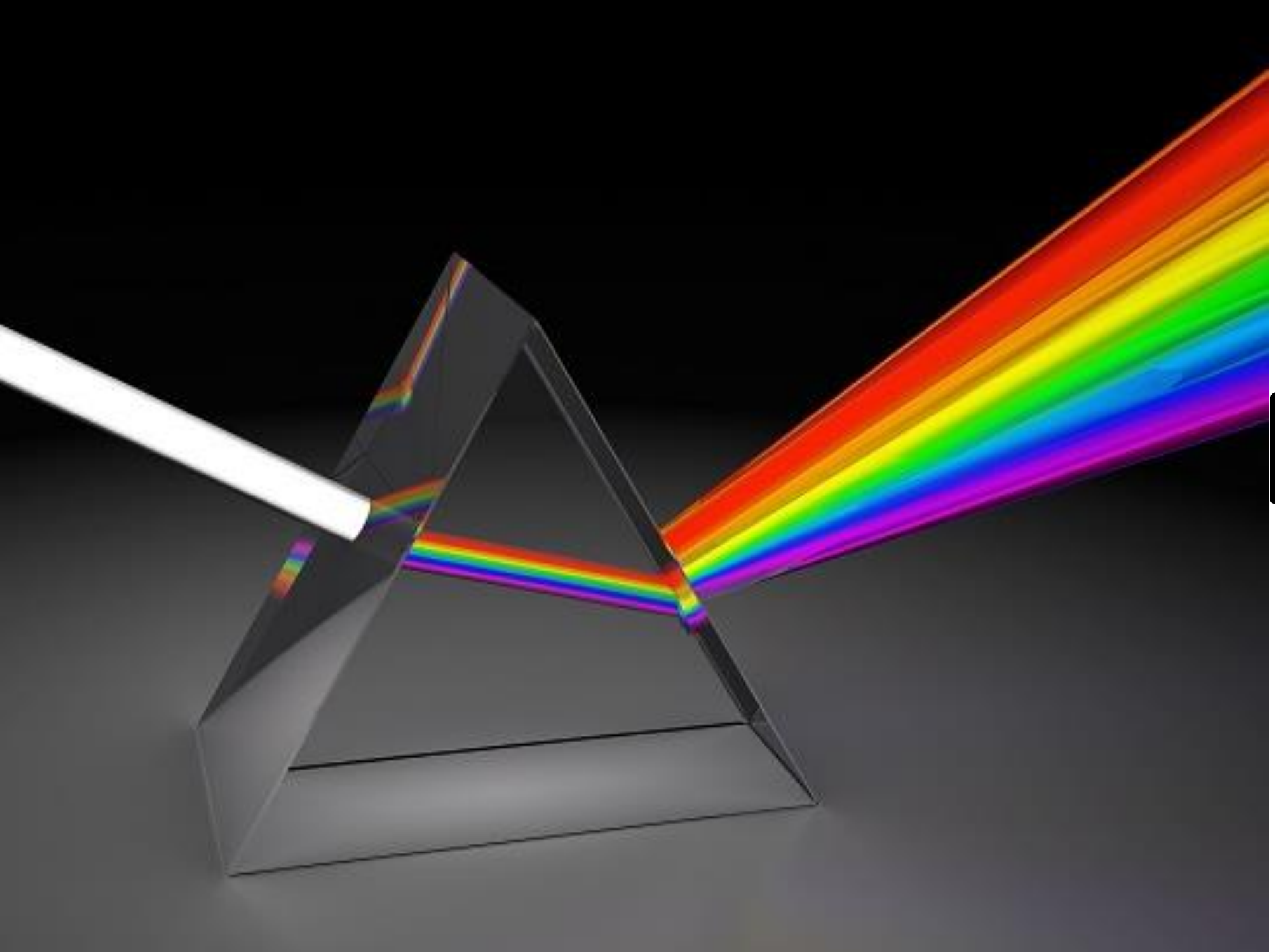
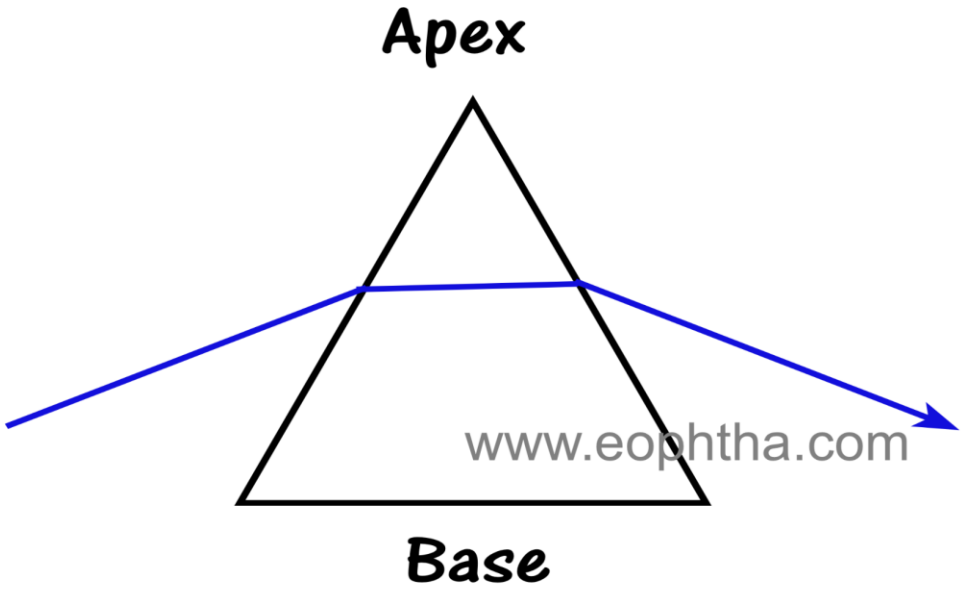


OPTOM INSIGHT

Prisms

- Prism is wedge shaped lens material which deviated light towards its base without changing its vergence.
- A prism consists of two angled refracting surfaces..



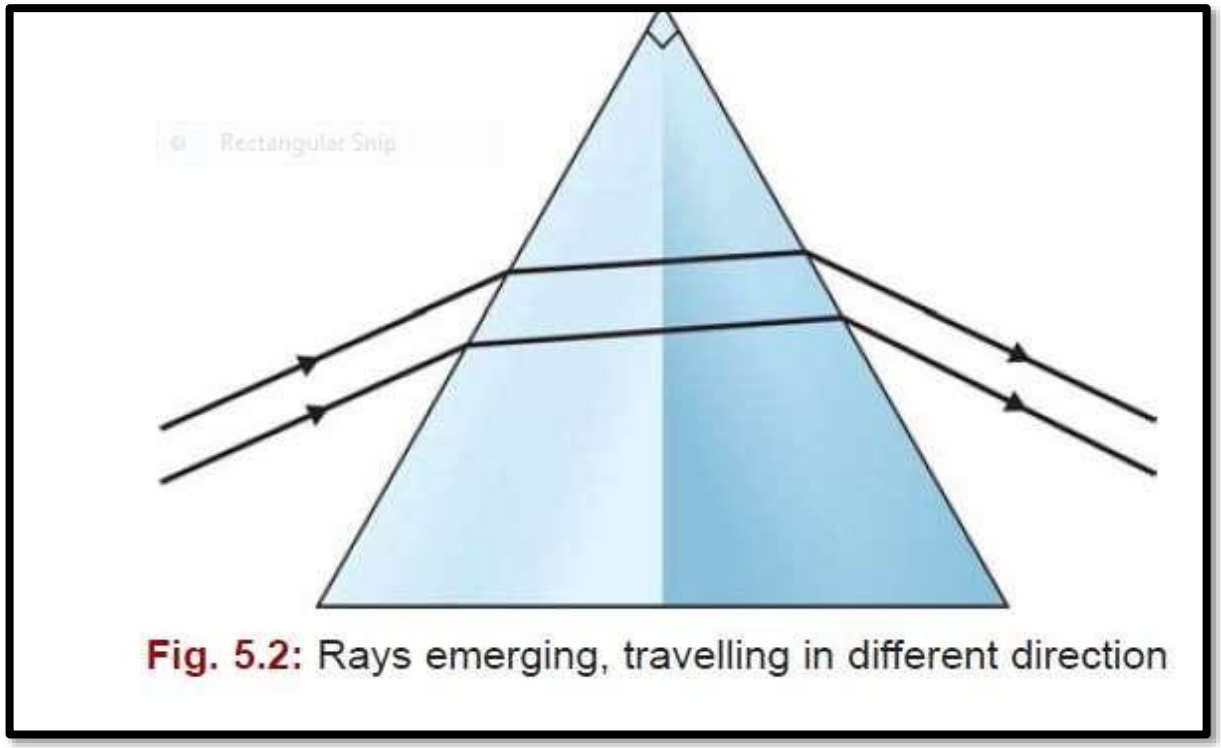
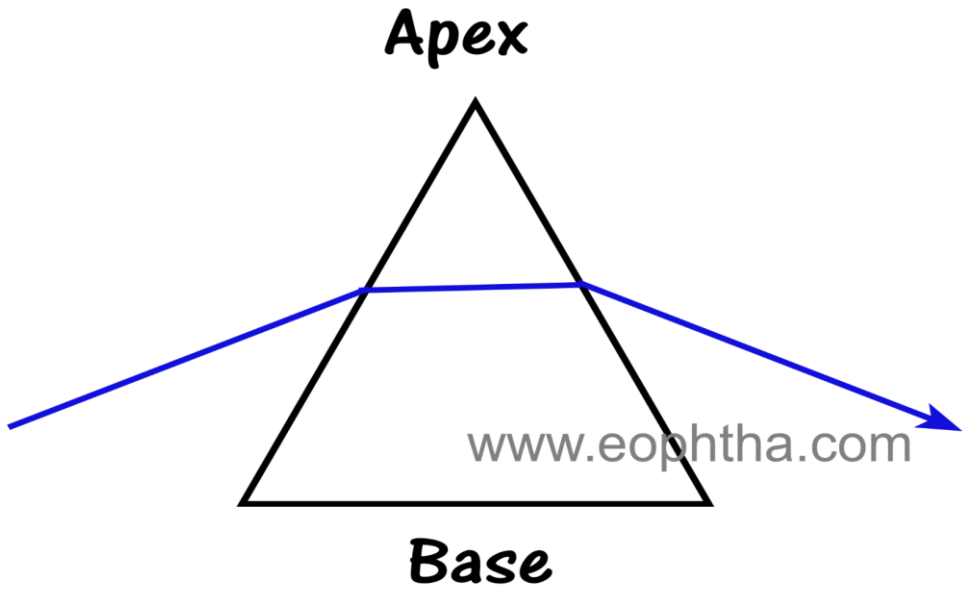
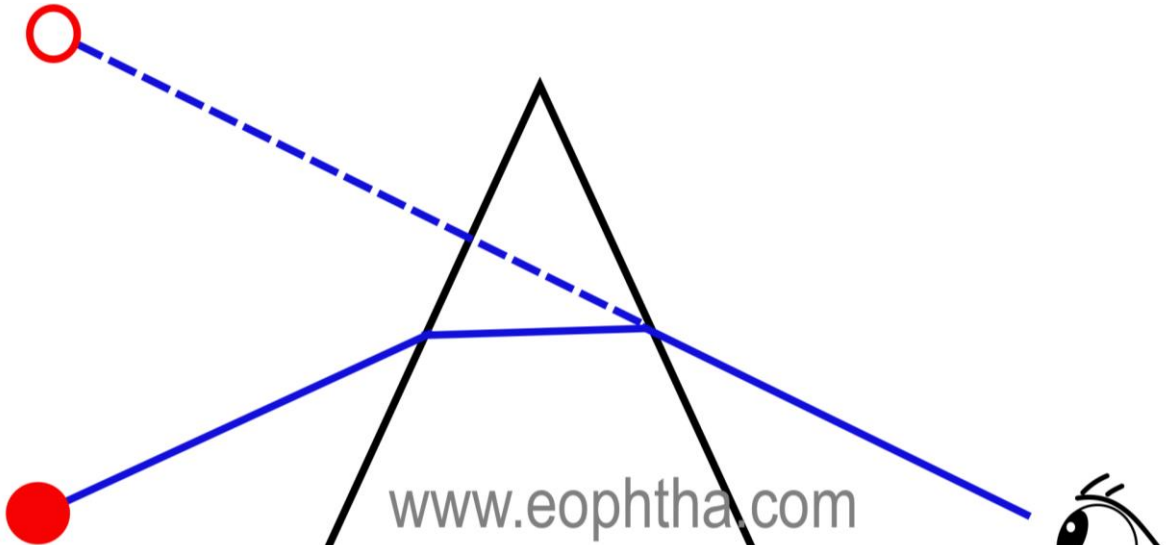


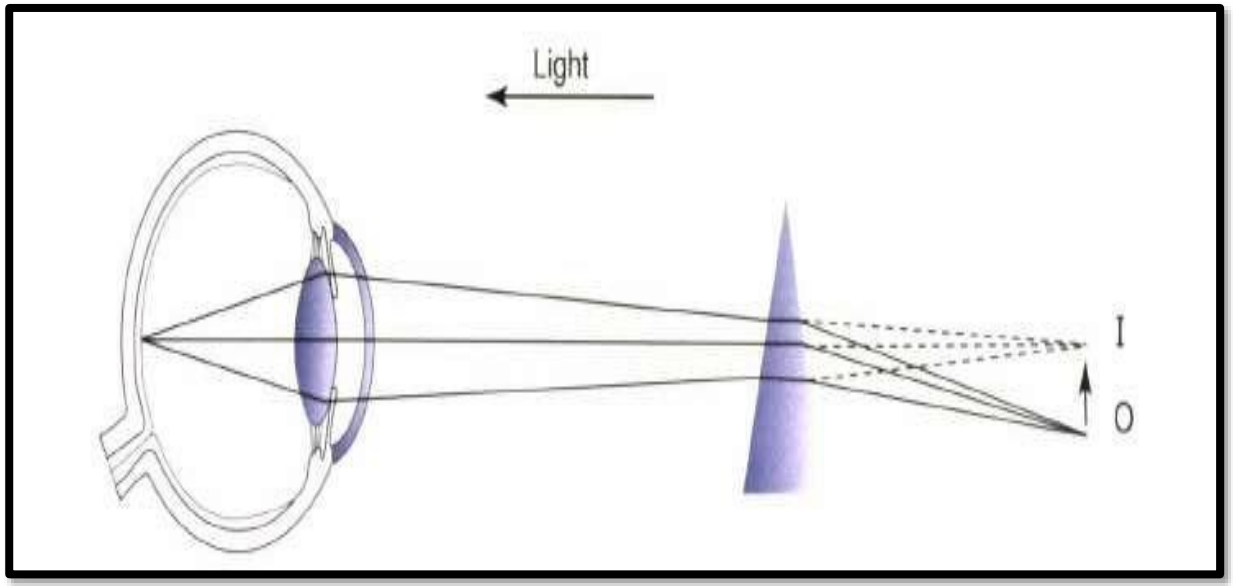
Fig. 5.2: Rays emerging, travelling in different direction

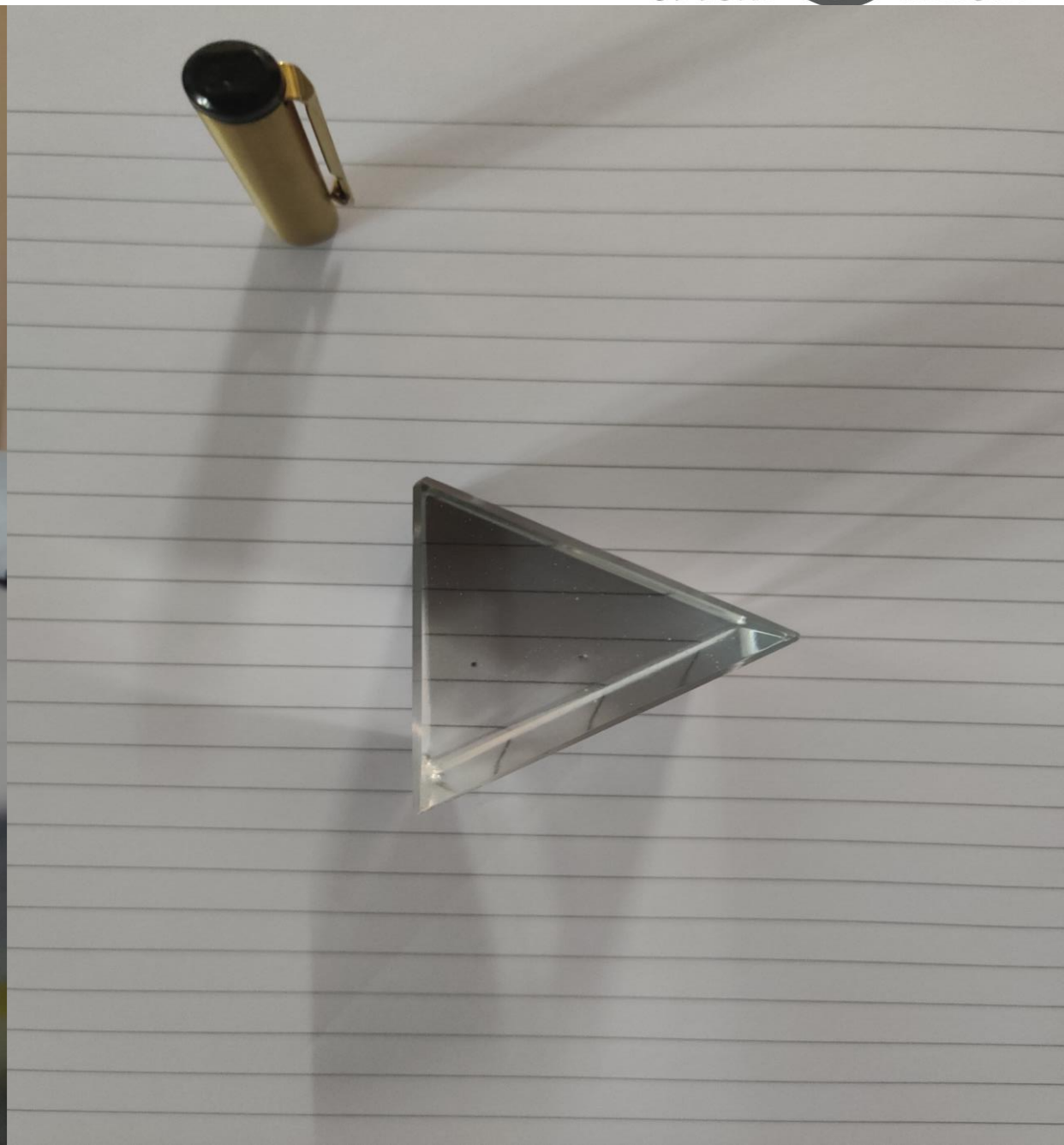
- The simplest form of a prism is two flat surfaces that come together at an angle at the top. The point is called the *apex* of the prism; the wider bottom of the prism is called the *base*. A prism consists of two angled refracting surfaces.
- The angle between two surfaces is called apical angle.

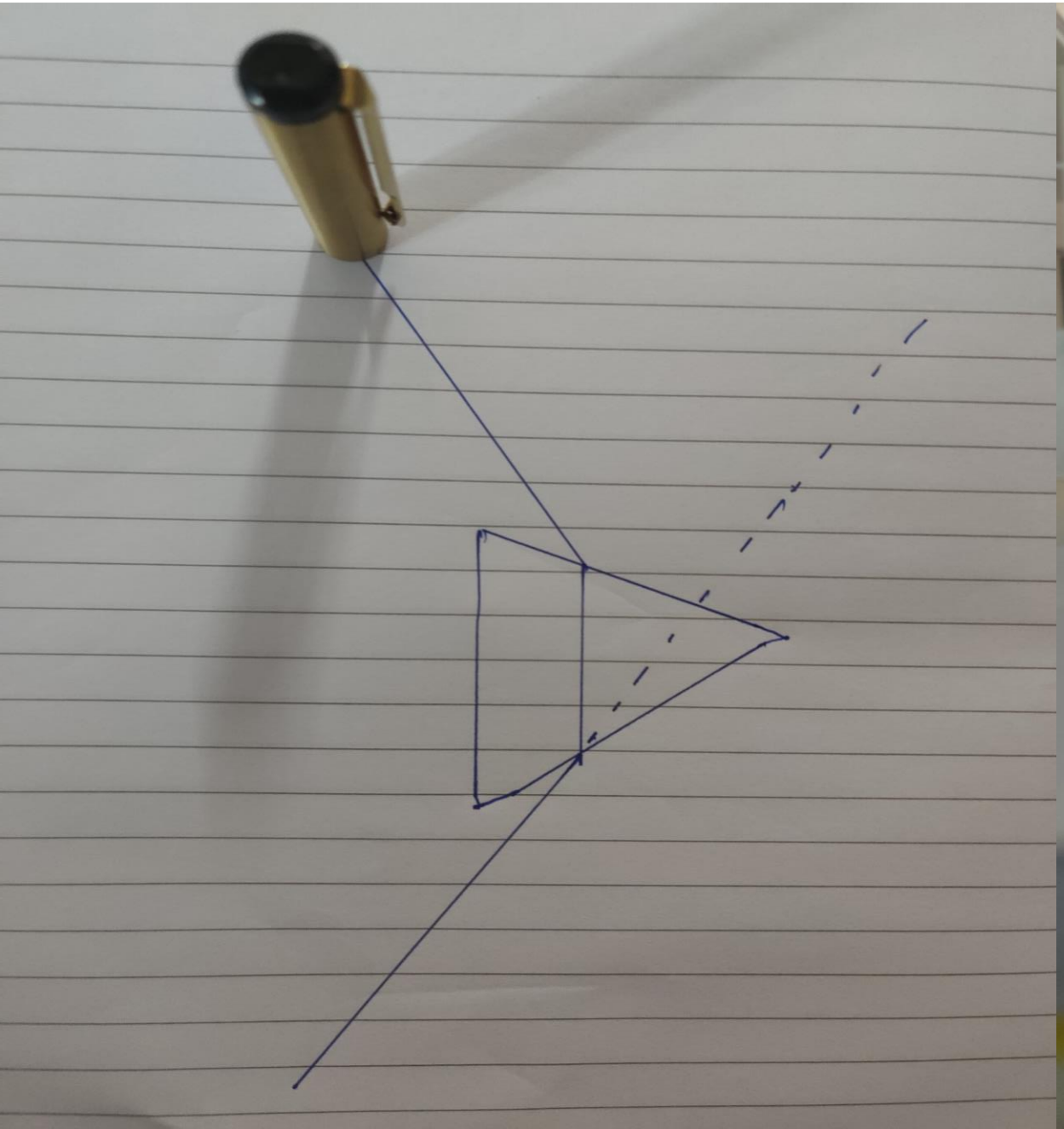


- When prism is prescribed, the orientation of its indicated by the position of the bases
- i.e. base in, base out, base up, base down.
- The light entering and leaving the prism are bend towards of the prism base.
- This cause object to be displaced towards its apex. Thus if an object is viewed through a base down prism it will be seen displaced upward.



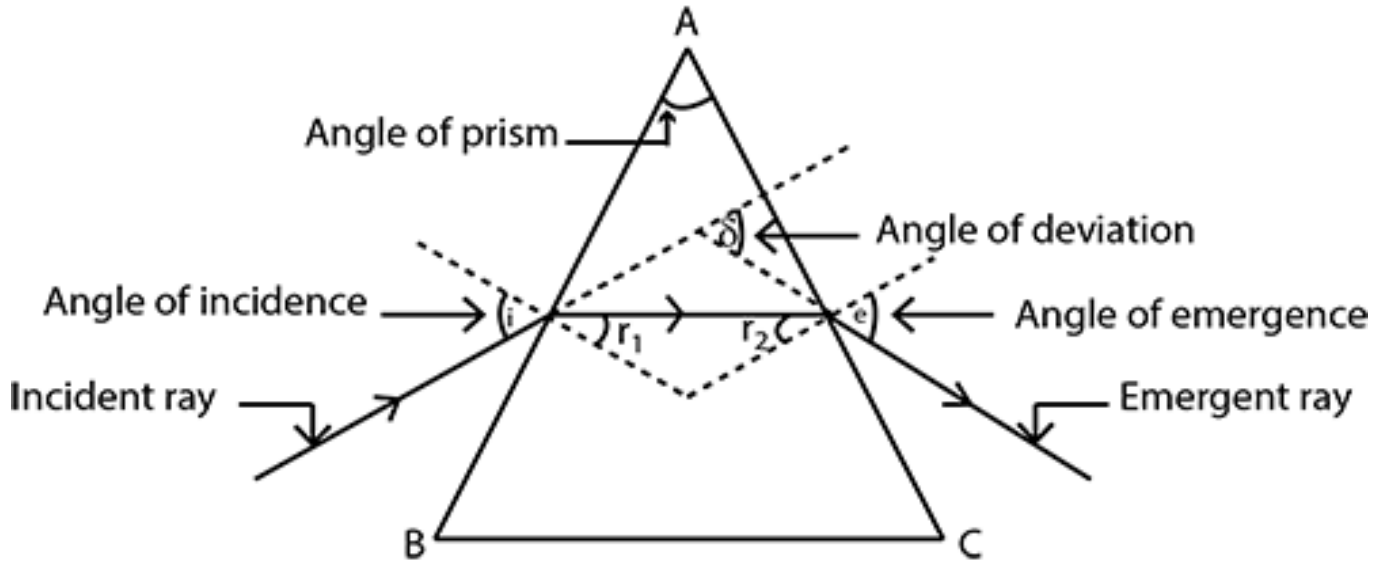




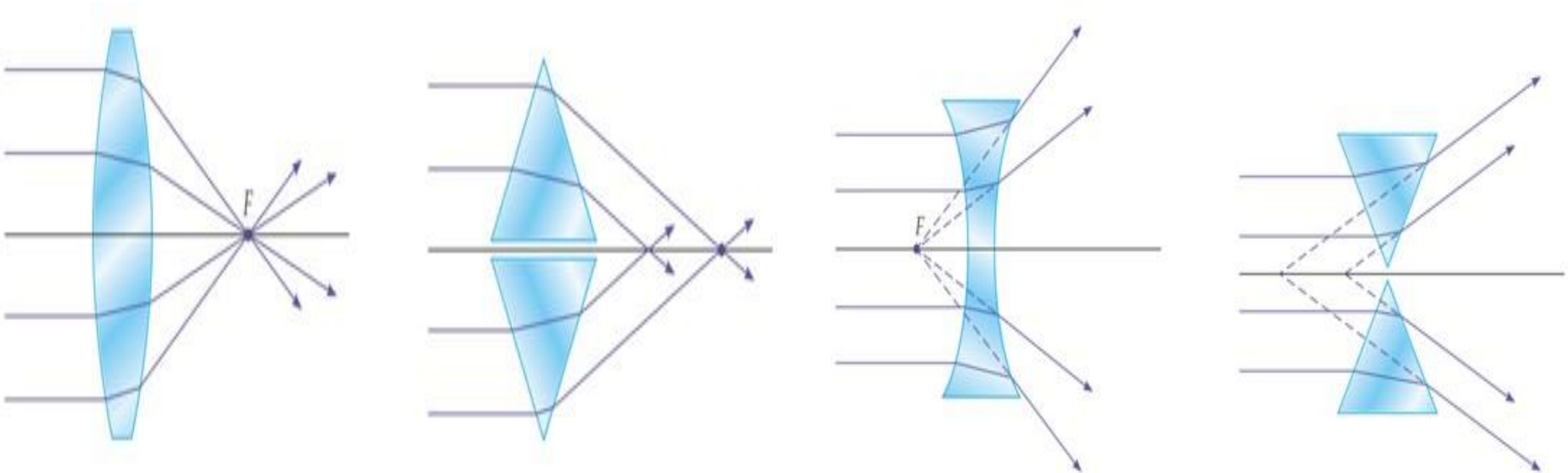


The amount by which a ray will be deviated when it passes through the prism depends on:

- The apical angle
- The refractive index of material
- The wavelength of the ray
- The angle from which the ray approaches the prism.



Convex and concave lens



CHARACTERISTICS OF PRISM

- A prism has a thickest edge, the base and athinnest edge, the apex.
- A prism displaces the incident rays towards the base of the prism.
- A prism displaces the image towards the apex of the prism.
- A prism does not change the vergence of the rays.
- A prism does not magnify or minify the image.
- A prism also disperses incident pencil rays into its component colours.

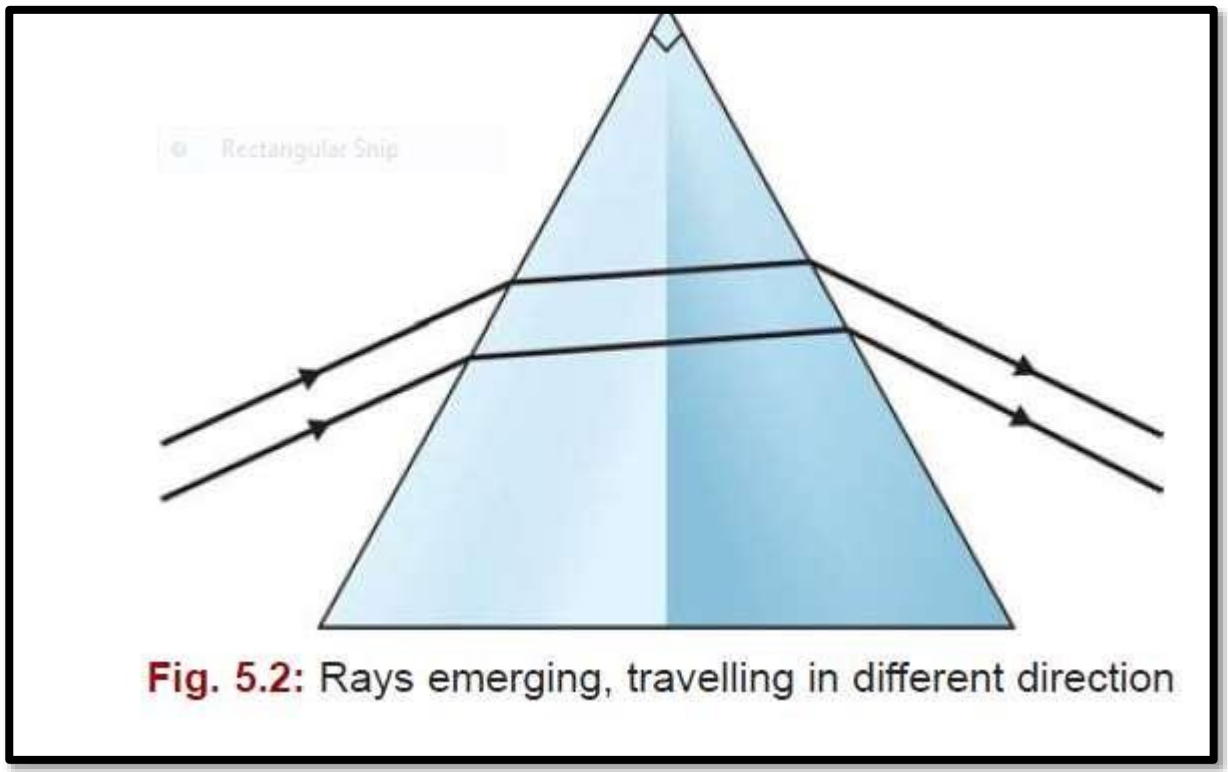


Fig. 5.2: Rays emerging, travelling in different direction

Units of prisms

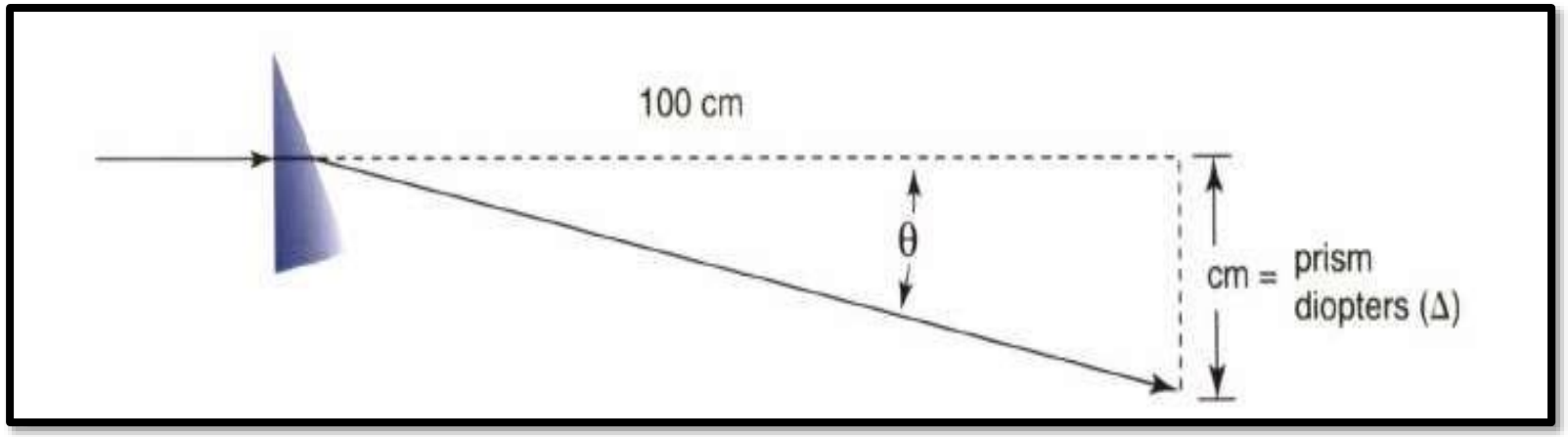
The power of a prism can be expressed in various unit.

1. The prism dioptre

2. The centrad

The prism dioptre (Δ)

- A prism of one prism dioptre power produces a linear apparent displacement of 1 cm , of an object O, situated at 1 m.
- Denoted by the symbol Δ.
- Prism dioptre= deviation in cms / distance in meters.



The centrad

- This unit differs from the prism dioptre only in that the image displacement is measured along an arc 1m from the prism.

- The centrad produces a very slightly greater angle of deviation than the prism dioptre, but the difference ,in practice is negligible.

PRISM ORIENTATION

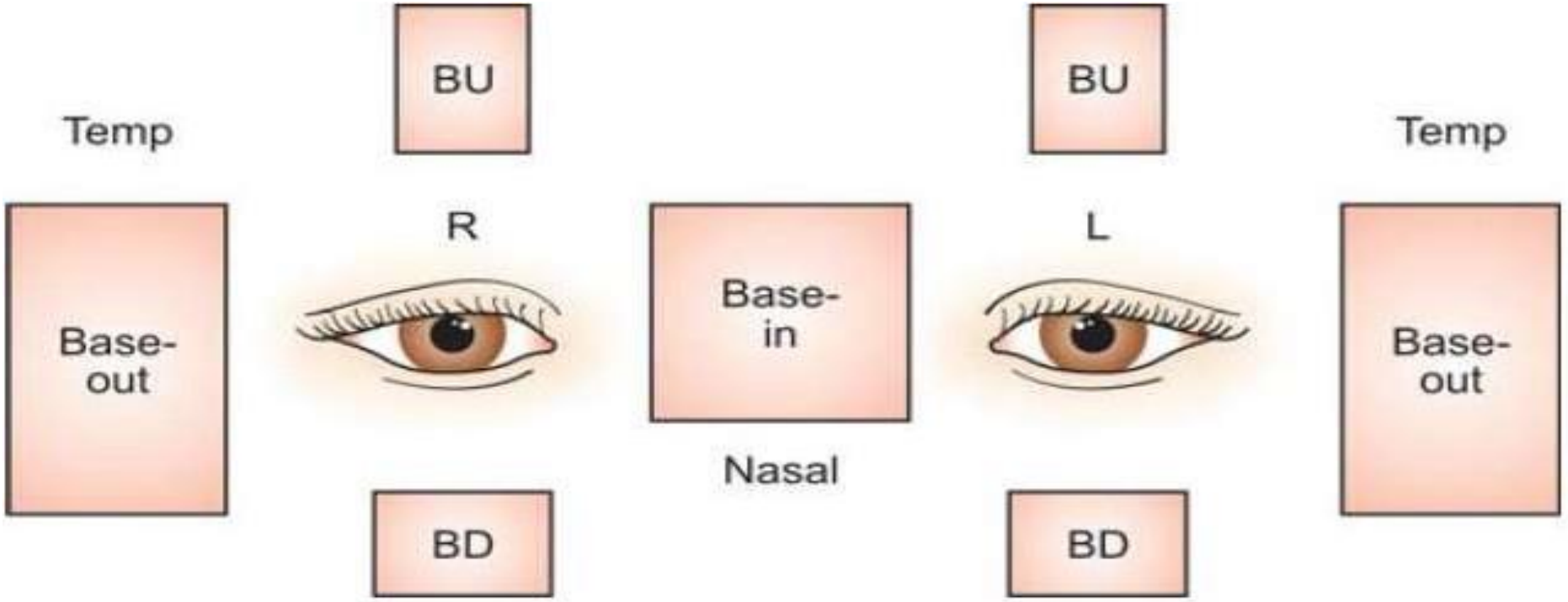
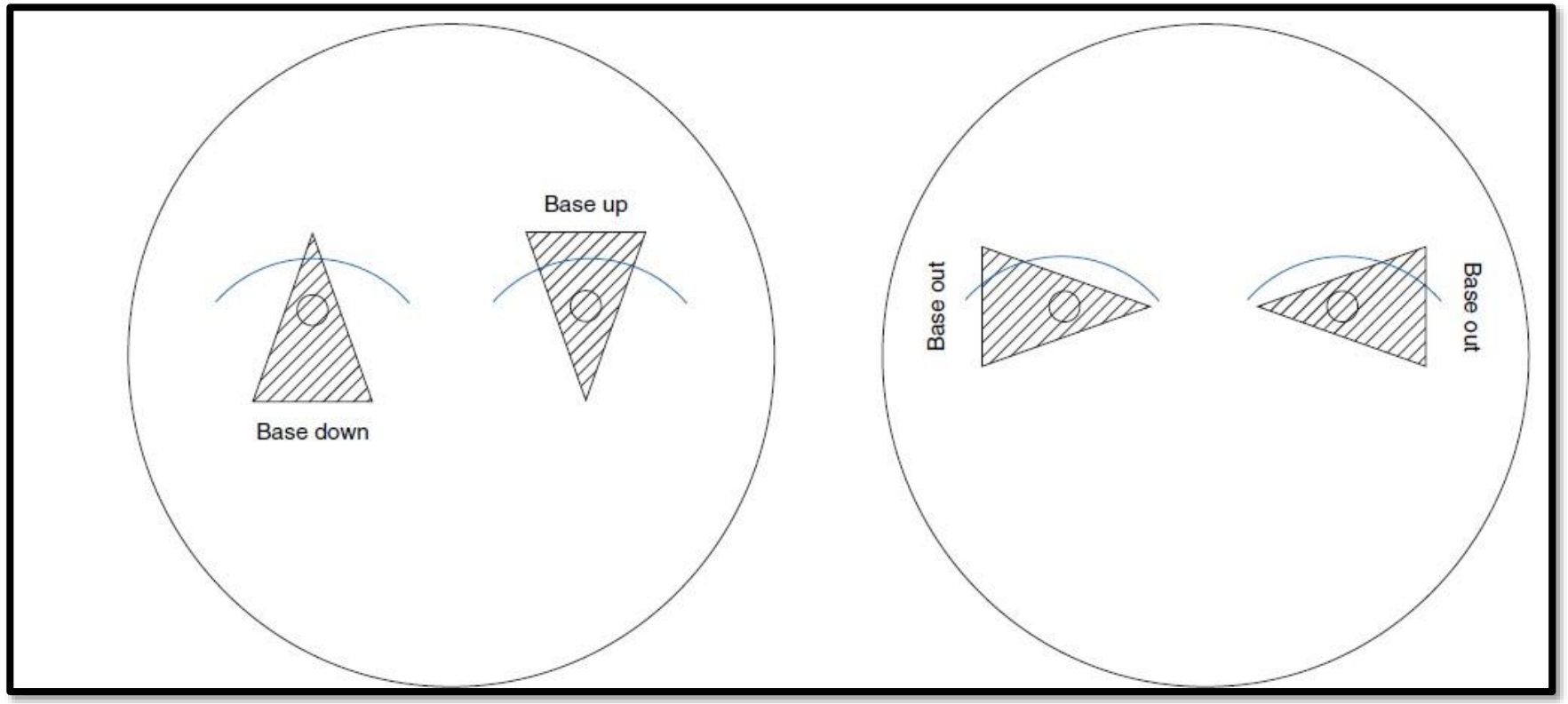


Fig. 5.4: Orientations of prism

PRISM ORIENTATION



Prism orientation notation

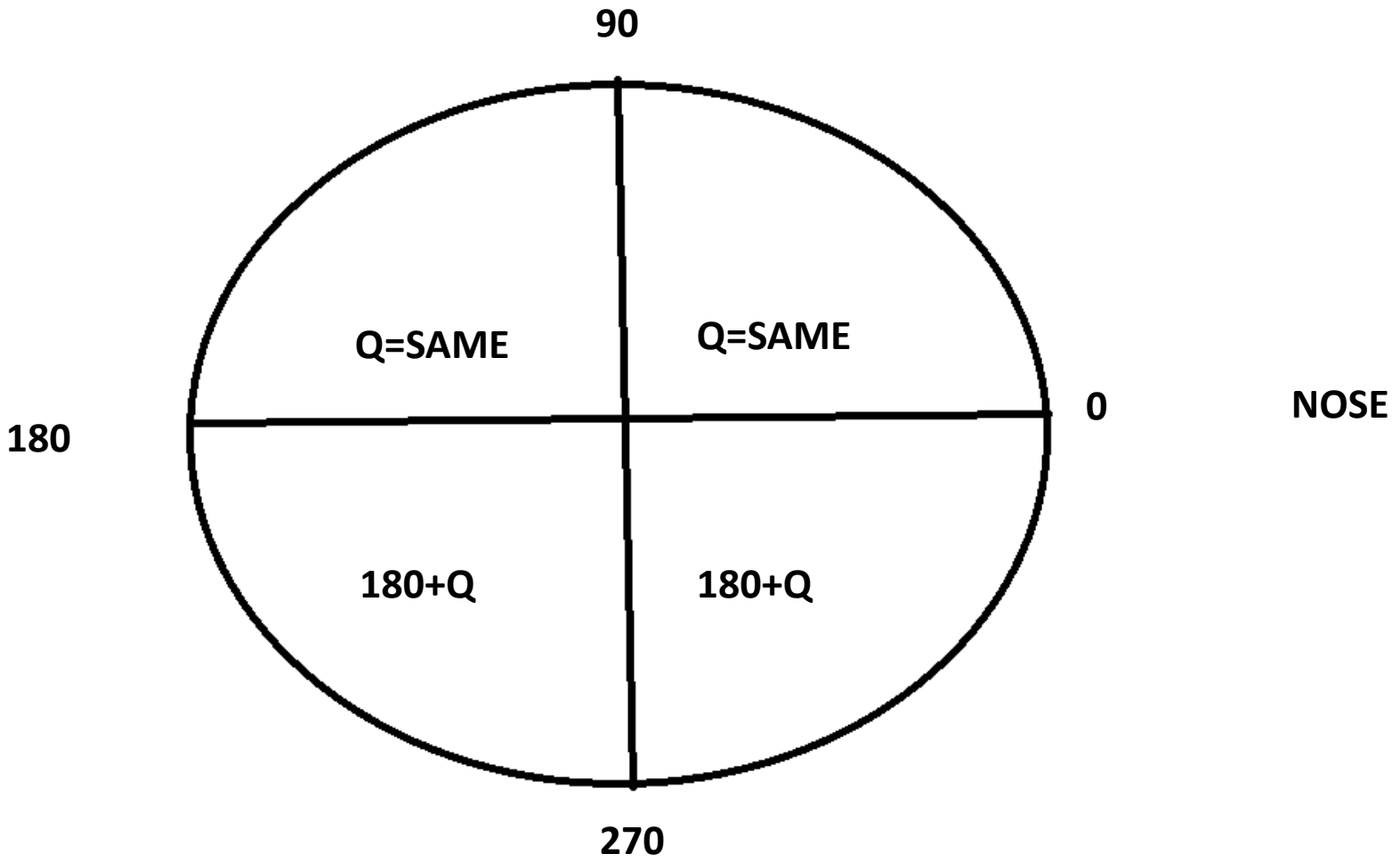
- **180 notation**: one prism which base power, direction and axis with 0-180 degree is given:

e.g. 2 Δ base in and up 45 degree

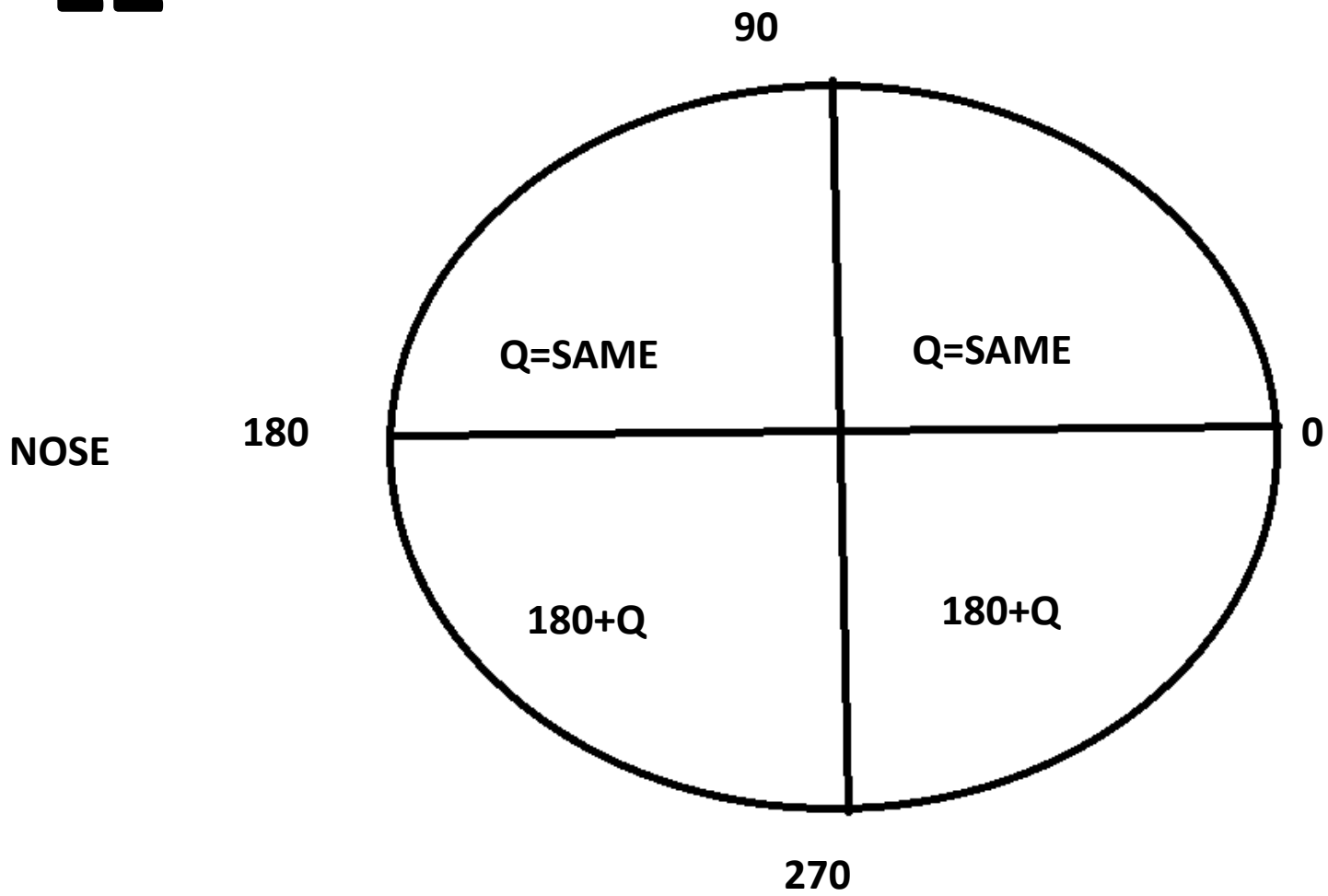
- **360 notation**: one prism with base power and axis given

e.g 2 Δ @ 45 degree

RE



LE



- E.g

CONVERT TO 360 NOTATION

- RE=1 Δ base out and down @ 45 degree
- OS= 2 Δ base down and out @ 130 degree

Convert to 180 notation

RE= 2 Δ@320 degree

OS= 2 Δ@110 degree

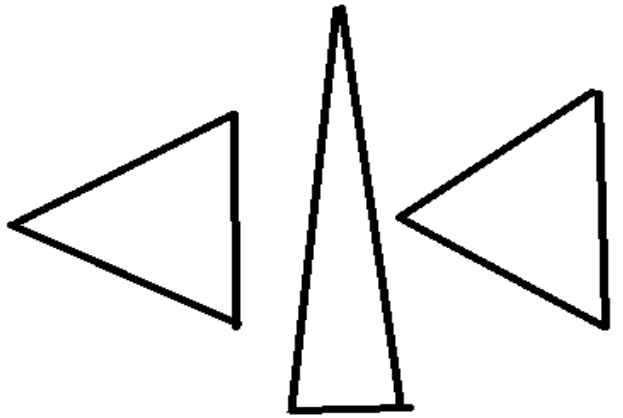
- H.W
- RE=2 Δ base out and down @ 35 degree
- OS= 2 Δ base down and in @ 130 degree
- RE=1 Δ base down and in @ 145 degree
- OS= 2 Δ base down and in @ 110 degree
- OS=2 Δ @100
- OD=2 Δ@120
- OS=2 Δ@40

Resultant Prism Effects

- When prisms are placed in front of both eyes
  - the prism powers combine in different fashions depending on their bases
- When prisms make the eyes move in the same direction
  - the net effect is subtractive (diminishes the effect)
- When prisms make the eyes move in opposite directions
  - the net effect is additive (compounds the effect)

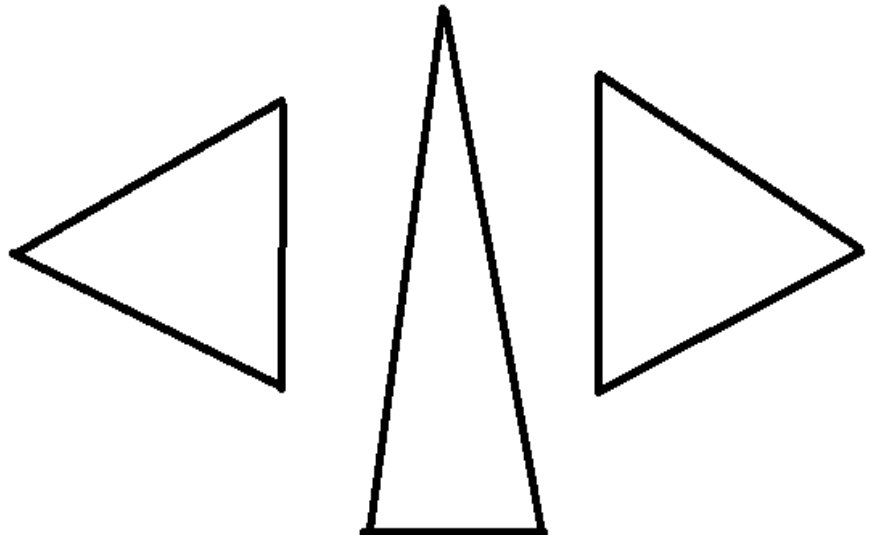
Resultant Prism Effects

- Horizontal Prisms
  - If bases are in **opposite directions** (one base in, one base out) the effect is *subtractive*
- Resultant prism effect
  - The difference in the prism powers; net direction is that of the stronger prism for *that eye*
- Ex:
  - OD 4 Base In
  - OS 2 Base Out
  - Net is 2 Base In OD



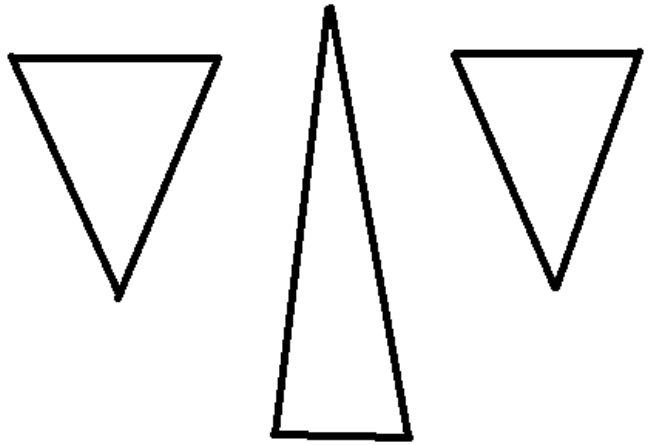
Resultant Prism Effects

- Horizontal Prisms
  - If bases are in **same direction** (both Base In or Base in) the effect is additive
- Resultant prism effect
  - adding the prism powers
- Ex:
  - OD 2 Base In
  - OS 2 Base In
  - Net is 4 Base In



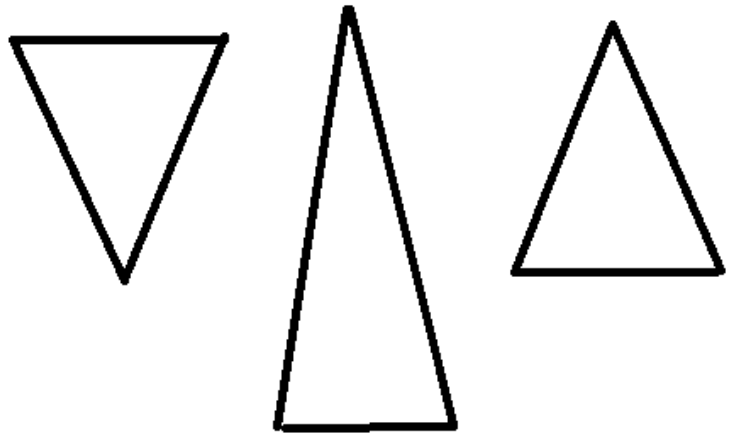
Resultant Prism Effects

- Vertical Prisms
  - If bases are in **same direction** (both base up or down), effect is subtractive
- Ex:
  - OD 3 Base Up
  - OS 1 Base Up
  - Net is 2 Base up OD



Resultant Prism Effects

- Vertical Prisms
  - If bases are in **opposite directions** (one base up, one base down) the effect is additive
- Ex:
  - OD 3 Base Up
  - OS 2 Base Down
  - Net is 5 Base Up OD or 5 Base Down OS



Uses of prisms

- Diagnostic prisms
- Therapeutic prisms

Diagnostic prisms

- Assessment of squint and heterophoria
- Measurement of angle objectively by prism cover test
- Measurement of angle subjectively by Maddox rod
- To assess likelihood of diplopia after proposed squint surgery in adults
- Measurement of fusional vergence.
- four dioptre prism test

Therapeutic prisms

Convergence insufficiency

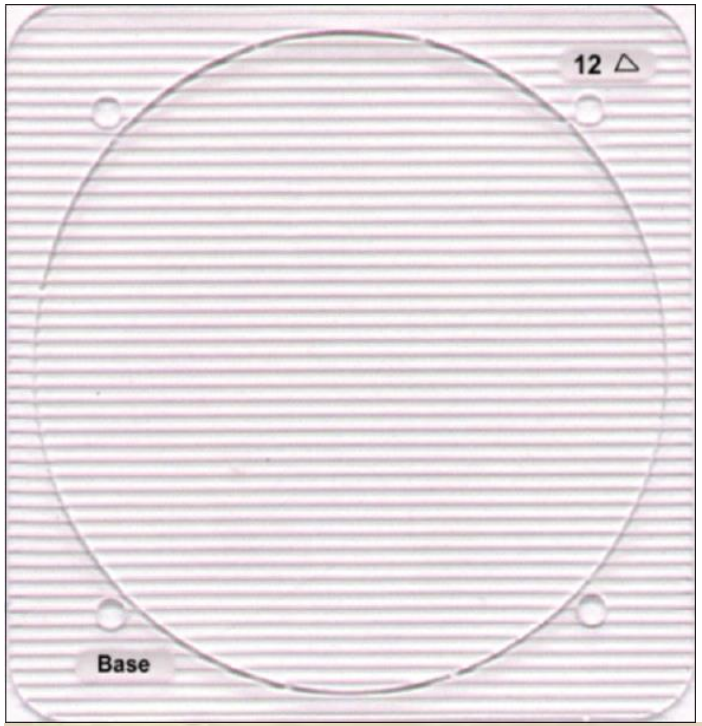
- Commonest therapeutic use of prism in orthoptics, for building up the fusional reserve of the patients with convergence insufficiency
- Base out prism is used for exercise peroids
- They are not worn constantly

To relieve diplopia on certain cases of squint

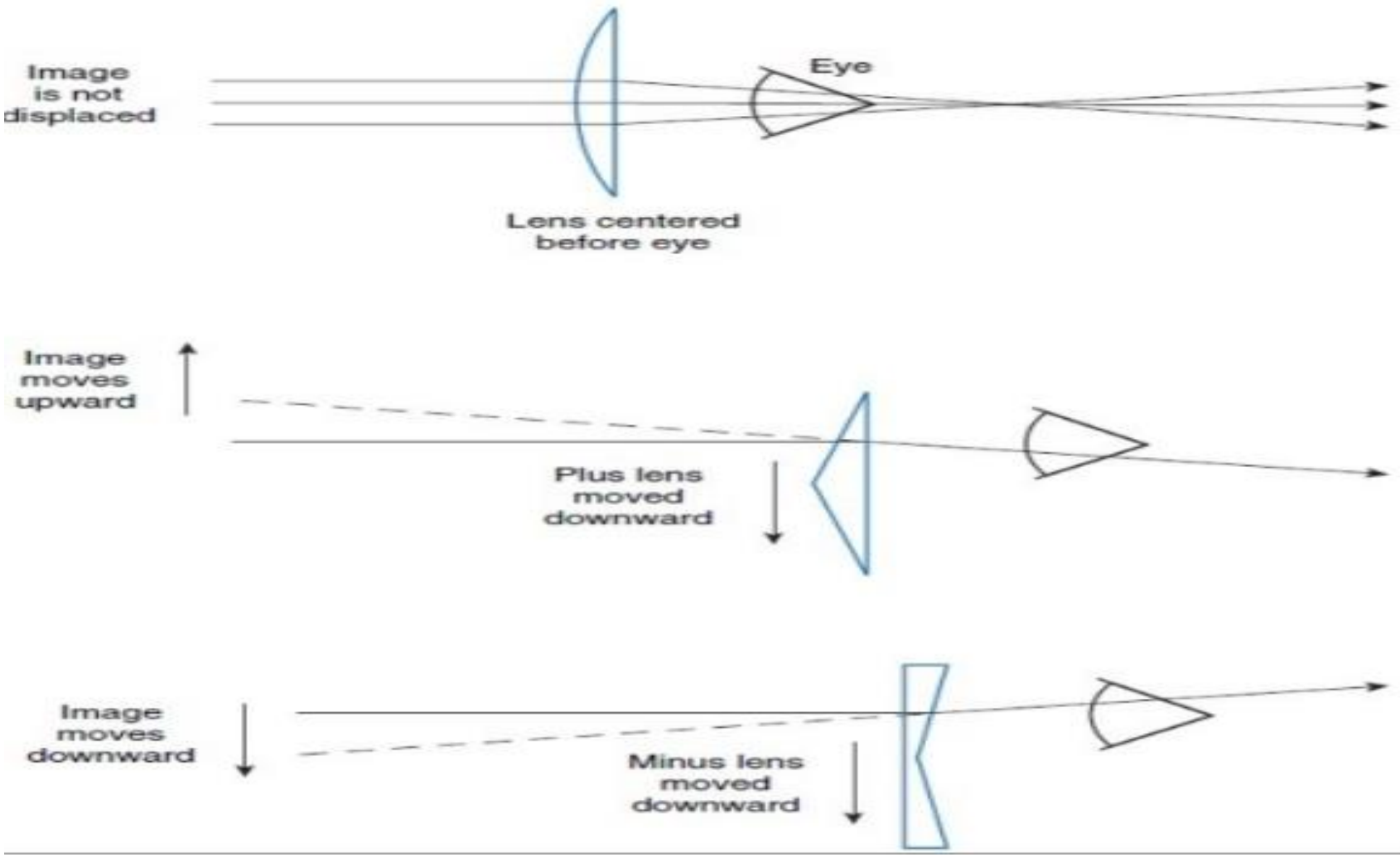
- Include decompensated heterophoria, small vertical squint and some paralytic squints with diplopia in primary gaze

Types of prism used in clinical practice

- Prismatic effect by decentration
- Loose prism
- Grounded prism
- Prism bars
- Trial prism
- Fresnel prism
- Rotatory prism



Prismatic effect by decentration



Prentice's Rule

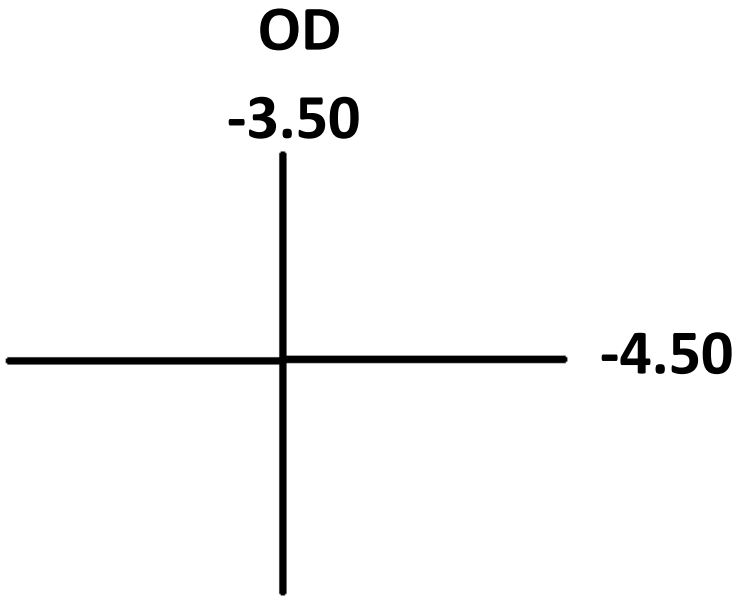
- The total prismatic effect at a point on a spherical lens is the product of the lens power and the distance from the optical center in centimeters

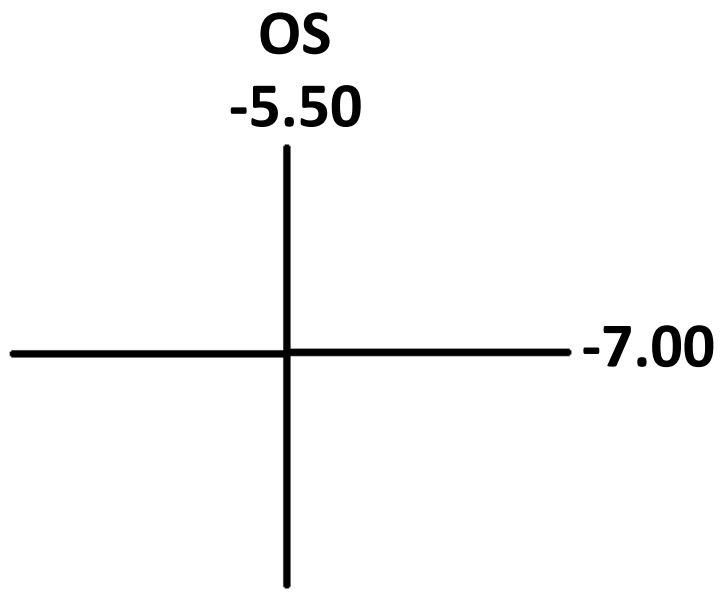
$$P = dF$$

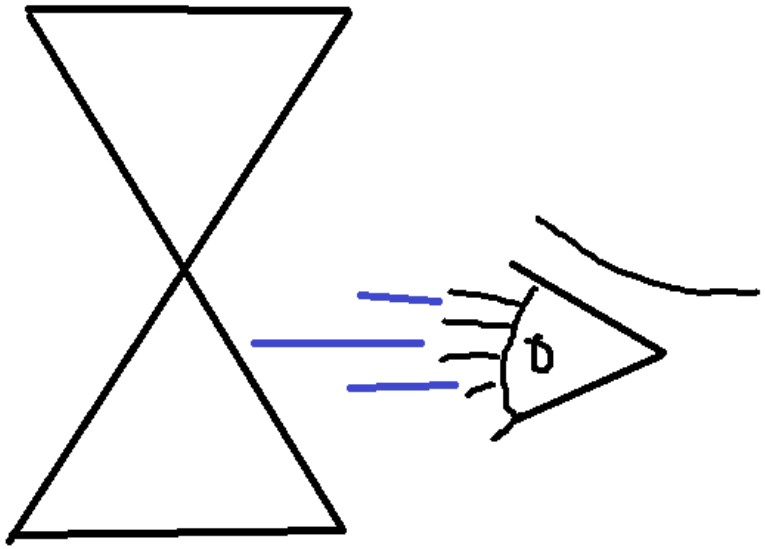
- P=Prism effect, d=distance in cm, F=lens power

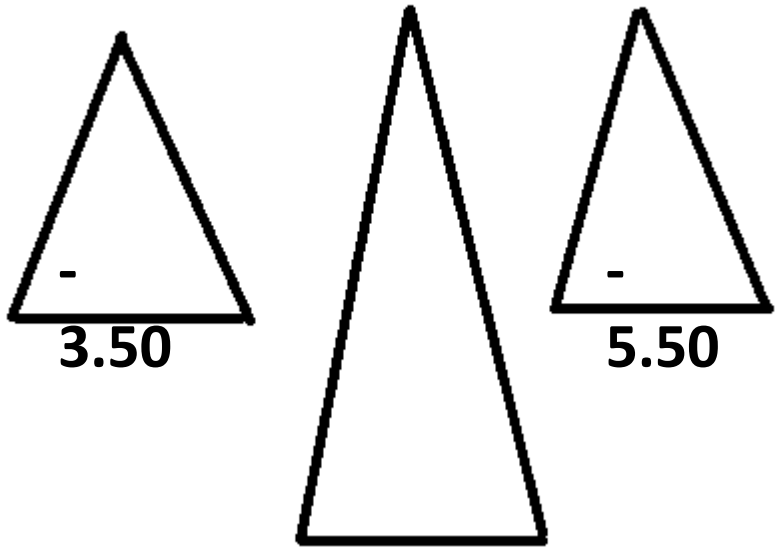
1. A +6.50 D lens before the right eye is decentred 3 mm nasal ward. What amount of prism is induced, and what is the base orientation?
2. A +4.00 D sphere lens is ordered for the right eye. The prescription also calls for 2Δ of prism base out before the right eye. How should the lens be decentred to obtain the correct amount of prism?

- E.g
- Patient prescription
- RE= -3.50DS/-1.00DC X 90
- LE=-5.50DS/-1.50DC X90
- How much vertical imbalance is present for reading level 10 mm below the distance optical centres?









Net= -2.00 prism Base down dioptre in LE

Loose prism

GROUND IN PRISM

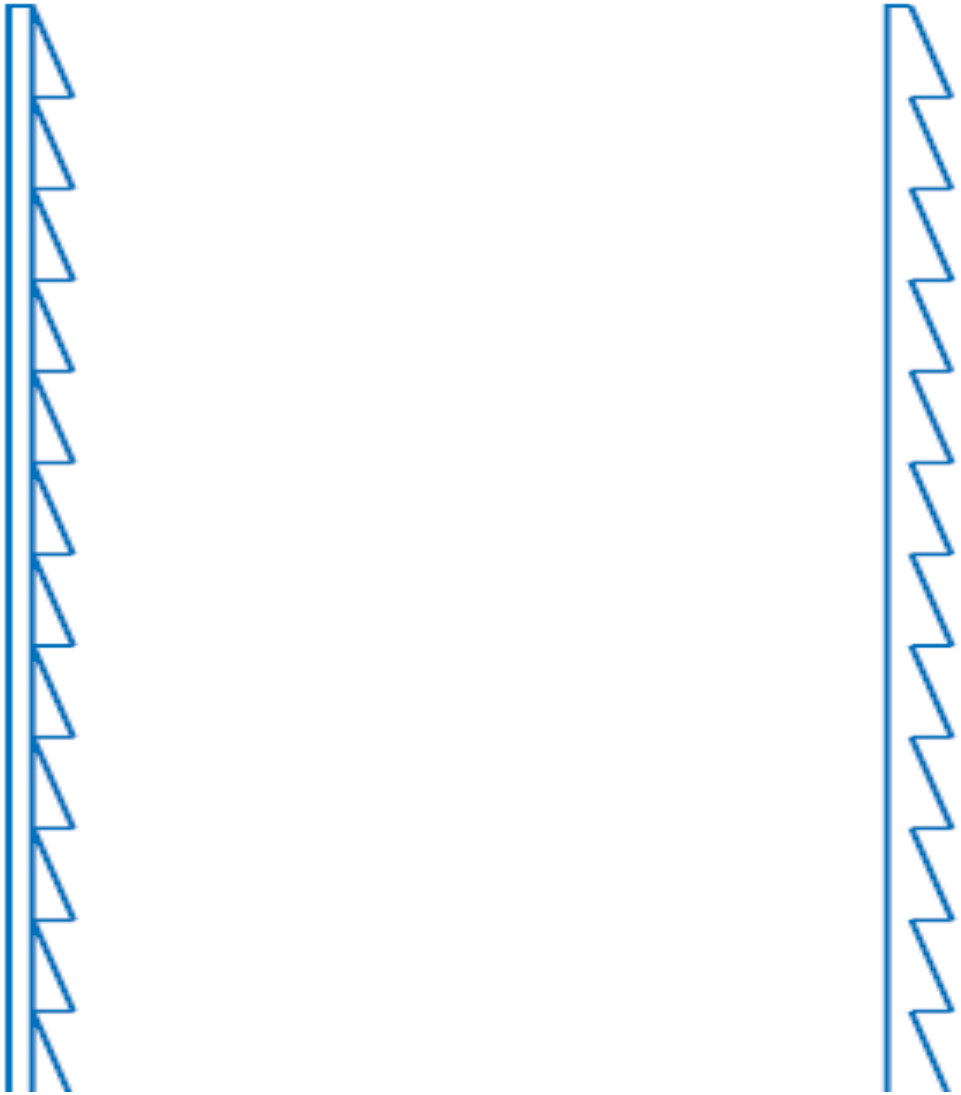
PRISM BAR

TRIAL PRISM

FRESNEL PRISM

FRESNEL PRISMS

- A **traditional prism** has two flat, nonparallel surfaces. Parallel light entering the prism is bent toward the base of the prism and leaves the back surface at an angle. A prism is thicker at the base than at the apex. The larger the prism, the thicker the base of the prism will be.
- A *Fresnel prism* attempts to circumvent thickness by building a "tower" of small, wide prisms. To understand how a Fresnel prism works, imagine cutting off the tops of a large number of equally powered prisms and gluing them, one above the other, onto a thin piece of plastic. A Fresnel prism is only 1 mm thick.



Advantages:

- It is very thin and extremely light weight
- It is flexible and can be applied to an existing spectacle lens, making it possible to apply it on house, without any in house optical laboratory
- As the lens is made from a soft, flexible material, it can be cut to any shape with scissor or razor blade
- Because conventional prism have a large increase in thickness from the apex to base a high powered prism is troubled by magnification difference and changes in across the lens. Although Fresnel lens don’t not eliminate this problem, they do reduce magnification difference considerably.

Disadvantages:

- Fresnel prism can be noticed by other, as they have a number of small ledges, they are harder to clean than the conventional lenses
- High powered prism will come a slight decrease in visual acuity. Most of this is due to the chromatic aberration and distortion associated with prisms
- They can also cause a slight loss of VA, caused by reflections at the prism ledges, especially under certain sources of illumination

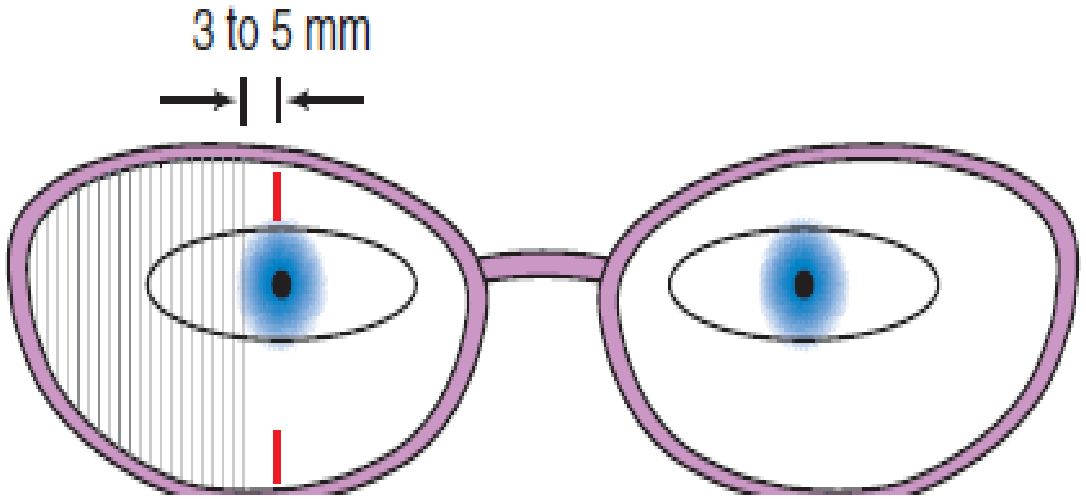
WHEN ARE FRESNEL PRISMS USED?

High Amounts of Prism :Because of its thickness advantage, Fresnel prism is especially useful for high amounts of prism.

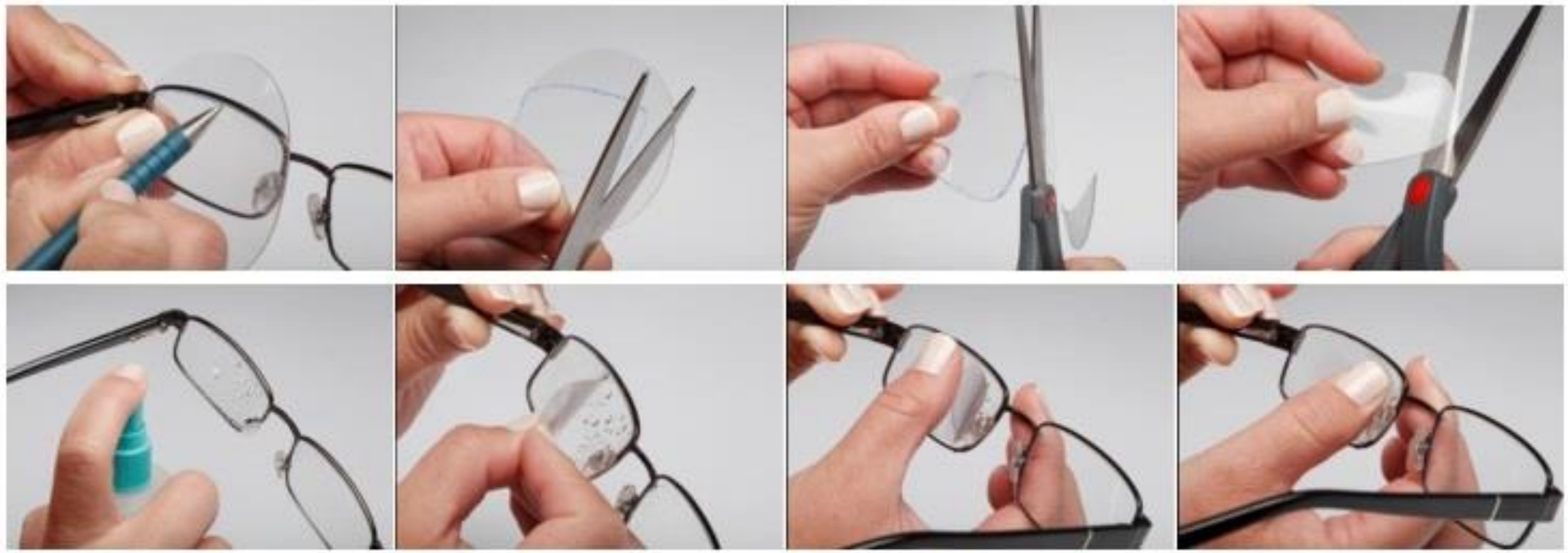
Use and Reuse: Fresnel prism lenses are easy to apply and remove. They may be used and reused. This is helpful when determining how a given prism amount will work long term or for use during visual training.

Sectorial Application: A partially paralyzed extraocular muscle may result in a different amount of prism needed for different directions of gaze. A Fresnel lens can be cut to fi t that particular lens area. Prism is present only where it is needed.

- Visual Field Defects: With visual field defects, prism may be applied in one section of the lens with the base direction in the direction of the defect and the edge of the prism close to the central visual area.

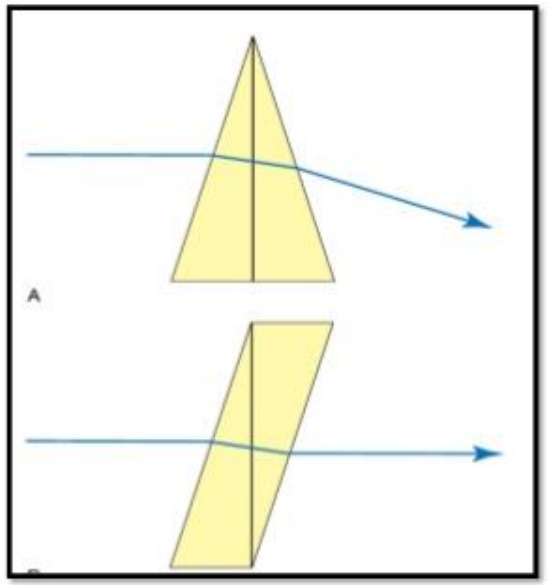


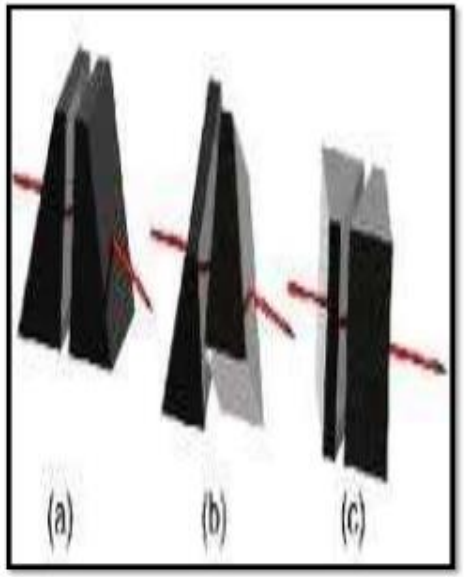
- Cosmetics of Non seeing Eyes: the use of prism to improve the appearance of a blind or prosthetic eye is discussed. Fresnel prisms can be used in such instances.
- Slowing of Nystagmus: In some cases nystagmus may slow when the person looks to one side or the other. For example, if the examiner sees that movement slows when the person looks to the right, equal amounts of prism may be applied to both lenses. The correct base direction would be base left. Because the eyes turn toward the apex, prism base left will keep the head pointed straight while the eyes turn to the right.



ROTATORY PRISM

Risley prism





Rotatory prism

A rotatory prism is combination of two prism. These prism placed one on the top of the other. Initially, their base direction is exactly identical, but as the prisms are rotated, their bases move by equal extend in opposite directions

There are two common forms of the rotating prism in the ophthalmic practice. One found on the phoropter, is used to measure phoria's and ductions. The other found on the some lensometer and is used to measure large amount of the prism in spectacle lenses.

Clinical classification of prisms

Relieving prisms

- AIM: Stabilize motor functions
- ACTION: Optically reduced demand on controlling fusional vergence
- PRESCIPTION: Less than the angle of deviation
- Base: opposite to deviation
- USES: Intermittent strabismus, phorias

Inverse prism

For training and disruptive

AIM- to increase fusional vergence ability

Action- optically increases the demand for controlling fusional vergence

Base- same direction as deviation

Uses- training: in phorias

disruptive: to eliminate ARC

For cosmetics

Indication: poor prognosis for functional care

Aim: to make eye look better

Base: same as the deviation,

Yoked prism

- Aim; stabilizing binocular vision in non concomitancy or dampen nystagmus
- Action: direct the eye in specific gaze direction. Optically moves the retinal image of a fixed target in a parallel towards the base and moves the light towards in base and shows the target towards the apex- both eyes move in same direction
- Uses: Gaze palsy, DRS, Nystagmus

Sector prisms

- Aim: stabilize BSV in one or more gaze/ distances.
- Action: reduce demand for controlling fusional vergence in more then one gaze or distance.

E.g. 20Δ ET(distance vision)

10Δ ET (Near vision)

Rotating prisms

- A method to change sensory input for constant strabismus to precipitate changes from ARC to NRC
- Fresnel prism= 1 week BO then rotate BU,BI,BD
- Uses to disrupt ARC

Corrective prism

- Aim: to stabilise normal sensory fusion
- Action optically neutralize the demand for controlling fusional vergence by elimination of ocular motor deviation
- Prescription = magnitude of deviation= prism
- Base opposite to deviation

Over corrective prism

- AIM- to disrupt ARC
- ACTION: reverse the demand for controlling fusional vergence and optically change the direction of deviation
- Prescription- prism power > magnitude of deviation
- A deviation reverse is seen on cover test and eso become an optical eXo

3.The following Rx is ordered: OD: −5.00 D sphere, OS: −5.00 D sphere ,PD = 60 mm.

An exceptionally large frame is chosen. The frame is so large that it will not allow the correct interpupillary distance (PD) unless an extra large lens blank is used. Using conventional lens blanks will not allow enough decentration. A gap is created temporally where there is not enough lens material to fill the frame. If the blanks were to be used anyway, the situation would require an incorrect placement of the lenses at a PD of 64 mm. How much prism would be induced and in what direction if this wrong PD is used?

two

1. If a +3.50 D sphere is decentred 4 mm in and 5 mm down, what is the resulting prismatic effect?
2. A right lens of power −7.00 D sphere is decentred 3 mm out and 4 mm up. What are the resulting horizontal and vertical prismatic effects?

Oblique prism:

A right lens of power −7.00 D sphere is decentred 5 mm up and out along the 127-degree meridian. What is the resulting prismatic effect and base direction?

Cylindrical power

1. A plus cylinder lens of power Plano +5.00 × 180 is decentred 5 mm to the right. What prismatic effect is produced?
2. How much prism will be induced and in what direction will the base be oriented by decentring a pl −2.00 × 180 right lens a distance of 3 mm upward?
3. A pl +4.00 × 090 cylinder is decentred 5 mm up and 2 mm out. What is the resulting prismatic effect?

- A +6.50D before RE is decentred 3mm nasal. What amount of prism is induced and what is the base orientation.