

UPDAAN



2025

Human Eye and The Colorful World

PHYSICS

Lecture – 01

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Topics to be covered



- 1 HUMAN EYE AND ITS PARTS ✓
- 2 POWER OF ACCOMMODATION ✓
- 3 DEFECTS : MYOPIA (Near-sightedness) ✓
- 4 DEFECTS : HYPERMETROPIA (FAR-SIGHTEDNESS) ✓
- 5 DEFECTS : PRESBYOPIA (OLD AGE HYPERMETROPIA) ✓



Chapter

Human Eye

① eye + its parts

② Defects

- Myopia

- Hypermetropia

- Presbyopia

③ Numerical

— x — λ —

2h

Colorful World

— Dispersion

— Atmospheric Refraction

— Scattering

— NCERT Ques

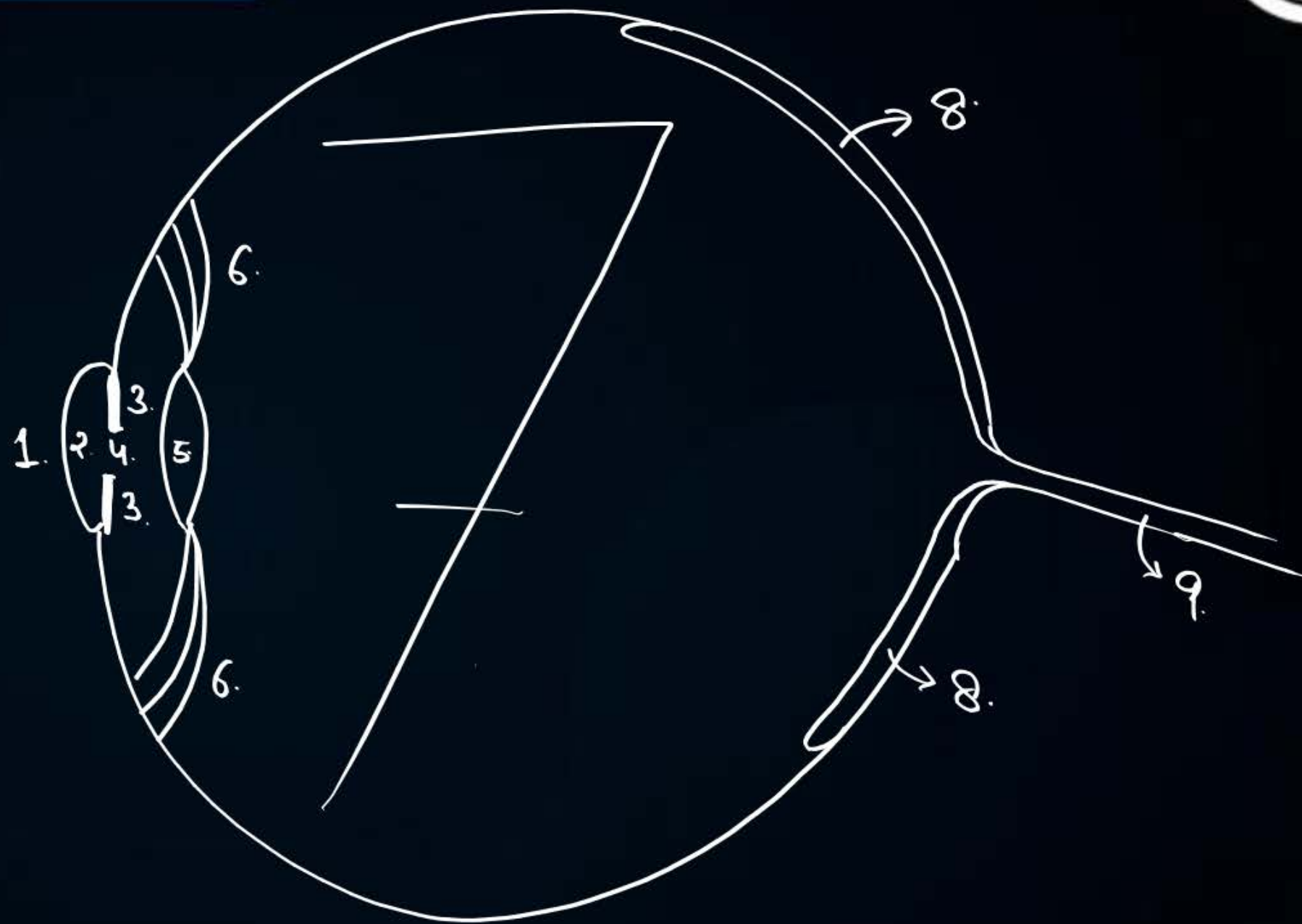
2h+



HUMAN EYE AND ITS PARTS



1. CORNEA
2. AQUEOUS HUMOR
3. IRIS
4. PUPIL
5. CRYSTALLINE EYE LENS
6. Ciliary muscles
7. Vitreous Humor
8. Retina
9. Optic Nerve





HUMAN EYE AND ITS PARTS



- * 1. CORNEA → Outermost part of eye, protects eye from Dust, bacteria etc.
→ 70-80% light is refracted here.
- 2. AQUEOUS HUMOR → Water like fluid, pressure balance inside and outside the eye.
- * 3. IRIS → Controls the size of pupil.
- * 4. PUPIL → regulates the amount of light entering the eye.
- * 5. CRYSTALLINE EYE LENS → flexible convex lens and it forms real and inverted image.
- * 6. Ciliary muscles → it adjusts the focal length of the eye lens.
- 7. Vitreous Humor → it maintains spherical shape of eye.
- * 8. Retina → Photo-sensitive screen, back of the eye, has two kinds of cells
 - Rod → Intensity Sensing
 - Cone → Color Sense
- 9. Optic Nerve → Electrical impulses to brain



POWER OF ACCOMMODATION

Lens formula

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



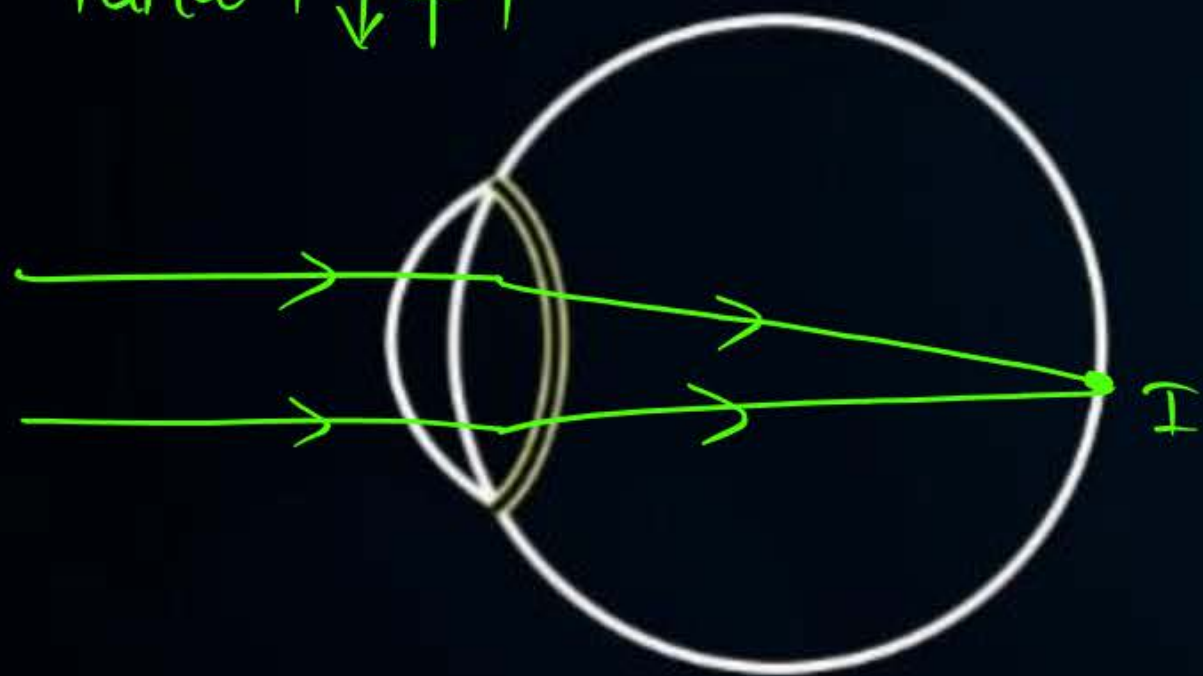
Adjustment

"different" fix

different

- The ability of the eye lens to adjust its focal length as the distances is called **power of accommodation**.

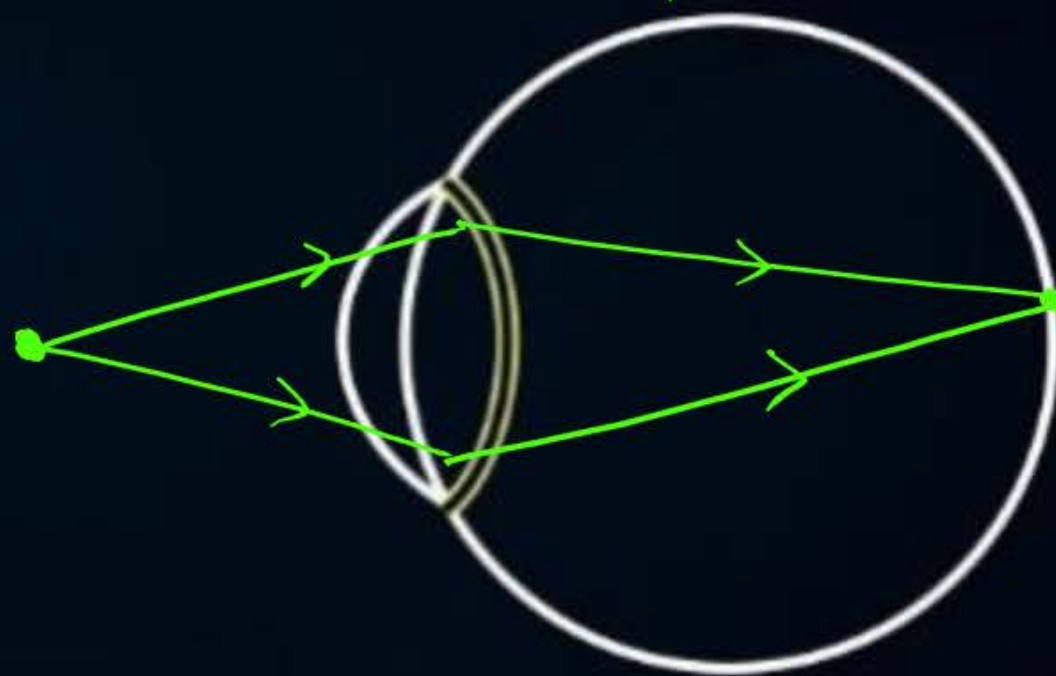
Ciliary muscles - Relax
Patla $P \downarrow f \uparrow$



far point $\Rightarrow \infty$

C.M. - Contracted

Motta $P \uparrow f \downarrow$



Near point = 25cm

QUESTION



An object is placed at a distance of 10 cm from a converging lens of focal length 5 cm. find the nature and position of the image.

- A** A convex lens with power +4D has a focal length -0.25 m.
- B** A convex lens with power -4 D has a focal length $+0.25$.
- C** A concave lens with power +4D has a focal length $+0.25$.
- D** A concave lens with power -4 D has a focal length -0.25 m



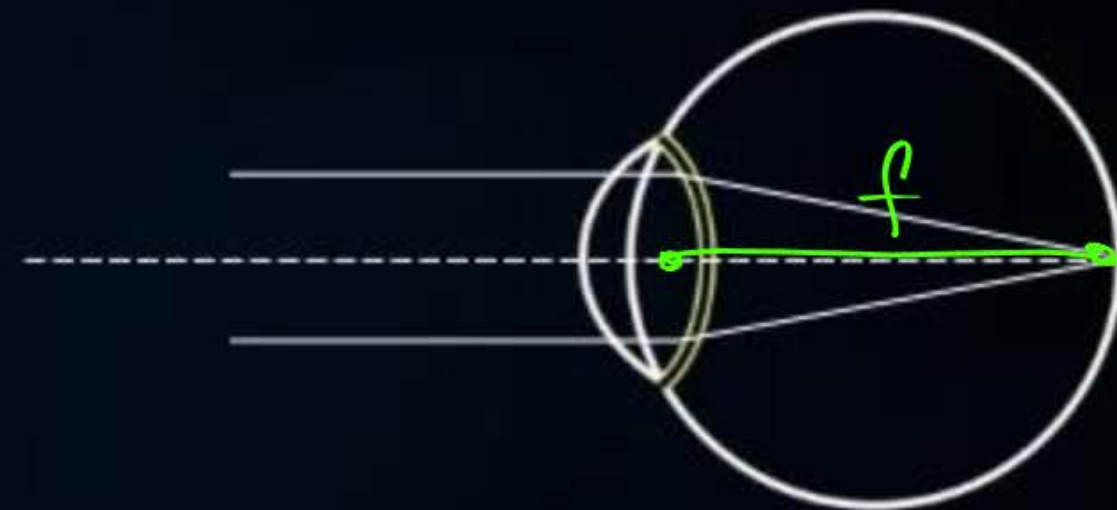
DEFECTS : MYOPIA (Near-sightedness)^{VIP}



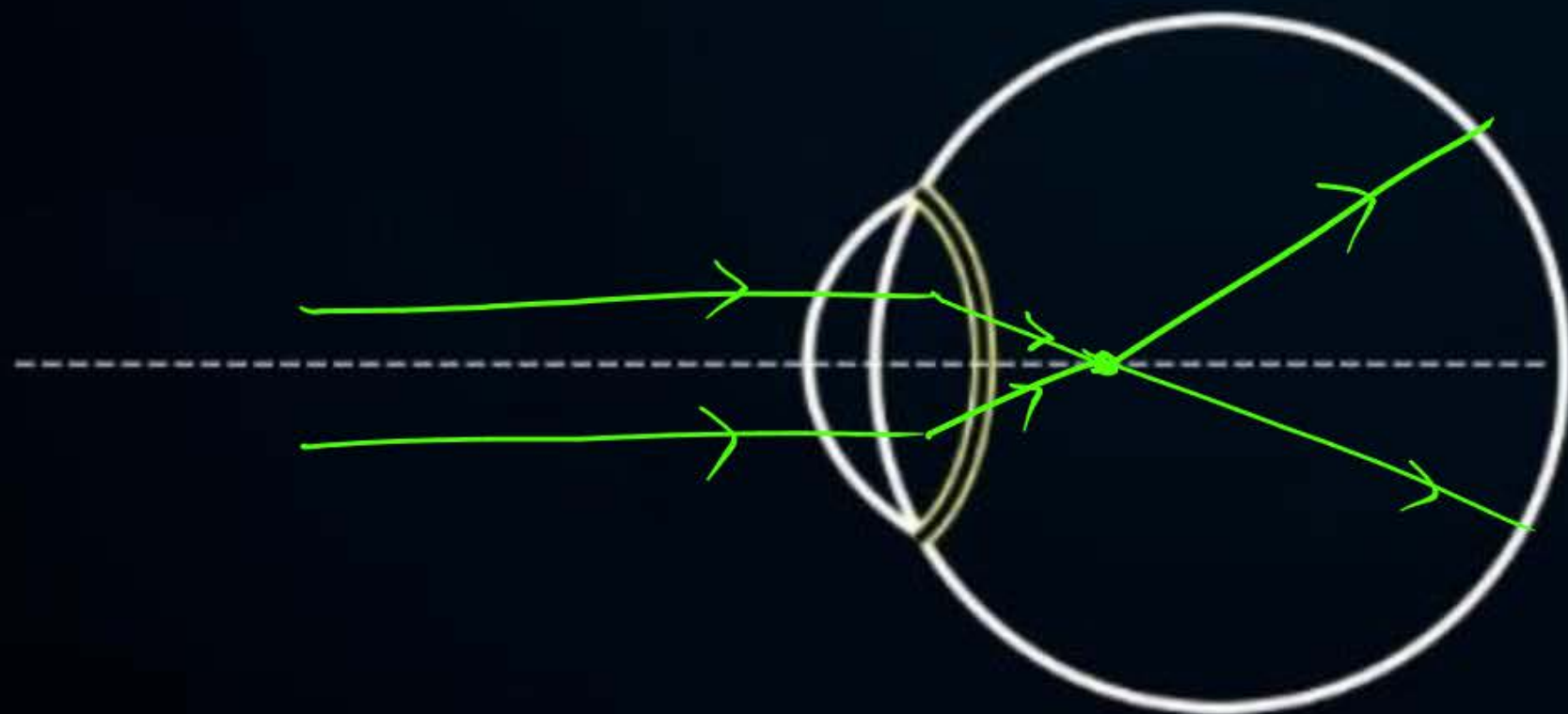
- It is kind of defect in the human eye Due to which a person can see near objects clearly but he cannot see the distant objects clearly. The image forms before the retina. Myopia is due to

Motta ↑
P ↑
f ↓

- (i) Excessive curvature of the eye lens.
- (ii) Elongation of eyeball.



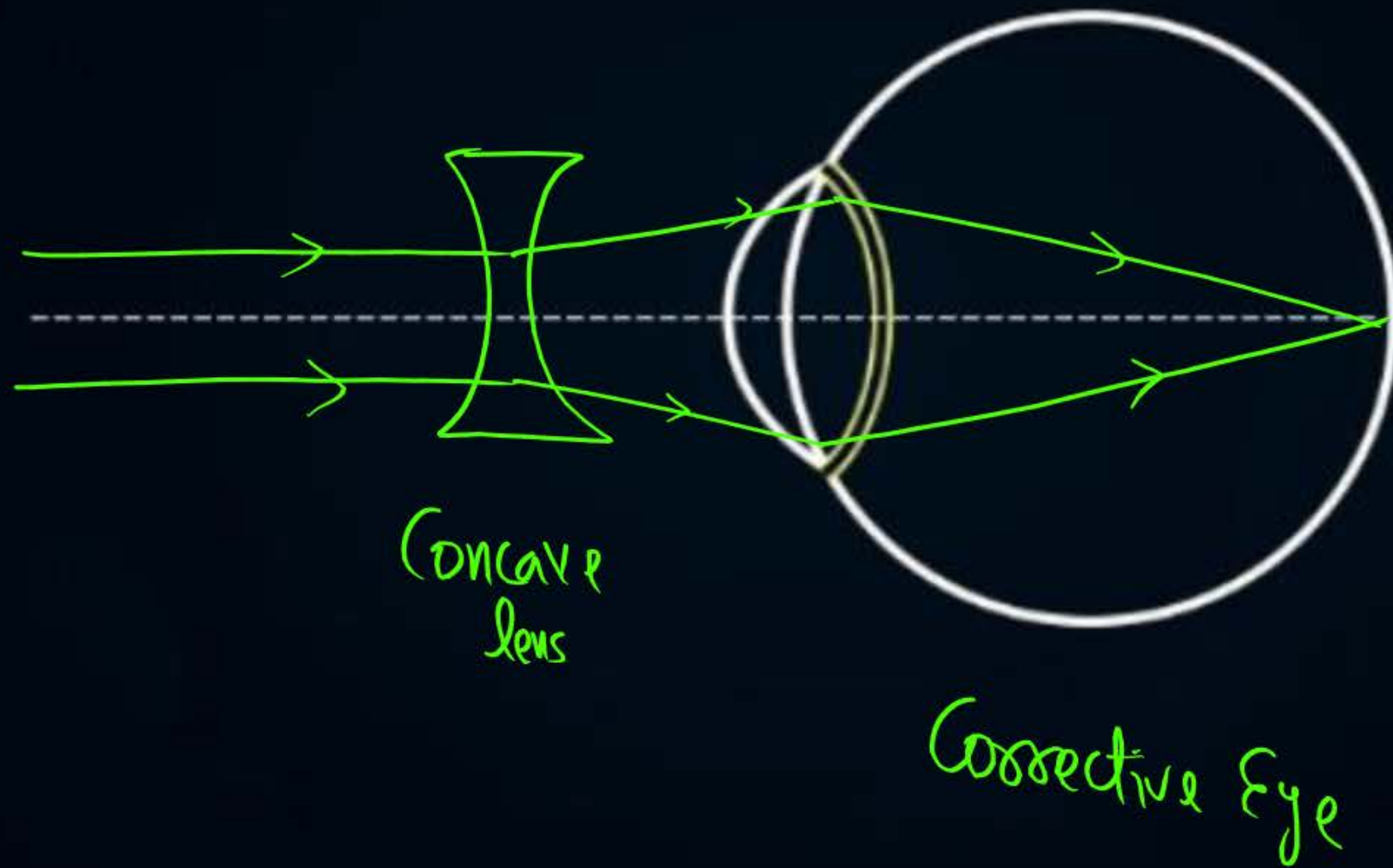
Healthy eye



Myopic Eye



CORRECTION : MYOPIA (NEAR-SIGHTEDNESS)





DEFECTS : HYPERMETROPIA (FAR-SIGHTEDNESS)



- It is a kind of defect in the human eye due to which, a person can see distant objects properly but cannot see the nearby objects clearly. It happens due to

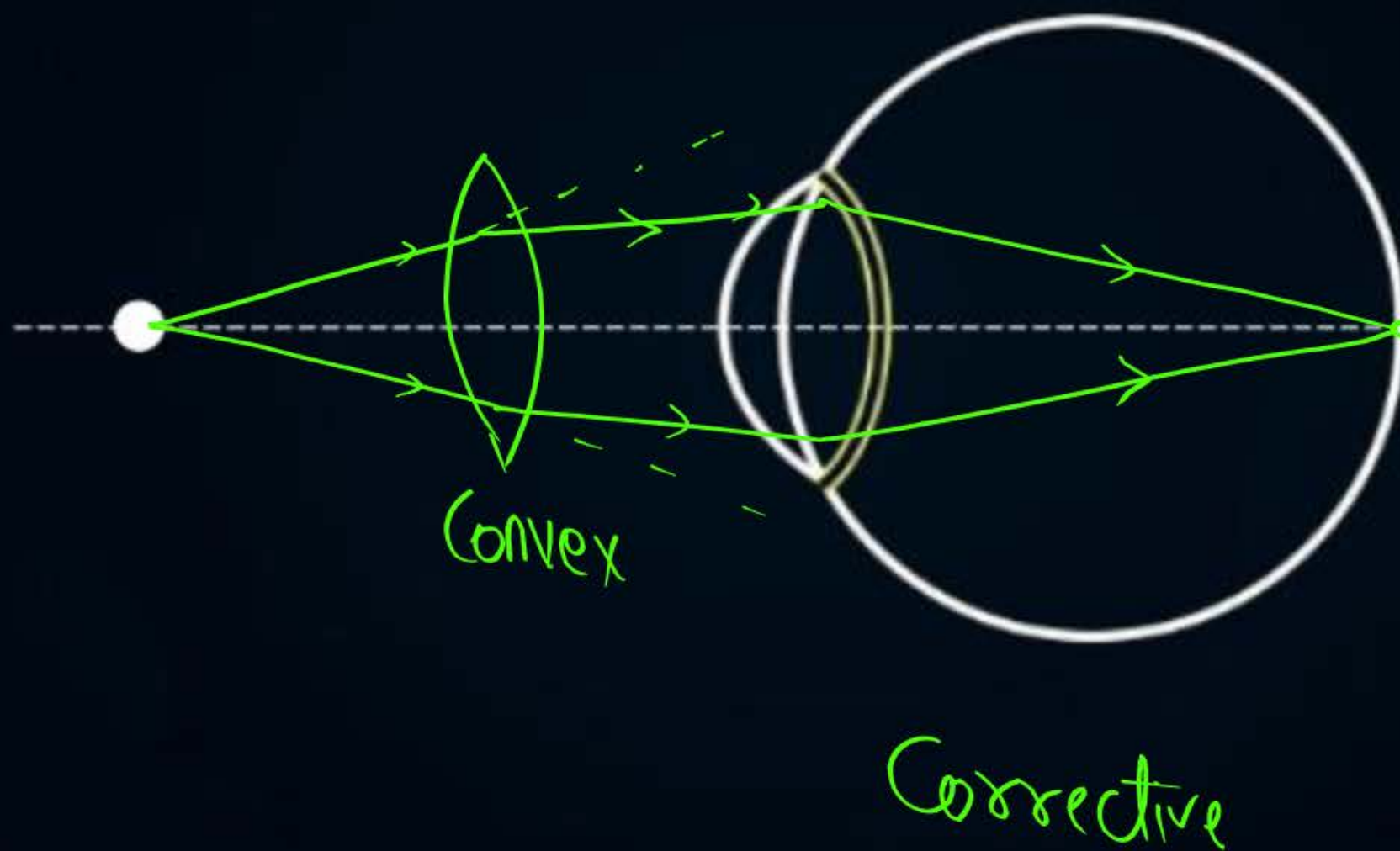
$P \downarrow$
 $f \uparrow$

- ✓ (i) Decrease in the power of eye lens i.e. increase in focal length of eye lens.
- ✓ (ii) Shortening of eyeball.





CORRECTION : HYPERMETROPIA (FAR-SIGHTEDNESS)

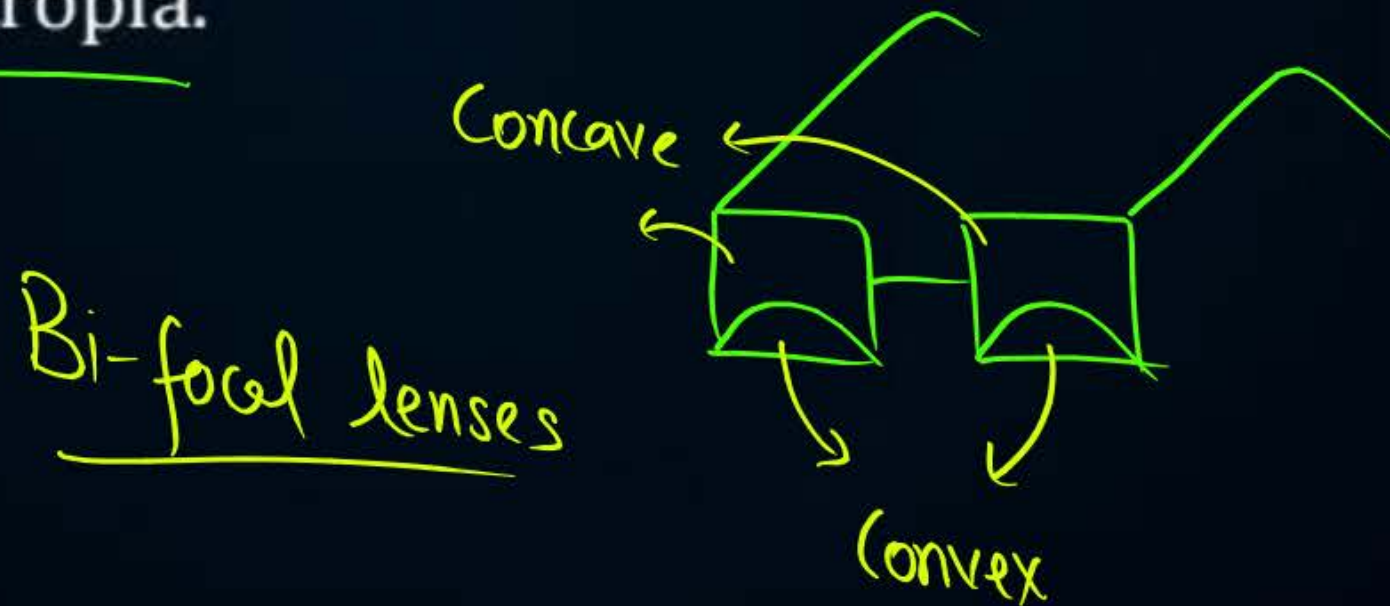




DEFECTS : PRESBYOPIA (OLD AGE HYPERMETROPIA)



- It is a kind of defect in human eye which occurs due to ageing. It happens due to the following reasons
 - (i) Decrease in flexibility of eye lens.
 - (ii) Gradual weakening of ciliary muscles. In this, a person may suffer from both myopia and hypermetropia.





DEFECTS : ASTIGMATISM

(cylindrical problem)



- In this defect a person cannot focus on both horizontal as well as vertical lines at the same time so the person can see objects clearly only in one plane.

Causes:- Astigmatism is caused by an irregularly shaped cornea or distorted lens.

Correction:- This defect can be corrected using cylindrical lens.



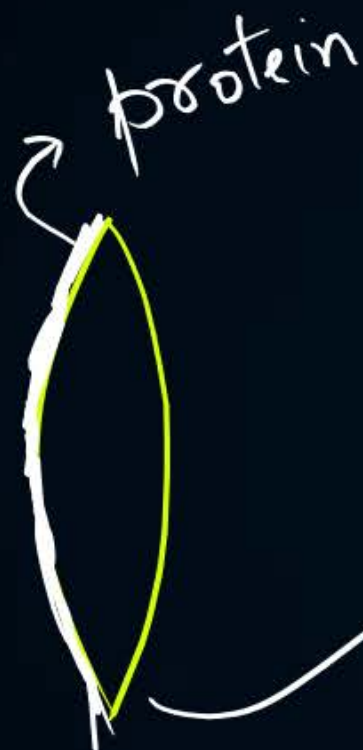


DEFECTS : CATARACT

(Motia bind)



in this defect,
a white opacity
of eye lens
occurs which
can lead to
total blindness.



'Surgery'

QUESTION



Which of the following eye defects can be rectified using cylindrical lens?

- A** Myopia
- B** Presbyopia
- C** Astigmatism
- D** Hyper myopia

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

Myopia

$$u = -\infty$$

$$v = - \text{Given Value of Gadbod}$$

$$f = ?$$

$$P = ?$$

Numerical

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

Hypermetropia

$$u = -25\text{cm}$$

$$v = - \text{Given Value of Gadbod}$$

$$f = ?$$

$$P = ?$$

QUESTION

Myopia

$$\frac{1}{\infty} = 0$$



A person can not clearly see objects at a distance more than 40 cm. He is advised to use lens of power.

$$u = -\infty$$

$$v = -40 \text{ cm}$$

$$f = ?$$

$$P = ?$$

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

$$\frac{1}{f} = \frac{1}{-40} - \left(\frac{1}{-\infty} \right)$$

$$\frac{1}{f} = -\frac{1}{40} + 0$$

$$f = -40 \text{ cm}$$

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

$$= \frac{100}{-40} = -2.5 \text{ D}$$

$$P = -2.5 \text{ D}$$

QUESTION

Hypermetropia \rightarrow Convex



An old aged person can read the newspaper by keeping it at 80 cm in front of his eye.
What is the nature and power of the lens required to correct the problem?

$$u = -25 \text{ cm}$$

$$v = -80 \text{ cm}$$

$$f = ?$$

$$P = ?$$

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

$$\frac{1}{f} = \frac{1}{-80} - \left(\frac{1}{-25} \right)$$

$$\frac{1}{f} = \frac{1}{-80} + \frac{1}{25}$$

$$\frac{1}{f} = \frac{-5 + 16}{400} = \frac{11}{400}$$

$$f = \frac{400}{11} \text{ cm}$$

$$P = \frac{100}{f(\text{cm})} = \frac{100}{\frac{400}{11}}$$

$$P = \frac{11}{4} \text{ D}$$

$$= \frac{1100}{400} = \frac{11}{4}$$



THANK
YOU

