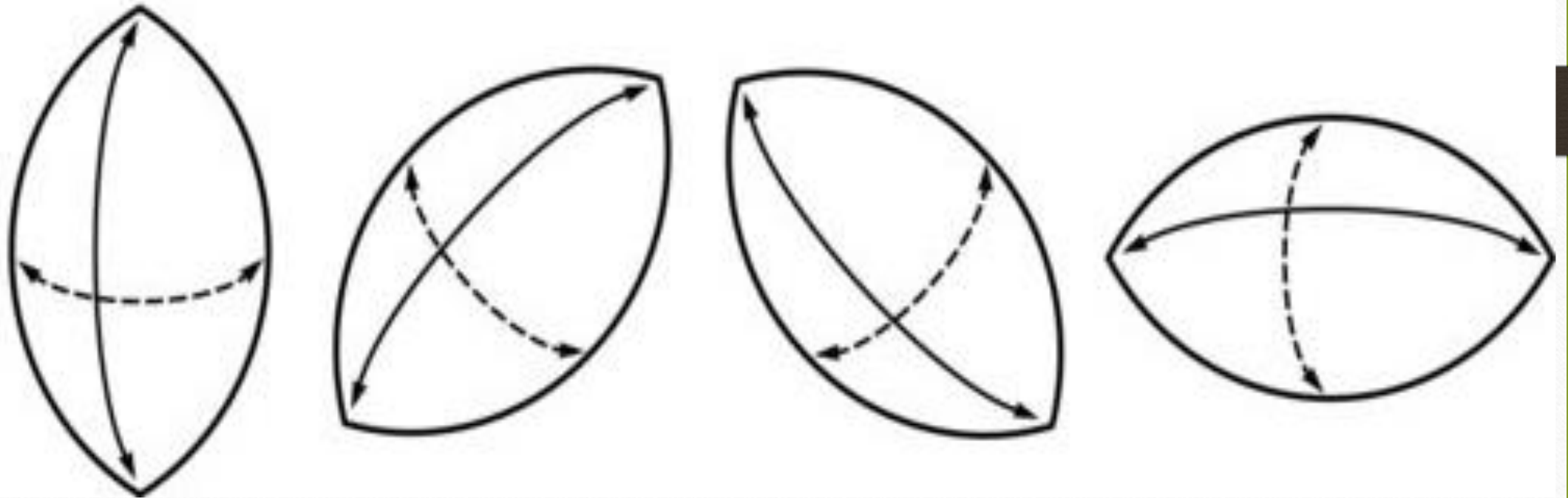
With-the-rule



Against-the-rule

Physiological types

- With rule astigmatism
- Against rule astigmatism
- Oblique astigmatism



Causes

- **Curvature**
 Ex: Keratoconus, Lenticonus etc..
- **Centering error**
 Ex: Sub location of the lens
- **Refractive index**
 Ex: Cataract
- **Retinal**
 Oblique placement of macula

Symptoms

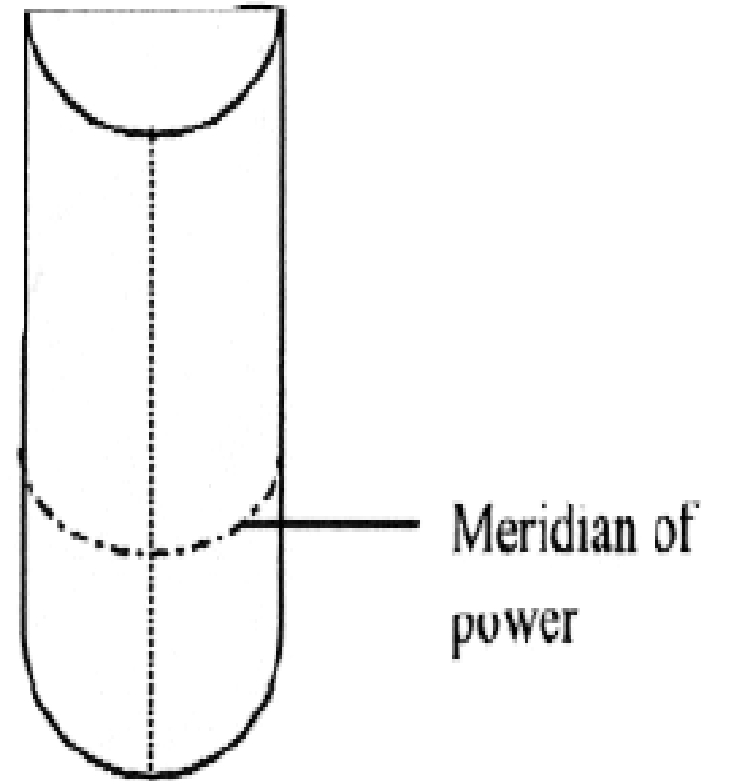
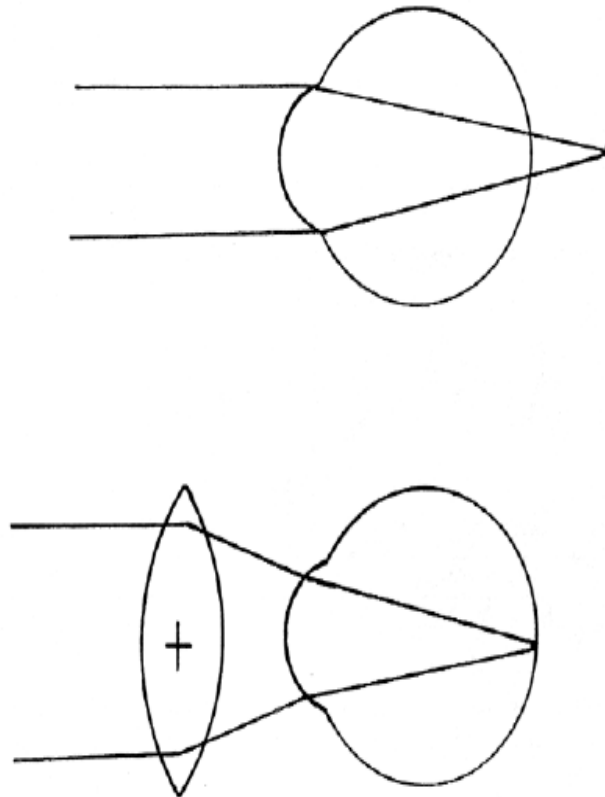
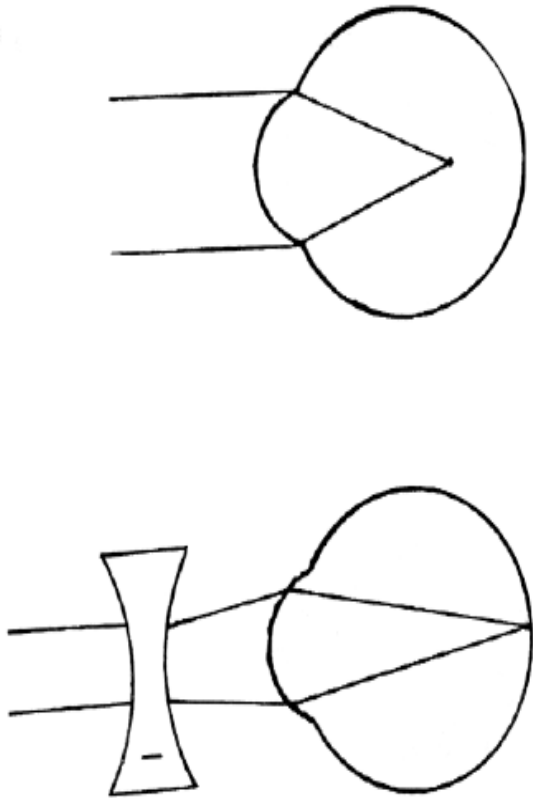
- Head ache
- Blurring of vision
- Eye tired
- Eye ache

Optical Treatment

Myopia
Minus lens

Hyperopia
Plus lens

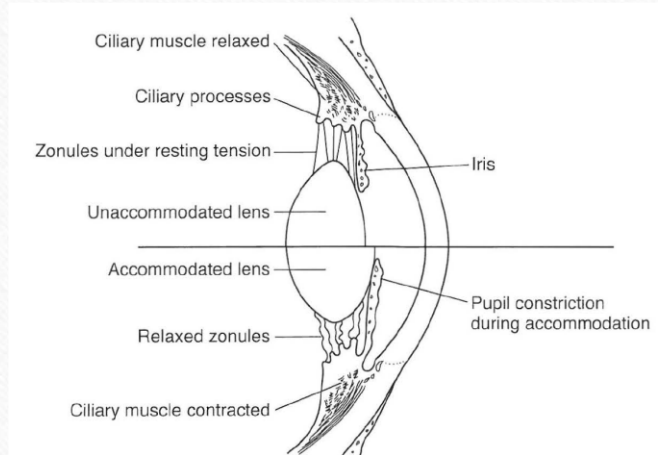
Astigmatism
Cylinder



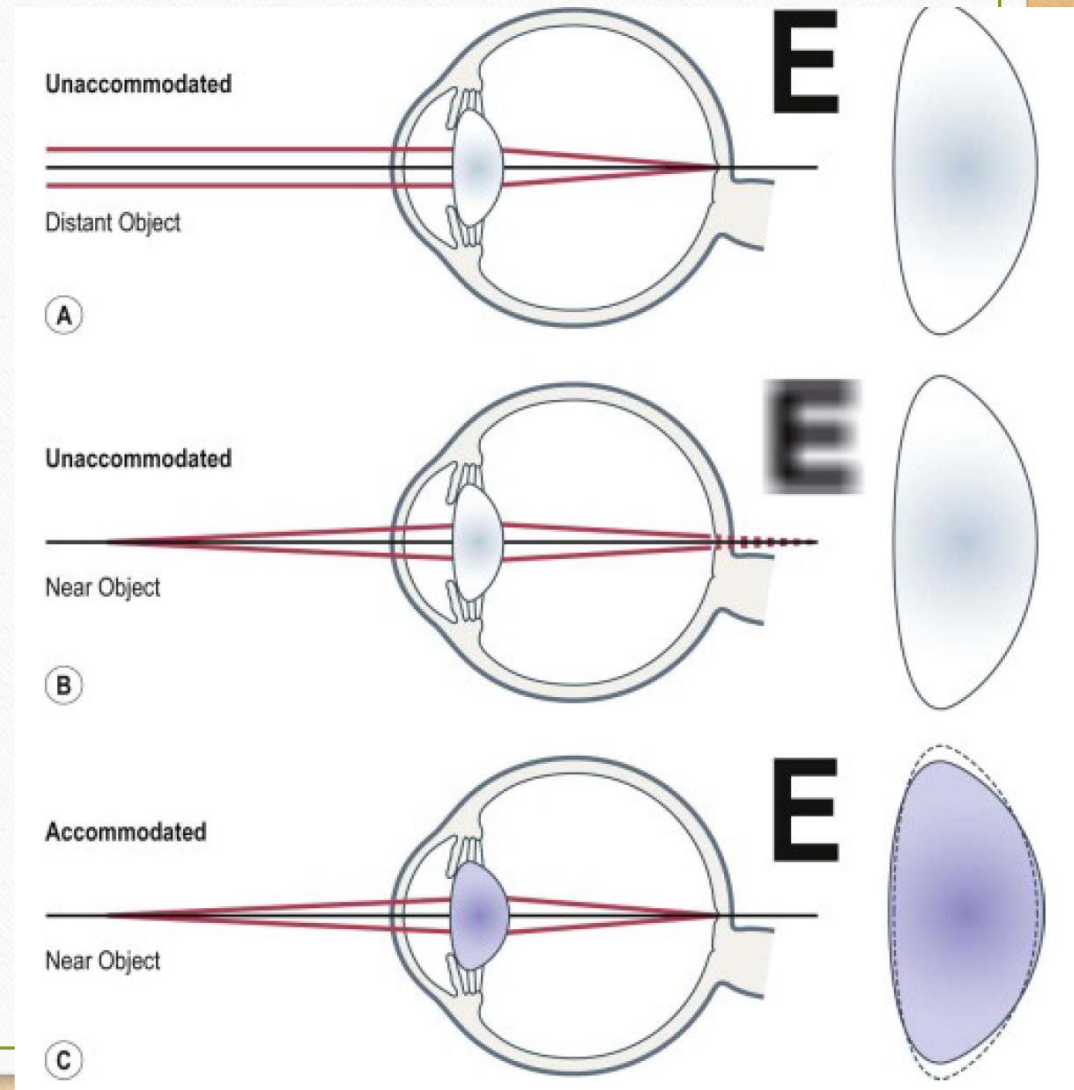
Treatment

- Optical
 - Spectacle Correction (Concave Lens)
 - Contact lens
- Surgical
 - PRK/ LASEK

Presbyopia



- This is a physiological aging process, In which the near point gradually recedes beyond the normal reading or working distance



Causes

- Lens matrix is harder and less easily moulded
- Lens capsule is less elastic
- Progressive increase in size of the lens
- Weakening of the ciliary muscle

Treatment

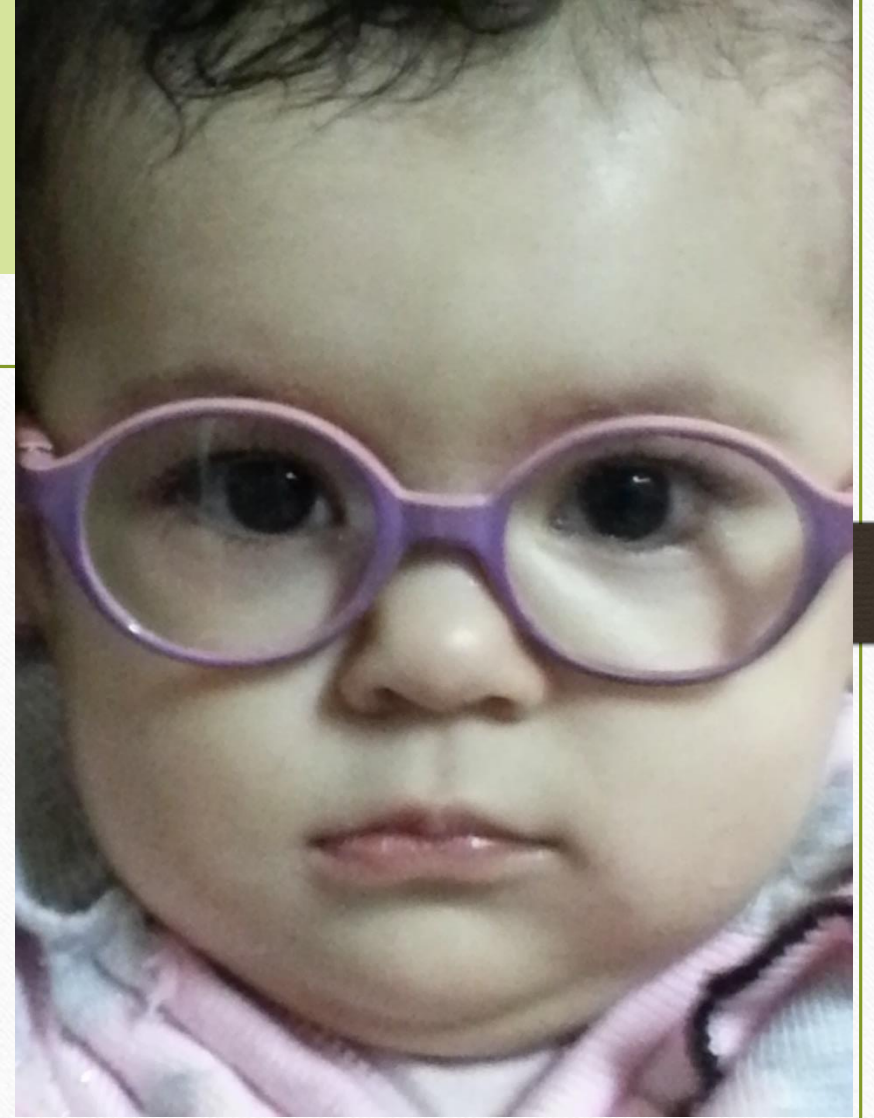
Near glass: plus lenses



Children

The Normal Age Variation

- At birth: - 2D to 3 D Commonly Present
- Most of infant birth with hyperopia
- At the age of 5 Yrs- 90% of Children's are Hypermetropic
- At Puberty:- Emmetropic
- Children are in the risk of amblyopia



Thank “U”

