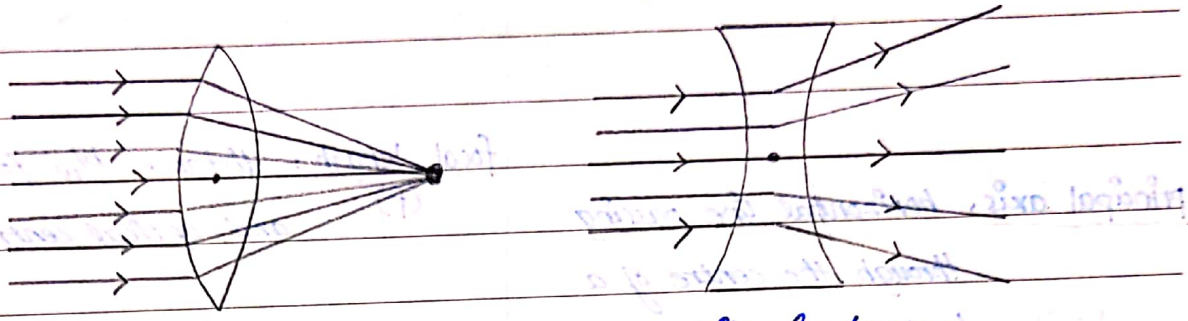
Date: 10/8/20

LENSE

→ a piece of glass or clear plastic with curved surfaces is called a lense

→ lense is used to refract light / light refracts when it passes through a lense



Converging lense

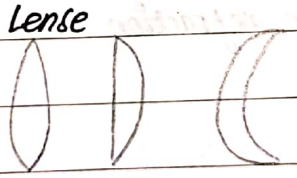
Diverging lense

→ when light passes through the centre of lens then it does not refract at all

→ when parallel light rays pass through the lens (other than the center) then it refracts

→ angle of refraction is greatest (maximum) for the light which passes through the edges of the lense

Converging Lense

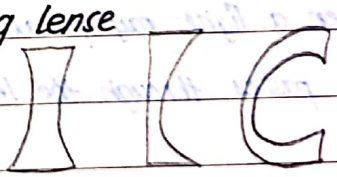


★ convex lense

★ a lense which is thick at the middle and thin at the edges

★ it is used to bring parallel rays of light at a point or converge parallel rays of light at a single point

Diverging lense



★ concave lense

★ a lense which is thin at the middle and thick at the edges

★ it is used to spread out parallel rays rays of light or diverge parallel rays of light

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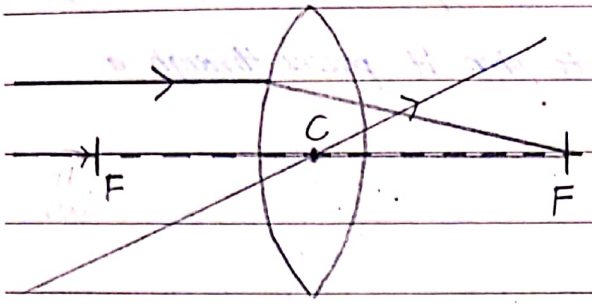
Properties of a converging lense



principal axis: horizontal line passing through the centre of a lense perpendicularly

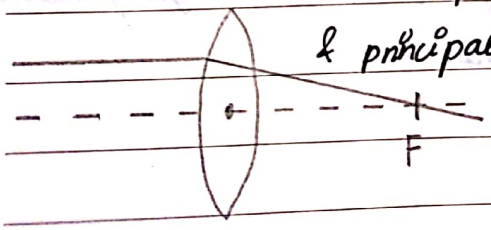
optical centre (C): centre of lense that lies on the principal axis

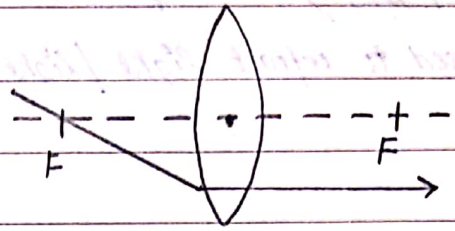
→ light will not refract when it passes through the optical centre regardless of the angle of incidence

→ when a light ray parallel to principal axis passes through the lense it refracts

focal point (F): a point at which parallel rays of light meet after passing through the lense

distance b/w optical centre & principal focus





focal length (f): distance b/w focal point and optical centre

- u is the object distance from the centre of the lens
- v is the image distance from the centre of lens

principal focus: point on principal axis through which light passes after refraction

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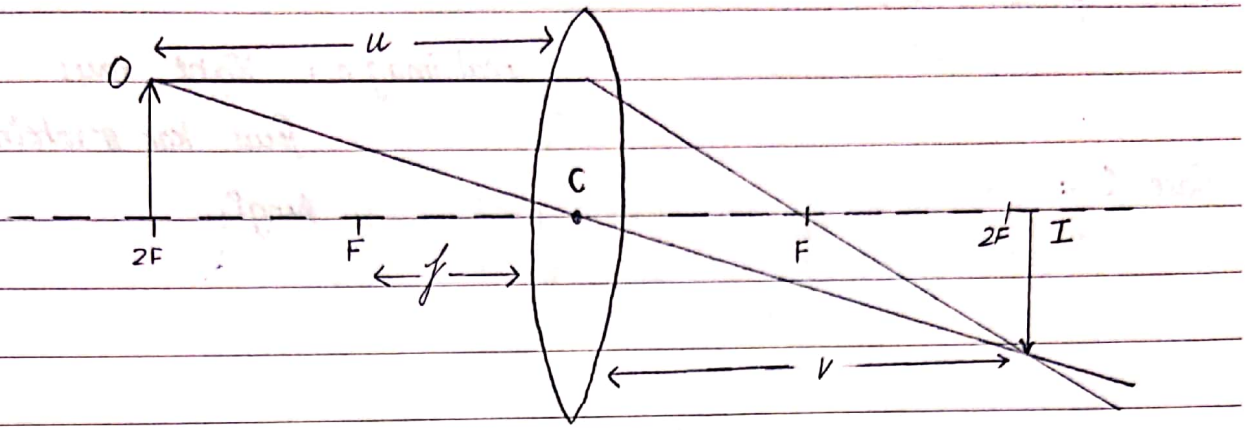
Image formed by a thin converging lens



O : object

I : Image

u = distance of object from lens

v = distance of image from lens

f = focal length

* parallel to principal axis light ray → must pass through focal point (F)

Opposite haga kay light ray passing from focus will refract parallel to principal axis

Steps

1. Draw a horizontal line to represent the principle axis
2. Draw a converging lens at the middle of principle axis. It must be ⊥ to the principle axis
3. label optical centre of the lens as point C
4. Label focal point on both sides of the lens
5. Draw a vertical arrow on the leftside of the lens to represent object O.
6. Label distance b/w point O & C as "u"
7. Pass two rays of light from the lens starting from the head of the object such that one of the rays passes through the optical centre & other ray passes parallel to the principle axis

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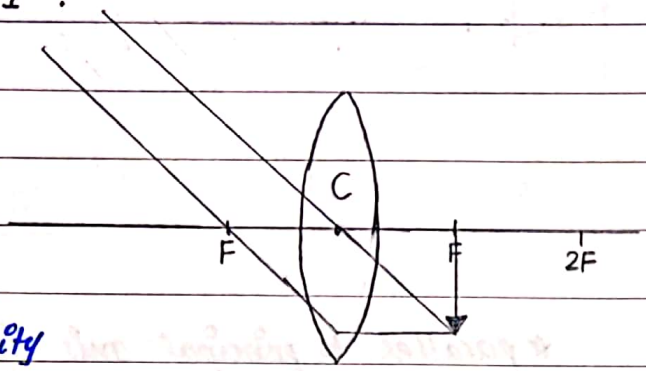
(8). Join the axis with intersection of the rays through an arrow & label it as 'I'

real image : light rays focus kar rahein hongi

Case 1 :



u = infinity

v = f

Image :

(1). inverted

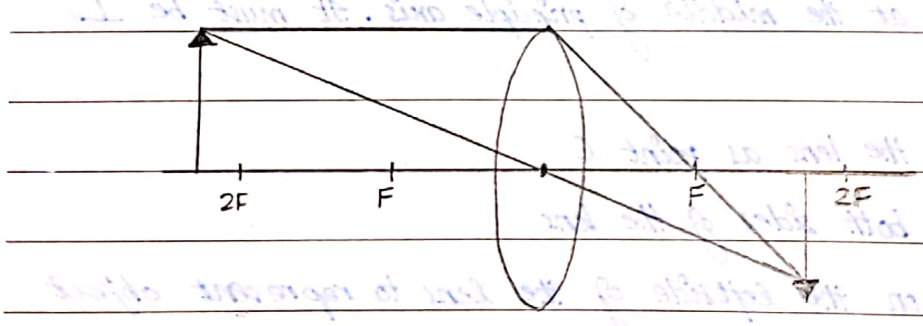
(2). real

(3). diminished

Use :

→ contact lense of a telescope

Case 2 :



u > 2F

f < v < 2f

Image :

(1). inverted

(2). real

(3). diminished

Use :

→ camera

→ eyes

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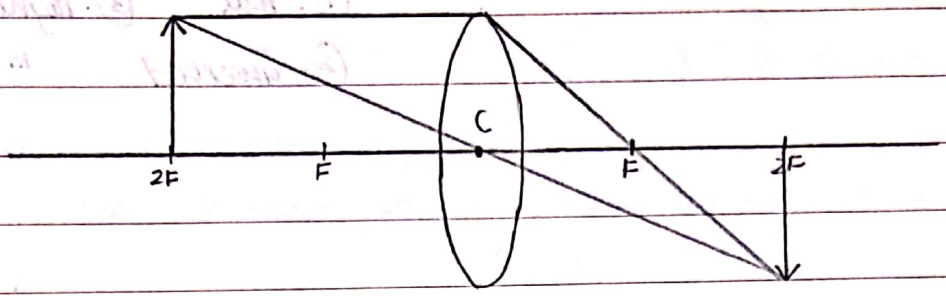
magnification = $\frac{\text{height of image}}{\text{height of object}}$

Case 3:



$u = 2f$

$v = 2f$

Image:

1. inverted
2. real
3. same size

Use:

→ photocopier machine

Case 4:

$f < u < 2f$

$v > 2f$

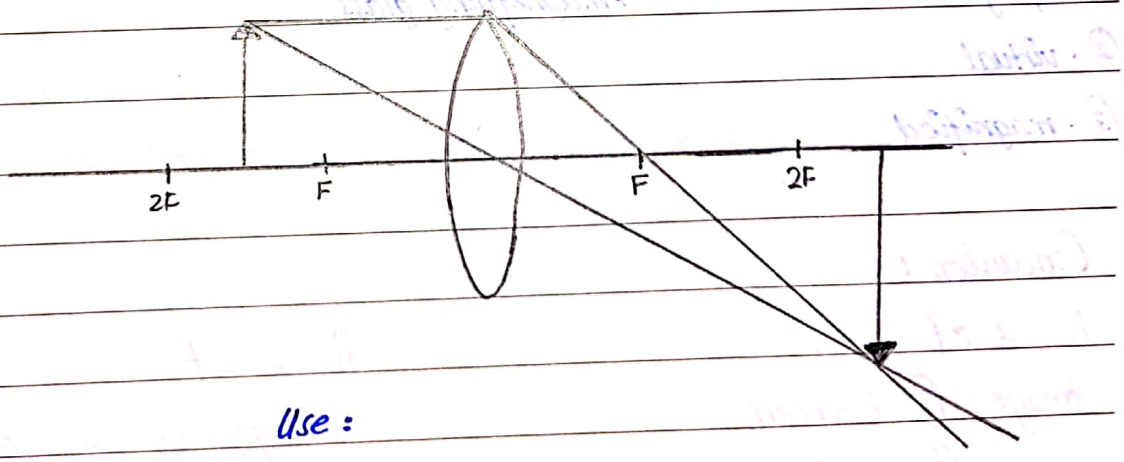


Image:

1. inverted
2. real
3. magnified

Use:

→ ~~magnifying glass~~

→ projector

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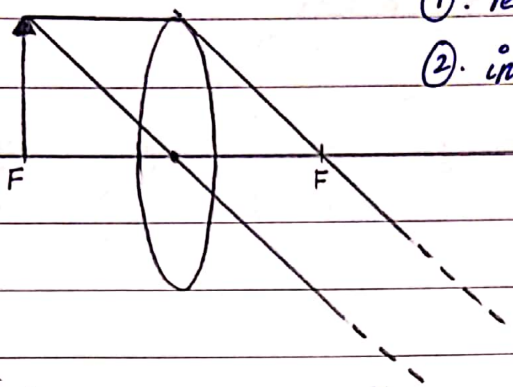
Case 5:

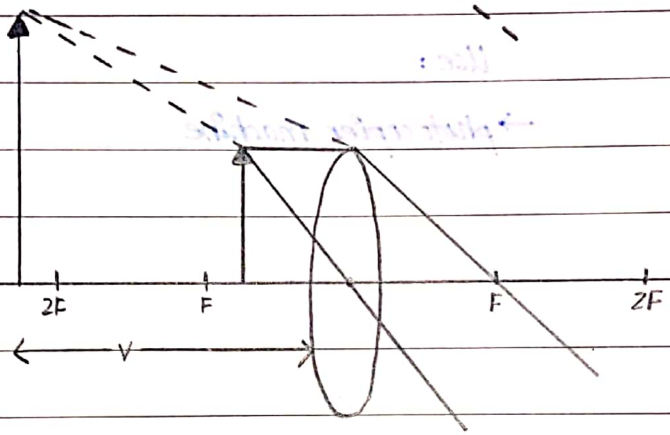
Image:
① . real
② . inverted
③ . highly magnified

$u = f$
$v = \infty$



Case 6:

$u < f$
$v > u$



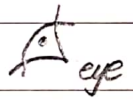


Image:
① . upright
② . virtual
③ . magnified

Use:
→ magnifying glass

Conclusion:

i. $u > f$

Image: ① . inverted
② . real
③ . opposite side of lens

ii. $u \leq f$

Image: ① . upright
② . virtual
③ . same side of lens

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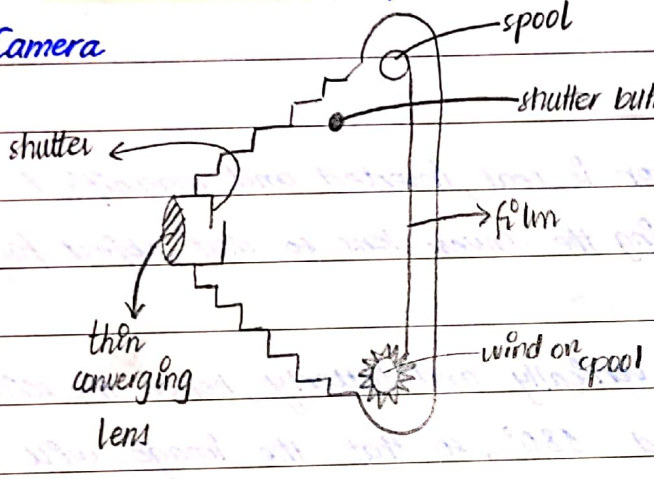
magnification = $\frac{\text{image size}}{\text{object size}} = \frac{\text{image distance}}{\text{object distance}} = \frac{v}{u}$

magnification: ratio of image size to the object size for the converging lens is called magnification

linear magnification: ratio of image distance to object distance for a converging lens

USES OF THIN CONVERGING LENS

1. Camera



→ the camera uses convex lense to produce a real, inverted and diminished image on film

→ focusing is done by varying the distance of the lens from film

→ object distance varies from infinity to slightly larger than f

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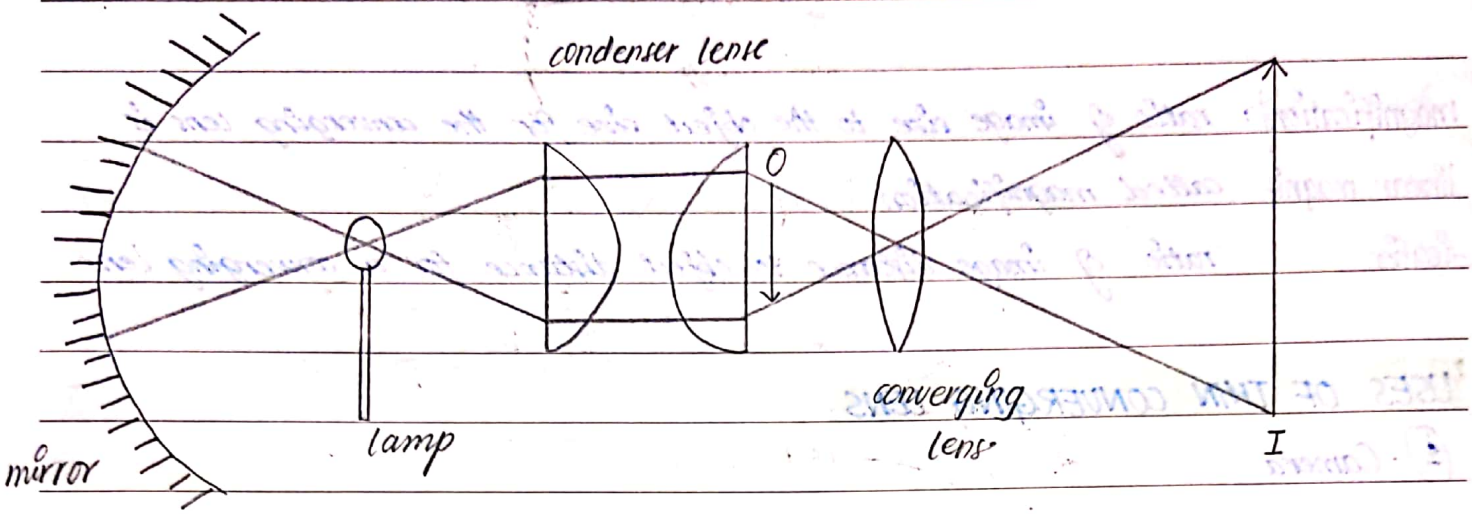
(2). Projector



→ the image produced by a projector is real, inverted and magnified

→ focusing of image is done by moving the convex lens so that object falls between f and 2f

→ since, the image is inverted both vertically and latterly, hence the slide is placed upside down and flipped 180°, so that the image will be projected right away

(3). Photographic Enlarger

→ the working principle of a photographic enlarger is basically same as that of projector

→ the film on a photograph enlarger is placed b/w f and 2f of the focusing lens

→ the image produced is real, magnified and inverted

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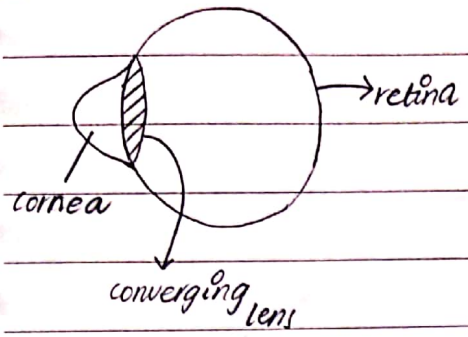
EYE



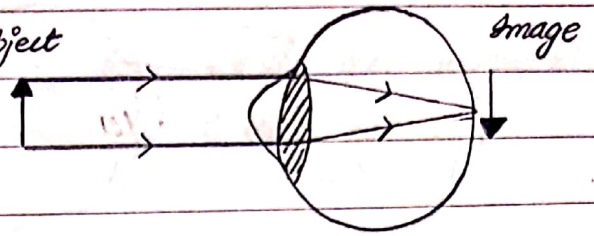
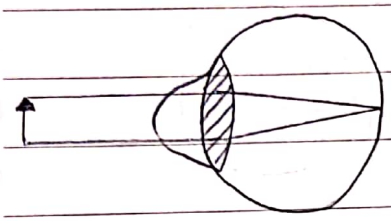
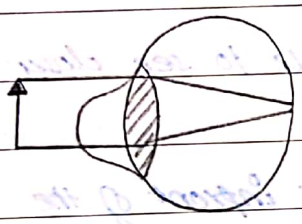


Image : ① · real
② · inverted
③ · diminished



• lens is thinner from the middle & less curved



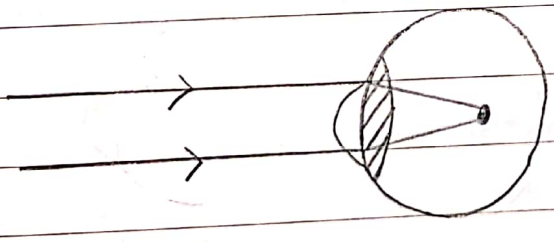
• lens is thicker at the middle & more curve

→ to have the rays converge at retina instead before or after retina

Defects in Eye :

① · Short Sightedness

(dur ke nazar kharab hai)



→ if eye is able to see closer objects clearly but is unable to see distant objects clearly

→ this defect in eye is corrected by placing a diverging lens infront of eye

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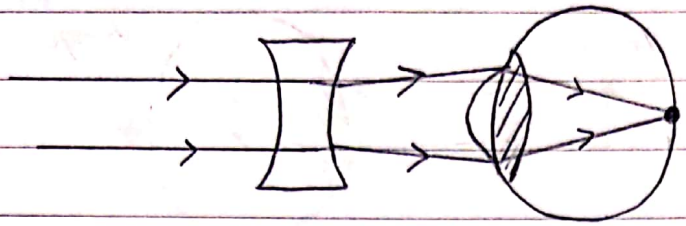
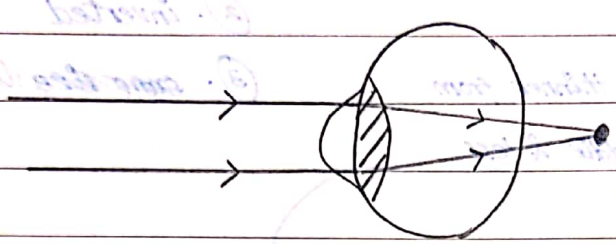
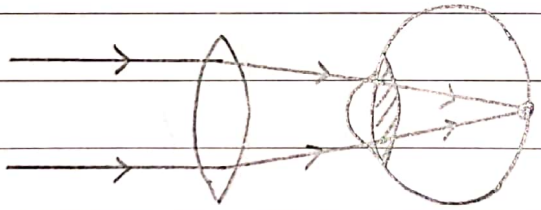


② · Long sightedness :



→ if eye is able to see distant objects clearly but unable to see closer objects unclearly

→ this defect is corrected by placing a converging lens infront of the eye



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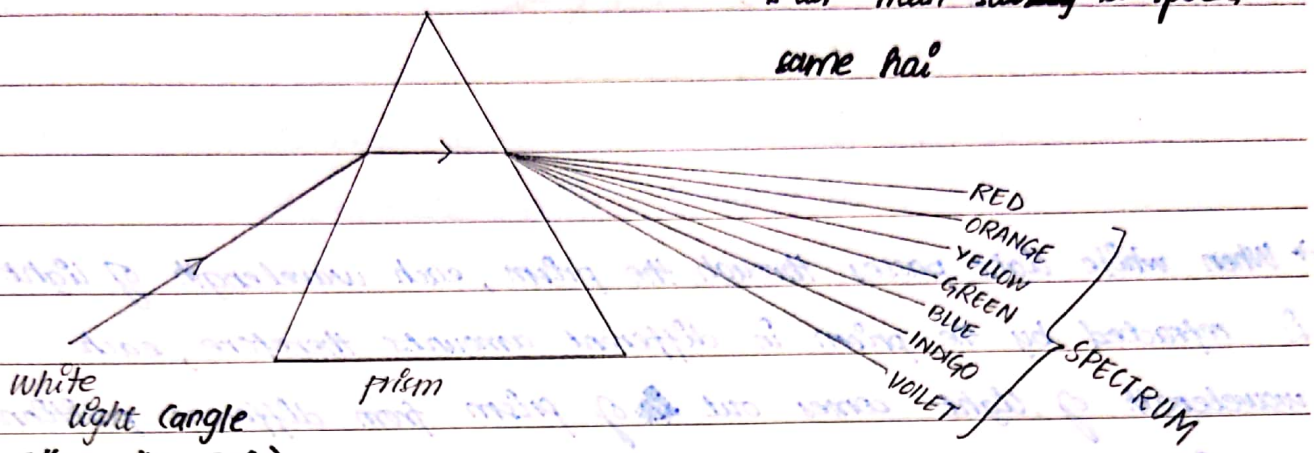
DISPERSION OF LIGHT

* air mein sab ki speed same hai



ROYGBIV

→ when white light passes through a prism, its splits in 7 colors called: 'spectrum' (towards the base of prism)

→ this process is called dispersion of light

Q. Why is it splitting?

A. Because white light is a combination of 7 wavelengths.

→ When it passes through a prism, every wavelength refracts in different amounts. So, every wavelength comes out at different positions, displaying its own color.

red wavelength (fastest) : least refraction : longest wavelength : minimum frequency

violet wavelength : most refraction (most refractive index) : shortest wavelength : maximum frequency

monochromatic light : light of single wavelength [does not split in any colors]

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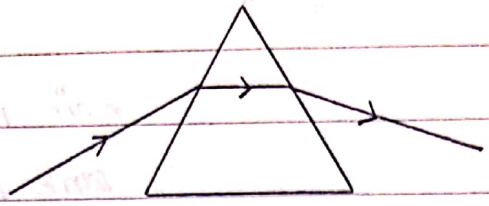
e.g/ red laser light
blue laser light



→ When white light passes through the prism, each wavelength of light is refracted by the prism in different amounts therefore, each wavelength of light comes out of prism from different positions or different angles and each wavelength of light after coming out of the prism will show its own color.

→ Since refraction produced in wavelength of red light is minimum, therefore, red color comes first in the spectrum of white light and refraction produced by the wavelength of violet light is maximum therefore it comes at the end of the spectrum produced by the white light

→ each color travels with the speed of light

ultra-violet radiations: beyond the violet end of spectrum is the invisible UV radiations

they can be detected by blackening of photographic film or fluorescence e.g/ currency notes usually have certain marks, which glow under UV lamps

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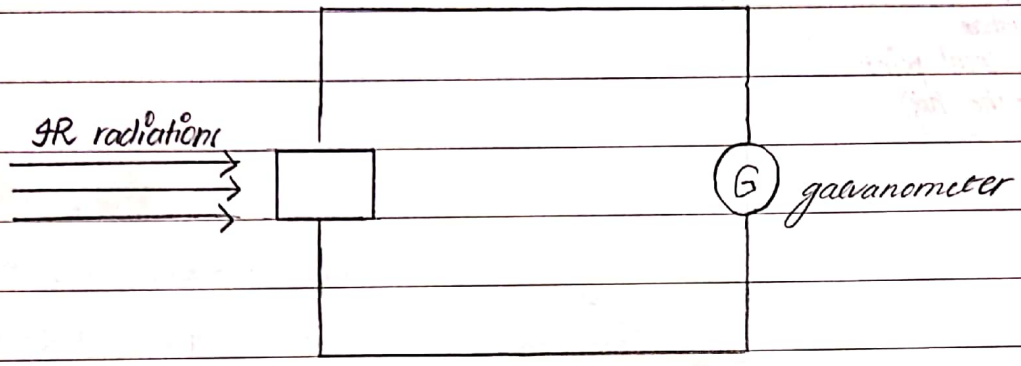
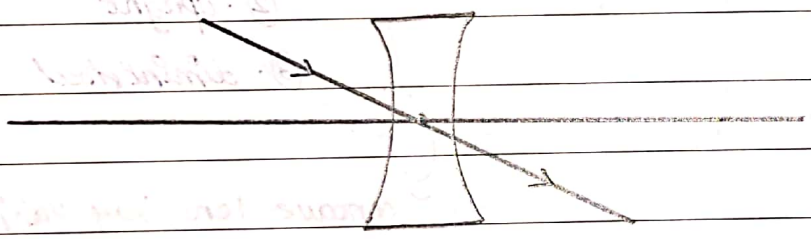
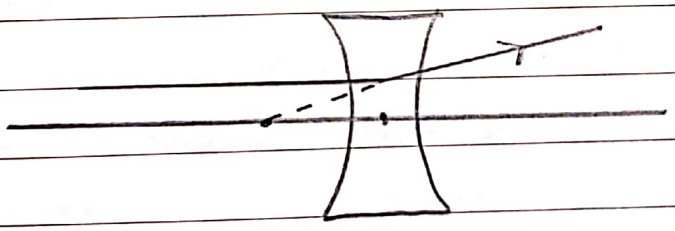
infra-red radiations: beyond the red color of visible spectrum is the invisible IR radiation

they can be detected by thermopile galvanometer deflects by sensing IR-radiations or by placing thermometer, since IR-radiations cause heating effects

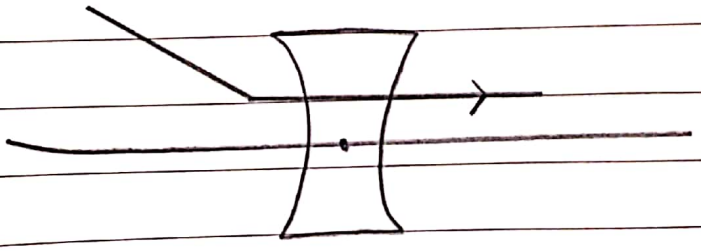


Concave lense rules:



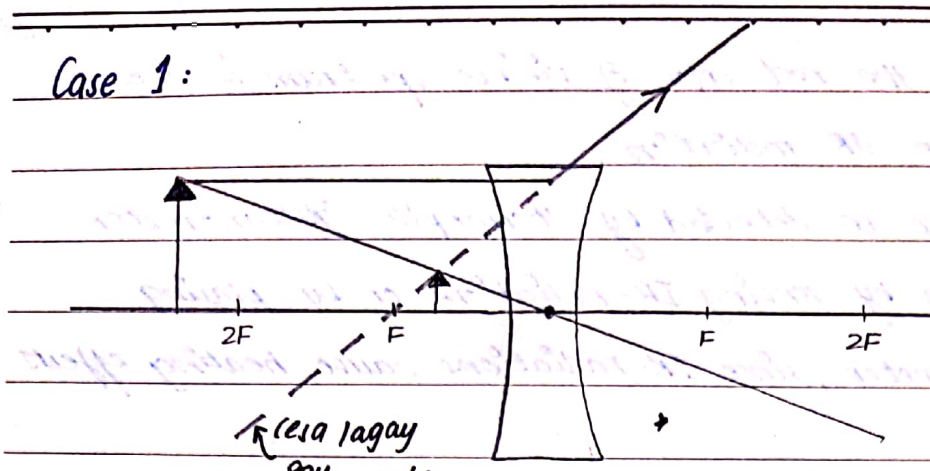


(appears to be coming from focal point)



Date: _____

Case 1:



(esa lagay jay * yahan say jesh focal point say arahe hai)

Image:
① · virtual
② · upright
③ · diminished

Case 2:

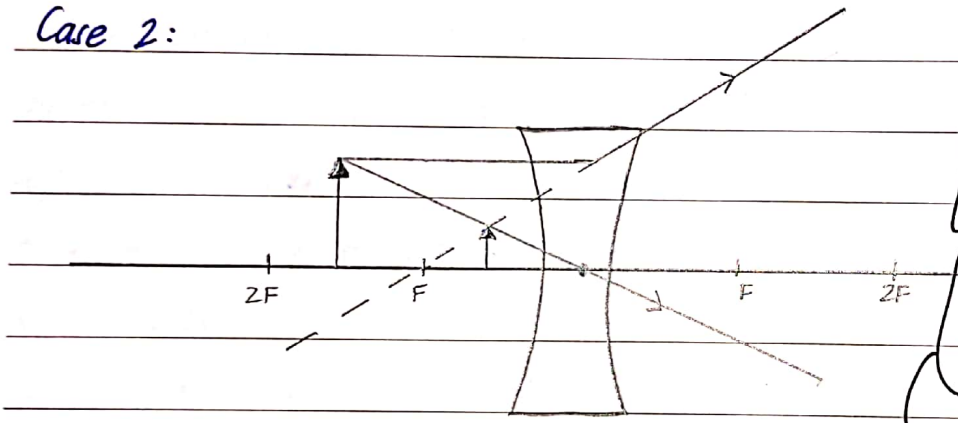


Image:
① · virtual
② · upright
③ · diminished

concave lens kay yahi properties hongi hamesha