UDAAN

2025

LIGHT

- Reflection & Refraction

PHYSICS | Lecture – 03

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Topics to be covered

1. Sign convention in spherical mirrors
2. Mirror Formula and Magnification
3. Numerical on Reflection through spherical mirror
4. NCERT in One shot : Reflection

Agar Numerical Karne Ho To !!!

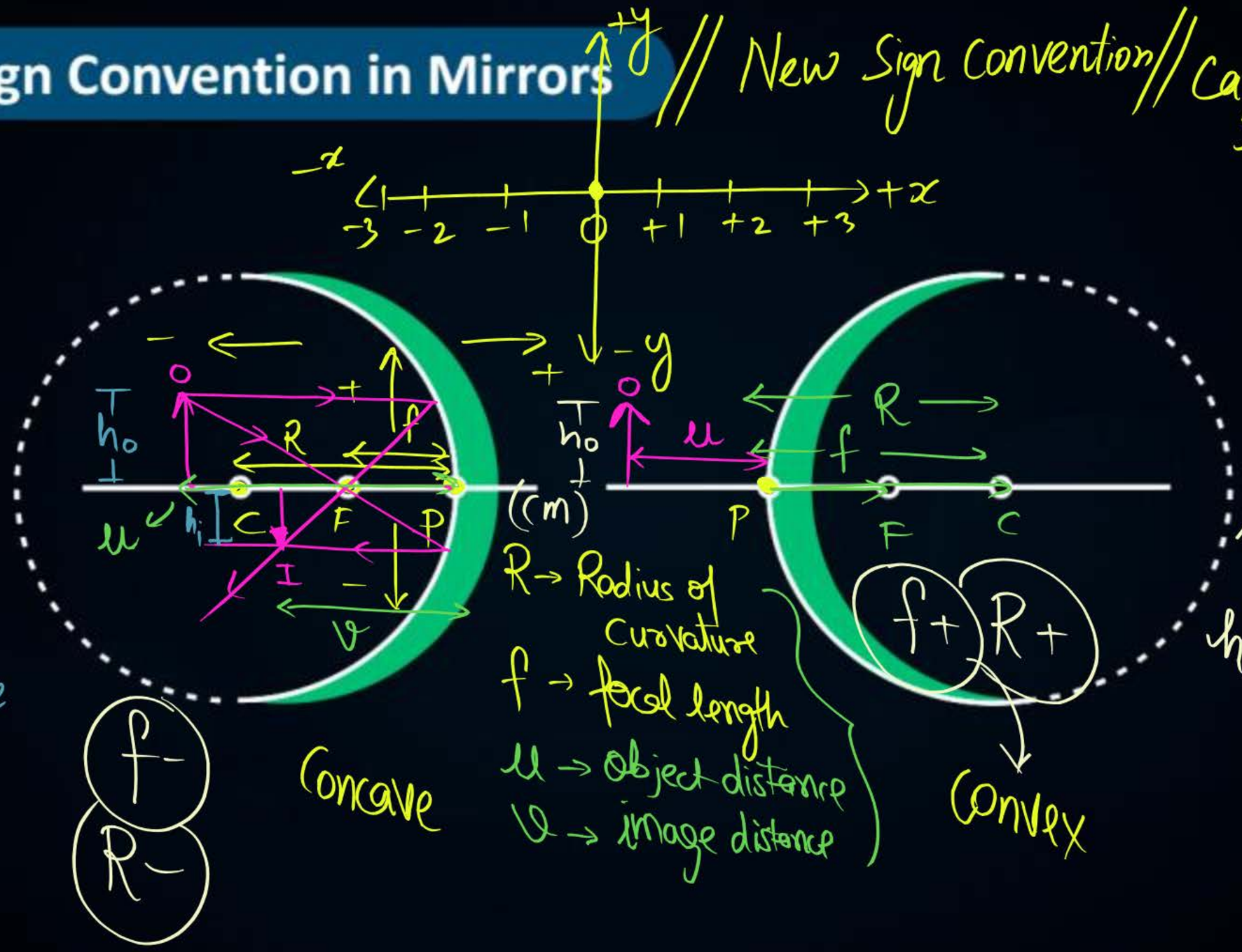
H.W. of prev. Year

- **Ray Diagrams** Yaad Hone chahiye !!!
- **Sign Convention** Samajhne Ki Cheez hai !!!
- **Formulae** Ratna Hai !!!

O.P. ↓ Numerical O.P.

Sign Convention in Mirrors

// New Sign Convention // Cartesian Sign Convention



h_o → height of object (cm)

h_i → height of image (cm)

R → Radius of Curvature

f → focal length

u → object distance

v → image distance

NOTE :-

u → Always -ve

h_o → Always +ve

Formulae

Mirror formula : $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ → याद

Derivation in XII

Magnification : $m = \frac{-v}{u}$ → याद

By Definition → $m = \frac{h_{img}}{h_{obj}}$ → समझना है।

Weapons

→ Image ka Nature Pata Karne

Value chupa ke Sign dekho
Sign chupa ke Value Dekho

$0 < m < 1$: Diminished

$m = 1$: Same Size

$m > 1$: Enlarged / magnified

m → $+$: Virtual + Erect

→ $-$: Real + inverted

* Magnification :- Ratio of height of image to height of object.

1) denote by `m'

2) Unitless

$$m = \frac{h_i \rightarrow \cancel{cm}}{h_o \rightarrow \cancel{cm}}$$

* Feel → `m' Hume Yeh Batata hai ki image ki height, object ki height se kitne Guna Badi hai/choti hai/same hai

One Step Ahead : Formulae

- Mirror Formula :

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

- Magnification Formula :

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

$$m = \frac{h_{\text{image}}}{h_{\text{object}}}$$

$0 < m < 1$: Diminished

$m = 1$: Same size

$m > 1$: Enlarged / Magnified

m → + : ERECT

m → − : INVERTED

Practice
QUESTION

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

इनको

↳ Concave Mirror

(Always) $u = -10cm$

$f = -5cm$

$V = ?$

$m = ?$

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

$$\frac{1}{-5} = \frac{1}{V} + \left(\frac{1}{-10}\right)$$

$$-\frac{1}{5} = \frac{1}{V} - \frac{1}{10}$$

$$\frac{1}{10} - \frac{1}{5} = \frac{1}{V}$$

$$\frac{1-2}{10} = \frac{1}{V}$$

$$-\frac{1}{10} = \frac{1}{V}$$

$$\boxed{V = -10cm}$$

$$m = -\frac{V}{u}$$

$$m = -\left(\frac{-10}{-10}\right)$$

$$\boxed{m = -1}$$

R+I

Same Size

NCERT DISCUSSION

REFLECTION

in ONE SHOT

QUESTION-01 (Page No. 168)

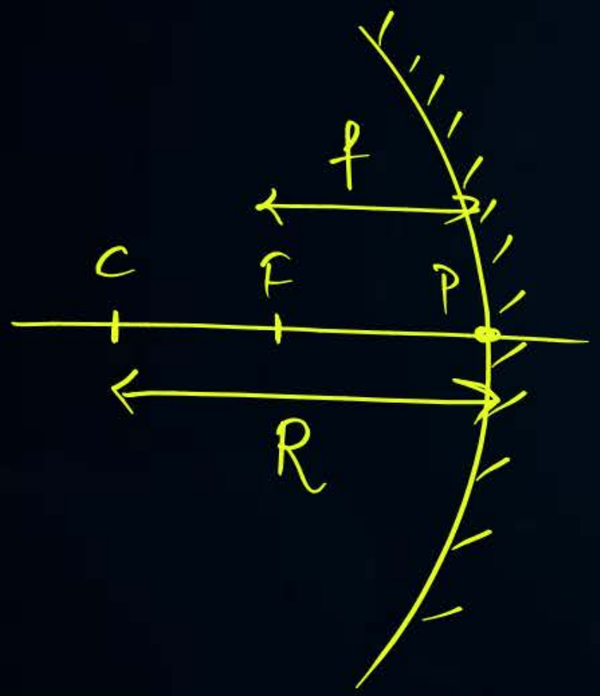
Define the principal focus of a concave mirror.

↓

'Notes'

QUESTION-02 (Page No. 168)

The radius of curvature of a spherical mirror is 20 cm. What is its focal



$R = 20\ cm$

$f = ?$

$R = 2f$

$20 = 2f$

$f = 10\ cm$

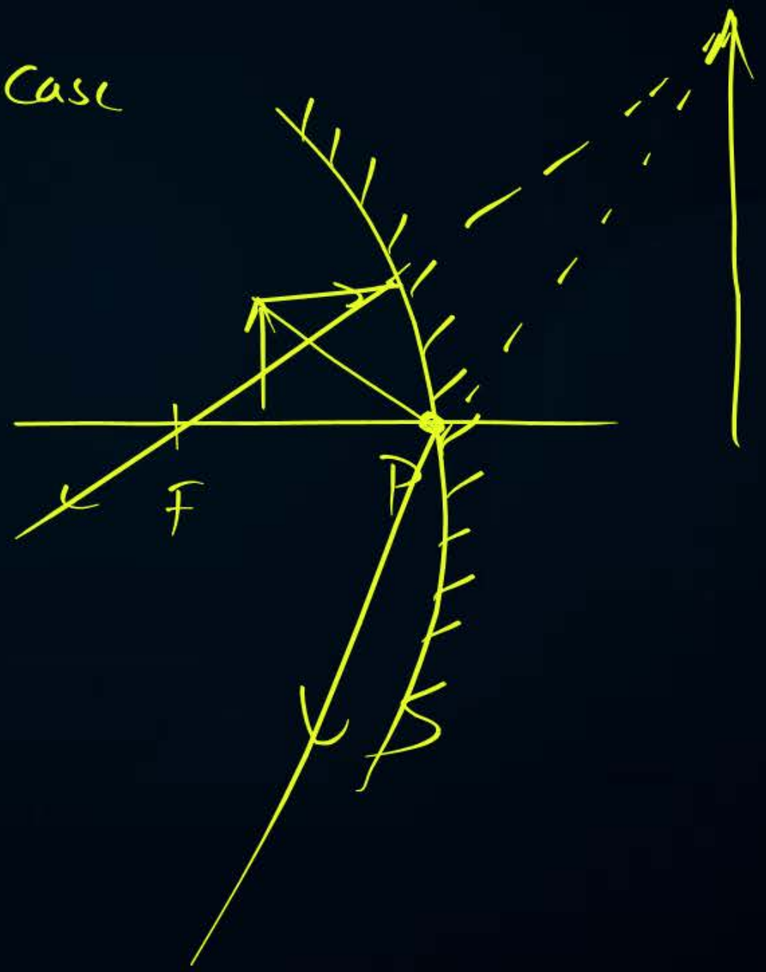
QUESTION-03 (Page No. 168)

V.E.D. ⇒ Convex

Name a mirror that can give an erect and enlarged image of an object.

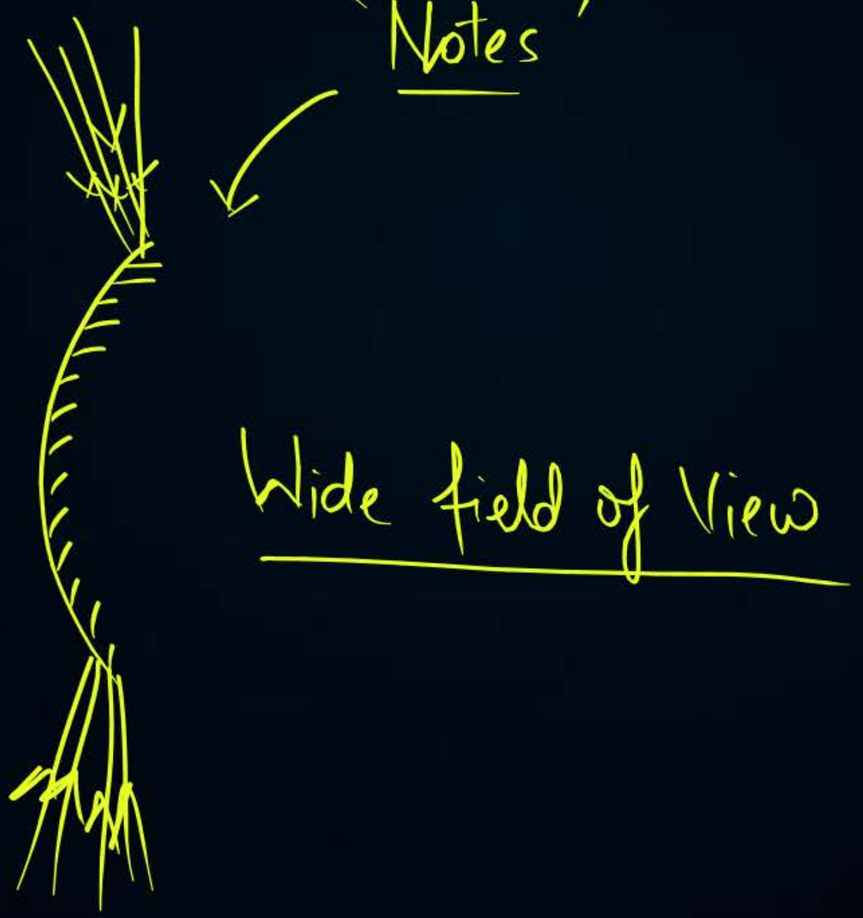
Concave Mirror

6th case



QUESTION-04 (Page No. 168)

Why do we prefer a convex mirror as a rear-view mirror in vehicles?



Page No. 170 (Ex. 10.1)

A convex mirror used for rear-view on an automobile has a radius of curvature of 3.00 m. If a bus is located at 5.00 m from this mirror, find the position, nature and size of the image.

obj

$R = +3m$

$f = +1.5m$

(Always) $u = -5m$

$V = ?$

$m = ?$

Size = Diminished

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

$$\frac{1}{1.5} = \frac{1}{V} + \left(\frac{1}{-5}\right)$$

$$\frac{1}{1.5} = \frac{1}{V} - \frac{1}{5}$$

$$\frac{10}{15} + \frac{1}{5} = \frac{1}{V}$$

$$\frac{10}{15} + \frac{1}{5} = \frac{1}{V}$$

$$\frac{10+3}{15} = \frac{1}{V}$$

$$\frac{13}{15} = \frac{1}{V}$$

$$V = \frac{15}{13}m$$

$$m = -\frac{V}{u}$$

$$= +\frac{15}{13(+5)}^{3}$$

$m = +\frac{3}{13}$

V + E + D

Page No. 170 (Ex. 10.2)

An object, 4.0 cm in size, is placed at 25.0 cm in front of a concave mirror of focal length 15.0 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image? Find the nature and the size of the image.

→ 'Real Image'

Given :-

(Always) $h_o = +4\,cm$

(Always) $u = -25\,cm$

$f = -15\,cm$

- $v = ?$
- $m = ?$
- $h_i = ?$

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

$$\frac{1}{-15} = \frac{1}{v} + \left(\frac{1}{-25}\right)$$

$$-\frac{1}{15} = \frac{1}{v} - \frac{1}{25}$$

$$\frac{1}{25} - \frac{1}{15} = \frac{1}{v}$$

$$\frac{3-5}{75} = \frac{1}{v}$$

$$\frac{-2}{75} = \frac{1}{v}$$

$$\boxed{v = -\frac{75}{2}\,cm}$$

$$v = -37.5\,cm$$

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

$$= -\left(+\frac{75}{2}\right)\frac{3}{(-25)}$$

$$\boxed{m = -\left(\frac{3}{2}\right)}$$

R + I + Enlarged

$$m = \frac{h_i}{h_o}$$

$$-\frac{3}{2} = \frac{h_i}{+4}$$

$$\boxed{h_i = -6\,cm}$$

Inverted

Page No. 171 (Q.1)

Find the focal length of a convex mirror whose radius of curvature is 32 cm.

$R = +32\ cm$

$f = \frac{R}{2} = \frac{32}{2}$

$= +16\ cm$

Page No. 171 (Q.2)

Imp.

Inverted

+

A concave mirror produces three times magnified (enlarged) real image of an object placed at 10 cm in front of it. Where is the image located?

$m = -3$

$u = -10\,cm$

$V = ?$

$$m = -\frac{V}{u}$$

$$-3 = +\frac{V}{-10}$$

$$V = -30\,cm$$

Page No. 185 (Ex. Q.2)

MCQ

The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should be the position of the object?

6th Case

(a) Between the principal focus and the centre of curvature

(b) At the centre of curvature

(c) Beyond the centre of curvature

(d) Between the pole of the mirror and its principal focus.

6th Case

Page No. 185 (Ex. Q.4)

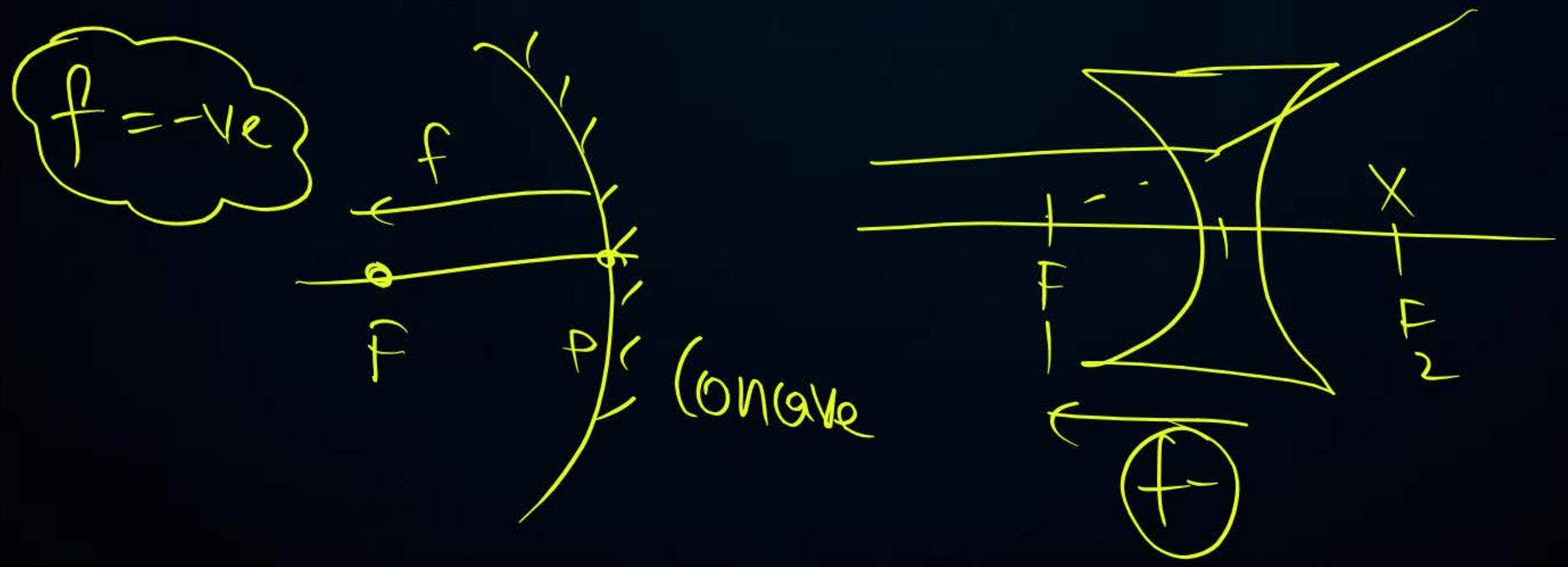
A spherical mirror and a thin spherical lens have each a focal length of −15 cm. The mirror and the lens are likely to be

(a) both concave.

(b) both convex.

(c) the mirror is concave and the lens is convex.

(d) the mirror is convex, but the lens is concave.



Page No. 185 (Ex. Q.5)

No matter how far you stand from a mirror, your image appears erect. The mirror is likely to be

(a) only plane.

(b) only concave.

(c) only convex.

(d) either plane or convex.

Convex Mirror → V.E.D.

Erect

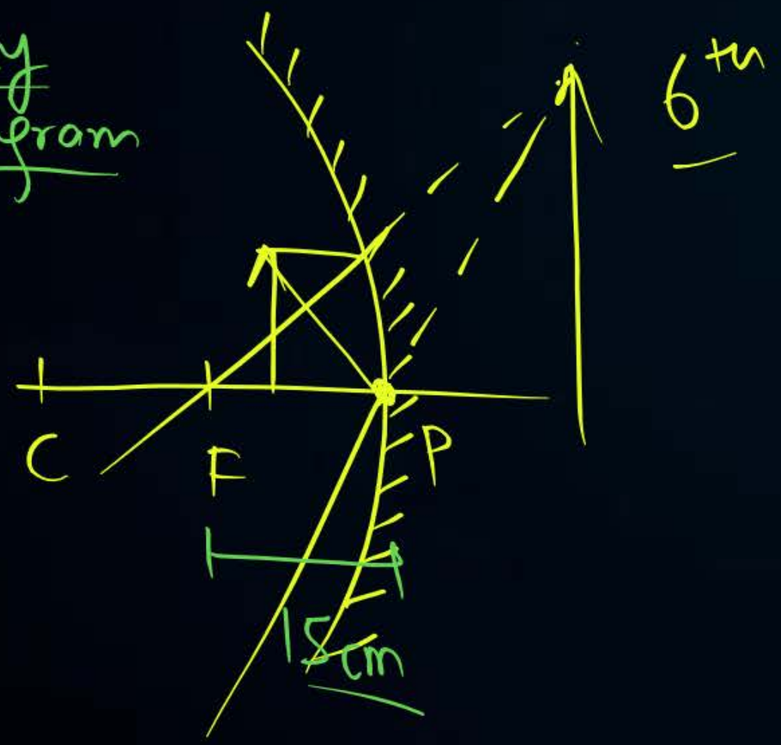
Plane

Page No. 186 (Ex. Q.7)

$\equiv$ 6th Case

We wish to obtain an erect image of an object, using a concave mirror of focal length 15 cm. What should be the range of distance of the object from the mirror? What is the nature of the image? Is the image larger or smaller than the object? Draw a ray diagram to show the image formation in this case.

Ray Diagram



Range : less than 15 cm

B/w F and P.

Virtual

Erect

Enlarged

Page No. 186 (Ex. Q.8)

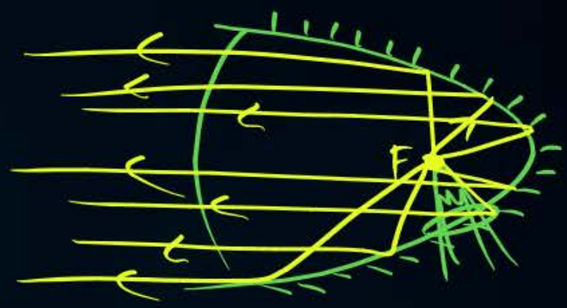
Name the type of mirror used in the following situations.

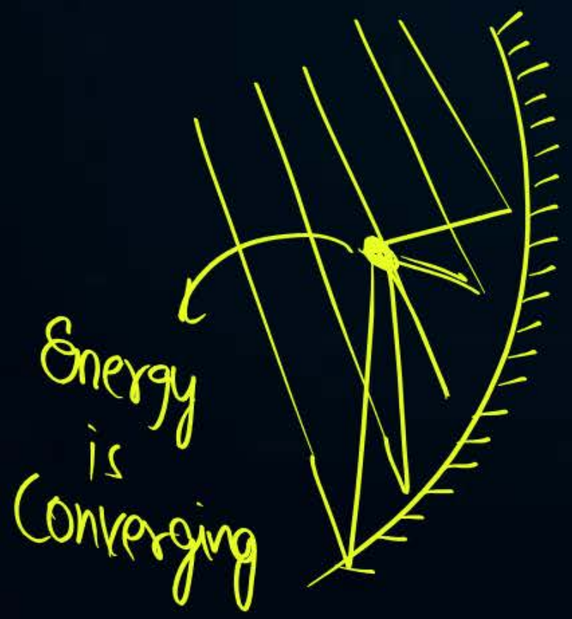
(a) Headlights of a car. → Concave Mirror

(b) Side/rear-view mirror of a vehicle. → Convex

(c) Solar furnace. → Concave Mirror

Support your answer with reason.





Page No. 186 (Ex. Q.12)

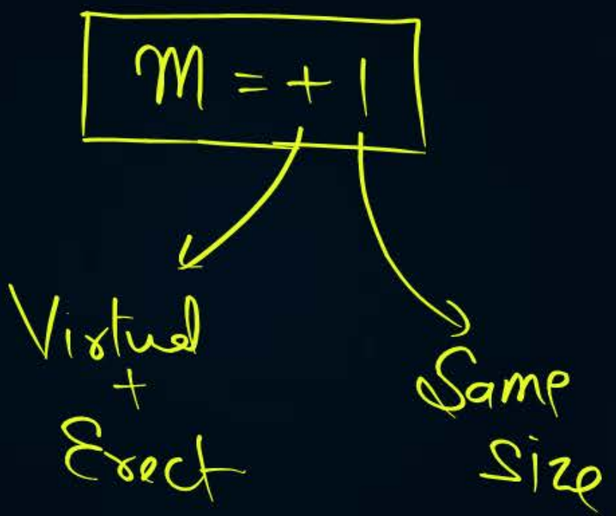
H.W.

An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position and nature of the image.

V m

Page No. 186 (Ex. Q.13)

The magnification produced by a plane mirror is +1. What does this mean?



Page No. 186 (Ex. Q.14)

H.W.

An object 5.0 cm in length is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. Find the position of the image, its nature and size.

$h_o = 5\text{cm}$

$u = -20\text{cm}$

$R = +30\text{cm}$

$f = +15\text{cm}$

Page No. 186 (Ex. Q.15)

An object of size 7.0 cm is placed at 27 cm in front of a concave mirror of focal length 18 cm. At what distance from the mirror should a screen be placed, so that a sharp focussed image can be obtained? Find the size and the nature of the image.

$h_o = 7\,cm$

$u = -27\,cm$

$f = -18\,cm$

$V = ?$

$m = ?$

$h_i = ?$

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

$$\frac{1}{-18} = \frac{1}{v} + \left(\frac{1}{-27}\right)$$

$$-\frac{1}{18} = \frac{1}{v} - \frac{1}{27}$$

$$\frac{1}{27} - \frac{1}{18} = \frac{1}{v}$$

$$\frac{2-3}{54} = \frac{1}{v}$$

$$-\frac{1}{54} = \frac{1}{v}$$

$$V = -54\,cm$$

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

$$= -\frac{(+54)}{(+27)}$$

$$m = -2$$

R + I + Enlarged

$$m = \frac{h_i}{h_o}$$

$$-2 = \frac{h_i}{7}$$

$$h_i = -14\,cm$$

HOMEWORK

2 Sawaal

D.P.P.

Ray Diagrams × 3

6th Case × 4

THANK YOU