

CH 4

REFLECTION

of

LIGHT

SBG STUDY

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CH - 4

Reflection of light

Assignment - 1

Ques 1. What is light?

Ans: Light is a form of energy that produces the sensation of sight.

Ques 2. What is meant by reflection of light?

Ans: Reflection is the phenomenon in which light rays on striking a polished smooth surface such as a mirror are sent back into the same medium.

Ques 3. What happens when a ray of light falls normally on the surface of a mirror?

Ans: When a ray of light falls normally on the surface of mirror, then it sends the light back.

Ques 4. What is lateral inversion?

Ans: It is a phenomenon in which when looked in a plane mirror, the left of the object becomes the right of image and vice-versa.

Ques 5. Name two natural phenomena based on the property that light travels in straight lines.

Ans: Two phenomena based on the property of light travels in straight lines.

(i) Regular reflection.

(ii) Irregular reflection.

Ques 6. If we hold a cardboard in front of us, why can we not see our face?

Ans: If we hold a cardboard in front of us, we will not be able to see our face in it. This is because the light falls on its surface is reflected in all directions irregularly, in a scattered manner. Such a reflection is called irregular reflection.

Ques 7: The angle between an incident ray and the normal to the surface of mirror is 40° .

(a) what is angle of incidence.

Ans. The angle of incidence is 40° because, incidence ray is equal to \angle of incidence.

$$\angle i = \angle r = 40^\circ$$

(b) what is angle of reflection.

Ans. The angle of reflection is 40° and because incidence ray is equal to angle of reflection.

Ques 8.

worksheet

Ques 1: The characteristic that will remain unaltered as light moves from one medium to another is

Ans: None of these

Ques 2: The speed of light in vacuum is

Ans: $3 \times 10^8 \text{ ms}^{-1}$

Ques 3: A letter which does show lateral inversion when placed before a plane mirror is

Ans: M

Ques 4: On looking in plane mirror, you are touching your left ear with your right hand. what would you find in your image?

Ans: We will see an ^{points} opposite image ~~acc.~~ to the real one.

In image we will observe that we are touching our left hand with right ear.

Ques 5: state the laws of reflection of light?

Ans: When a light falls on smooth reflecting surface it follows two laws:

1. The angle of incidence ($\angle i$) is equal to the angle of reflection ($\angle r$), i.e. $\angle i = \angle r$.
2. The incident ray, the normal to the reflecting surface at Point of incidence and reflected ray, all lie in same plane.

★ Home Assignment:

Ques 1: Name some common sources of light.

Ans: Sun is most important source of light and stars, Moon natural source of light and Candles, fire and oil lamps are artificial.

Ques 2: list any four characteristics of light?

Ans: four characteristics of light are:-

1. Quantity
2. Quality
3. Color Temperature
4. Direction

Do again this description

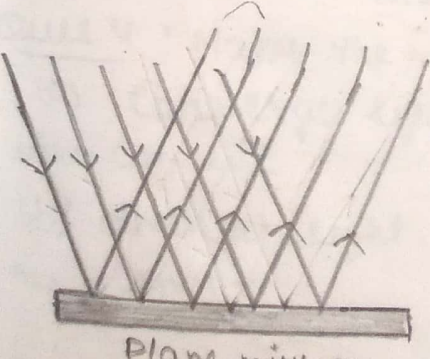
Ques 3: Distinguish between regular and irregular reflection.

Ans: Irregular reflection: It is when parallel rays of light falls on rough surface and reflect in all directions are known as irregular reflections

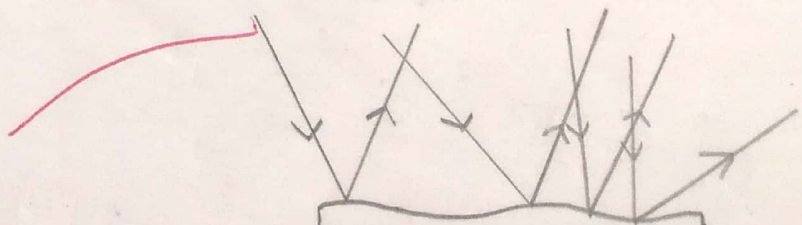
Regular reflection: The reflection which is caused by regular surface is known as regular reflection. In this type of reflection the reflected rays are parallel to each other.

Diagram:-

(i) Regular reflection.



(ii) Irregular reflection.



Ques 5: List any four characteristics of image formed by a plane mirror.

Ans: Characteristics of image formed by plane mirror

1. The image formed behind the mirror and has the same size as object.
2. The image is laterally inverted.
3. The image is far behind the mirror as object is in front of it.
4. The image is virtual. It cannot be received on a screen.
5. The image is erect.

Ques 6: If an object is placed at a distance of 5 cm in front of plane mirror, how far away will it be from its image?

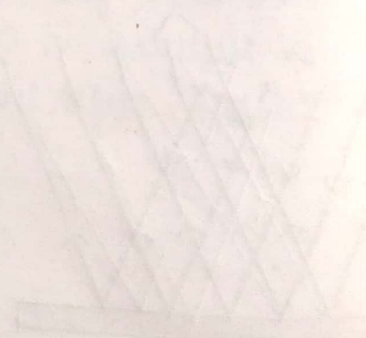
Ans: Image formed from mirror at distance is equal and opposite to that of object mirror distance.

It means that distance will be doubled that is given in question. So, image mirror distance is 5 cm and object image distance is 10 cm.

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Regular reflection: the reflection which is caused by regular surface is known as regular reflection. In this type of reflection, the reflected rays are parallel to each other.

Diagram:



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Assignment - 2

Ques 1: which side of spoon can be approximated to a concave mirror and which side to convex mirror?

Ans: The surface of spoon curved inwards can be approximated to a concave mirror and the surface of spoon bulged outwards can be approximated to a convex mirror.

Ques 2: Name the mirror whose focus is formed.

- (a) In front of mirror
- (b) behind the mirror

Ans (a) Concave
(b) Convex.

Ques 3: If the radius of curvature of concave mirror is 36 cm, what is its focal length?

Ans: Given quantity :

Radius of curvature, $R = 36 \text{ cm}$.

To find focal length, $f = ?$

Proof:

As we know Radius of Curvature formula is

$$R = 2f$$

putting the value.

$$36 \text{ cm} = 2 \times f$$

$$f = \frac{36}{2}$$

$$f = 18.$$

$$F = 18 \text{ cm}$$

Ques 4: Name the mirror which

- (a) Converges light

Ans Concave

- (b) diverges light

Ans Convex.

Ques 5: Define a spherical mirror.

Ans- Spherical mirror:-

A mirror which is a part of sphere in which inner or outer surface is reflecting.

Ques 6: Define the following terms of spherical mirror:

(a) Aperture:

Ans: The effective width (distance) of spherical mirror from which reflection of light can take place is called its aperture.

(b) Pole

Ans: The centre of the reflecting surface of spherical mirror is called Pole.

(c) Centre of Curvature:

Ans: The geometric centre of hollow sphere of which spherical mirror is part called Centre of Curvature.

(d) Radius of Curvature:

Ans: The radius of hollow sphere of which reflecting surface of spherical mirror is part is called radius of curvature.

(e) Principal axis:

Ans: The straight line passing through centre of curvature and pole of spherical mirror is called Principal axis.

(f) Focus:

Ans: If beam of light parallel to principal axis falls on concave mirror, all the rays after reflection meet at point on principal axis. This is called the focus.

$$f = 18 \text{ cm}$$

Ques 7: Name the mirror which

(a) converges light

(b) diverges light

(c) converges light

(d) diverges light

Ques 7. Explain why a concave mirror is also known as converging mirror.

Ans: The Principal focus of concave mirror is a point on its principal axis at which all the light rays which are parallel and close to axis, converge after reflection from concave mirror. So, a concave mirror is called converging mirror.

Ques 8. Distinguish between the focus of a concave mirror and convex mirror.

Sol. Difference b/w focus of concave and convex mirror.

Parameter	Focus of Concave mirror	Focus of Convex mirror
1. Position.	It lies in front of the mirror.	It lies behind the mirror.
2. Nature	It is real focus because the light rays after reflection from concave mirror actually converge at focus.	It is a virtual focus because the light rays after reflection from convex mirror appear to come from focus.
<u>Ques 9.</u> Distinguish between a concave and convex mirror.		
<u>Ans:</u> Difference between concave and convex mirror.		

Parameter	Concave mirror	Convex mirror
1. Reflection of light	Reflection takes place at concave surface (on bent-in surface).	Reflection takes place at convex surface (bulging out surface).
2. Nature.	A Parallel beam of light falling on mirror converges at point in front of mirror after reflection.	A Parallel beam of light falling on mirror appears to diverge from point behind the mirror after reflection.
3. Action	It is a converging mirror.	It is a diverging mirror.
4. Focus	It has a real focus.	It has a virtual focus.

worksheet

Ques 1: A concave mirror is distinguished from a convex mirror using the property of:

Ans: Convergence

Ques 2: If radius of curvature of concave mirror is 40 cm its focal length is

Ans: 20 cm.

Ques 3: which one following usually form a real image?

Ans: Concave mirror.

Ques 4: Image formed by convex spherical mirror is

Ans: virtual.

Ques 5: Distinguish between a real image and virtual image.

Ans: Difference between a real image and virtual image.

Parameter	Real image	Virtual image
1. Path of ray of light.	A real image is formed when two or more reflected rays intersected at a point front of mirror.	A virtual image formed when two or more reflected rays appear to intersect at a point behind mirror.
2. Obtainability of screen.	It can be obtained on a screen.	It cannot be obtained on a screen.
3. Nature.	It is inverted (upside down) with respect to the object.	It is erect with respect to the object.

Ques 6 The Radius of Curvature of spherical mirror is 90cm and what is its focal length?

Sol. ∴ Given Quantity

Radius of Curvature = 90cm.

find :- focal length $f =$ _____?

Proof: As we know that ;

$$\text{Radius of Curvature} = 2 \times \text{focal length}$$

Putting the above values .

$$90 = 2f$$

$$f = \frac{90}{2}$$

$$\boxed{f = 45}$$

Home Assignment .

Ques 1 : A Person moves 20cm towards a plane mirror with a speed of 25cm/s . what is relative velocity of image with respect to person?

Ans :

Ques 2: Establish the relationship between focal length and radius of curvature.

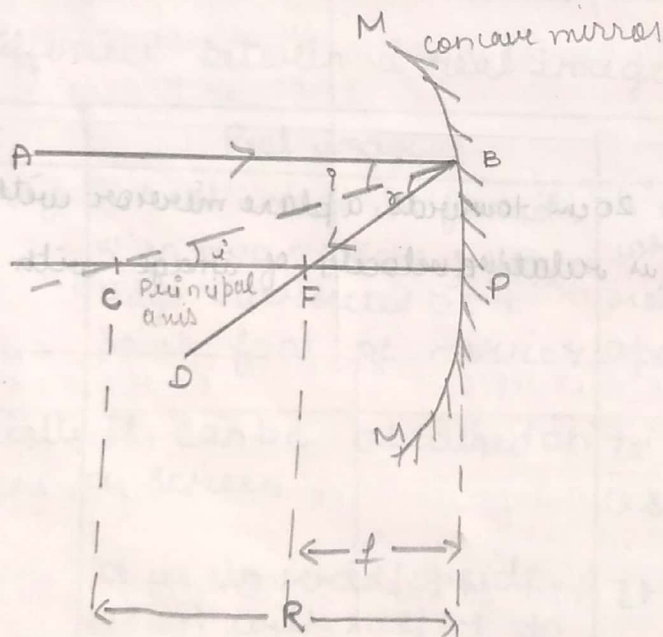
Ans: Relationship between focal length and radius of curvature of spherical mirror.

It has been found that for spherical mirror of small apertures the radius of curvature (R) is equal to twice of focal length.

Radius of curvature = $2 \times$ focal length.

$$R = 2f$$

The relationship is true for both concave and convex mirror. This implies that principal focus of spherical mirror lies midway between pole and centre of curvature.



Ray diagram to derive relation b/w radius of curvature and focal length of concave mirror.

Ques 3! Solve the numericals. -

(a) The radius of curvature of spherical mirror is 30 cm. what is focal length

Sol! Given Quantity

Radius of Curvature = 30 cm.

find :- focal length (f) = _____?

Proof :-

As we know Radius of curvature is :-

$$R = 2f$$

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

Putting the above values -

$$f = \frac{30}{2}$$

$$f = 15 \text{ Ans}$$

(b). If focal length of concave mirror is 20 cm. what is its Radius of Curvature?

Ans! Given

focal length (f) = 20 cm

find :- Radius of Curvature _____?

Proof. As we know Radius of Curvature formula

$$R = 2f$$

Putting the value.

$$R = 2 \times 20$$

$$R = 40$$

Ans!

(C) If sum of focal length and radius of curvature is 30 cm, what is focal length of that spherical mirror?

Ans: Given

$$f + R = 30$$

We know that $R = 2f$

$$f + 2f = 30$$

$$3f = 30$$

$$f = \frac{30}{3} = 10$$

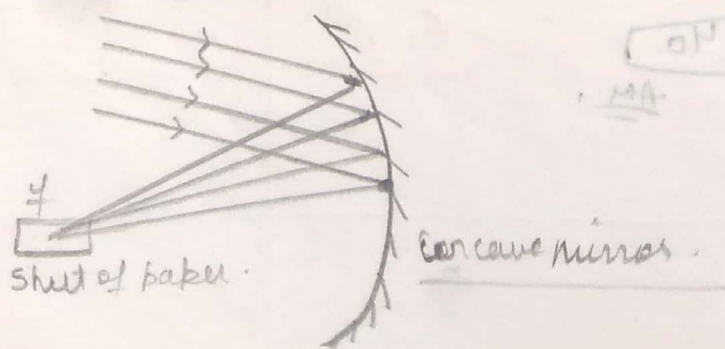
$$f = 10 \text{ cm}$$

Ques 7: write the Procedure used to find the focal length of a concave mirror.

Ans: To find focal length of concave mirror.

1. Hold a concave mirror in your hand and face its reflecting surface towards the sun.
2. Place a sheet of paper near concave mirror.
3. Adjust mirror such that sunlight reflected by concave mirror falls directly on sheet of paper placed close to mirror.
4. Move sheet of paper forward or backward gradually until a bright sharp spot of light is produced on sheet of paper. The spot of light is tiny, real, inverted image of the sun on sheet of paper. This point of focus of concave mirror.
5. The distance of this image from position of mirror gives approximate value of focal length of mirror.
6. If you hold mirror and paper in same position for few minutes, do you know what will happen? You will observe that paper begins to burn producing smoke. The smoke starts coming out from point where rays of sun are converged by concave mirror.
7. The light from sun is converged at point sharp, bright spot by mirror. The concentration of sunlight at point produces enough heat to cause paper to burn. It may even catch fire.

Diagram :-



Assignment - 3

Ques 1:- Name the type of mirror which is used as shaving mirror.
Give reason.

Ans: Concave mirror is used as shaving mirror because it enlarges to see, erect image of face.

Ques 2:- Name the type of mirror which is used as rear-view mirror in car. Give a reason.

Ans: Convex mirror are used as rear-view mirror in car bus, trucks etc. because it image formed highly diminished and give a wide field of view to see traffic behind and always produces a erect image.

Ques 3:- Name the spherical mirror, which always forms virtual image of an object.

Ans:- Convex mirror.

Ques 4:- when should an object be placed in front of a concave mirror to obtain an image, which is real, inverted and reduced in size?

Ans:-

Ques 5:- Can a concave mirror form a virtual image of same size as object?

Ans: No.

Ques 6:- which mirror has a large field of view - convex or concave.

Ans: Concave is not used for large field of view and convex mirror is used as.

Ques 7: To see enlarged image of an object, will you use a convex mirror or concave mirror.

Ans: Concave.

Ques 8: what should be position of an object, when a concave mirror is used as shaving mirror?

Ans: It will be placed within focal point of mirror and between.

Ques 9: Name the type of mirror which is used by dentist to examine the teeth of a patient. Give reason.

Ans: Concave mirror are used by doctors to focus light on internal body parts such as teeth. In the the beam of light converged to internal body part to be examined.

Ques 10: where will the image of an object be formed by a concave mirror if the object is placed at infinity?

Ans: It was formed at focus.

Ques 11: For what position of an object does concave mirror form a real image equal to size of object.

Ans: when placed at centre of curvature.

Ques 12: Can we get an inverted image of an object if we use a convex mirror?

Ans: No.

Worksheet

Ques 1 Focal length of concave mirror depends on its.

Ans:

Ques 2: The bulb used in torch light is placed at distance x from mirror used. The value of x is

Ans:

Ques 3: The Nature of image formed by convex mirror is

Ans:

Ques 4: Nature of image is not affected by position of object.

Ans

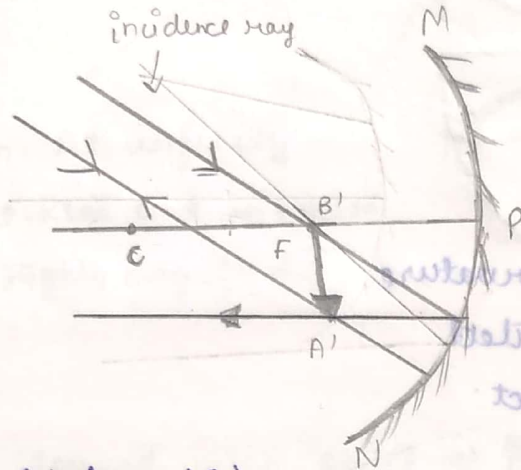
FORMATION OF IMAGES

BY A CONCAVE MIRROR

1. Case a.

when formed when object is at infinity.

Diagram :-

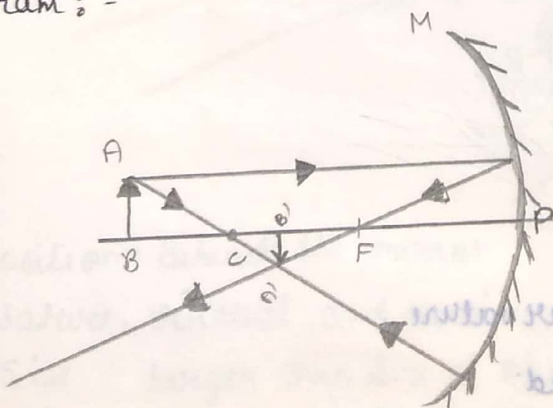


1. Position. At focus (F)
2. Nature. Real and inverted
3. Size: Highly diminished

2. Case II

Image formed when the objects is placed beyond the centre of curvature of mirror.

Diagram :-

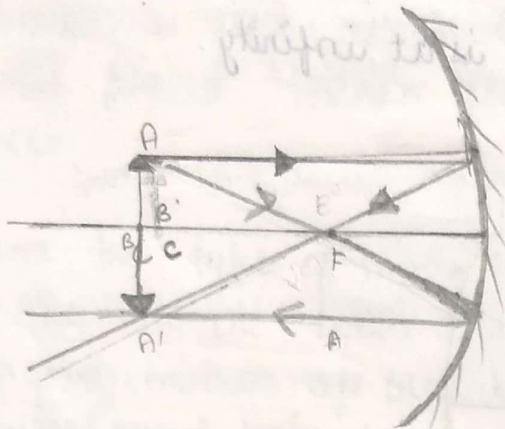


1. Position. Between the focus and Centre of Curvature
2. Nature. Real and inverted
3. Size :- Smaller than the object (diminished).

Case III

Image formed when object is placed at centre of curvature

Diagram:-

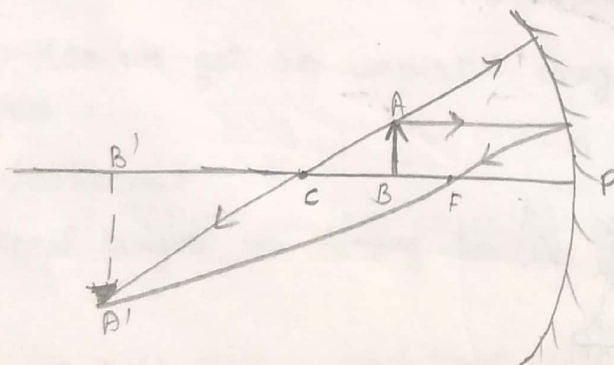


1. Position: At centre of curvature.
2. Nature: Real and inverted
3. Size: Same size as object.

Case IV

Image formed when object is placed between the focus (F) and Centre of Curvature

Diagram:-

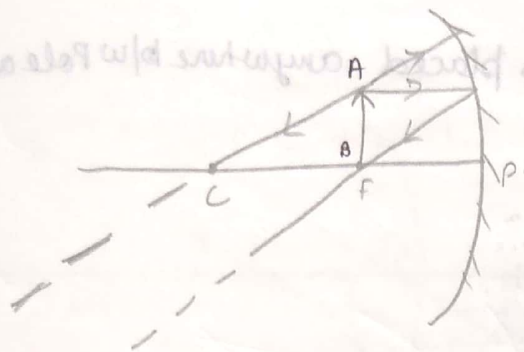


1. Position: Beyond Centre of Curvature.
2. Nature: Real and inverted.
3. Size: Larger than the object (magnified)

Case V.

Image formed when the object is placed at focus (F) of mirror.

Diagram:-

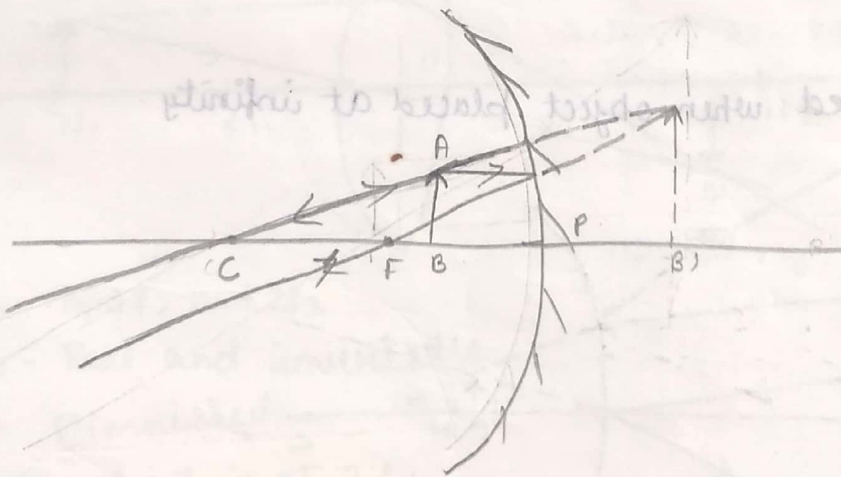


1. Position: At infinity.
2. Nature: Real and inverted
3. Size: Highly magnified.

Case VI.

Image formed when object is placed between pole and Focus.

Diagram:-



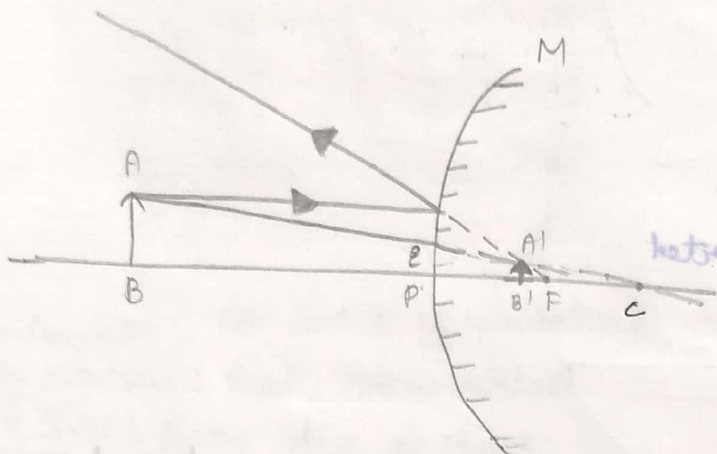
1. Position: Behind the mirror
2. Nature: Virtual and erect
3. Size: Larger than size of object (magnified).

* IMAGES FORMED BY CONVEX MIRROR

Case I

Image formed when object is placed anywhere b/w Pole and infinity

Diagram :-

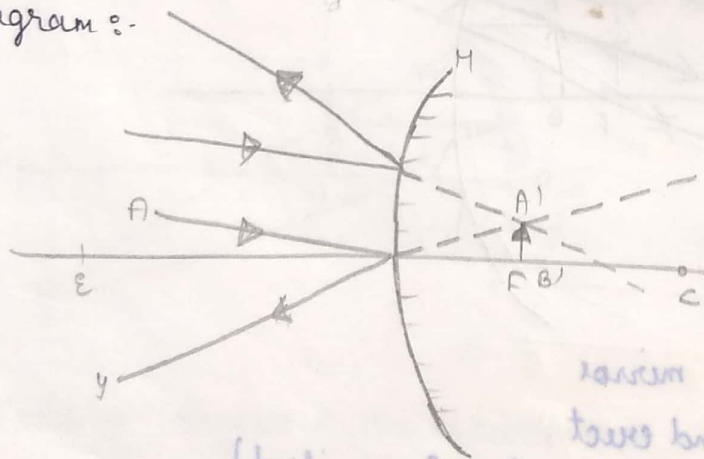


1. Position: Behind the mirror between Pole and focus.
2. Nature: virtual and erect.
3. Size: Diminished.

Case II

Image formed when object placed at infinity.

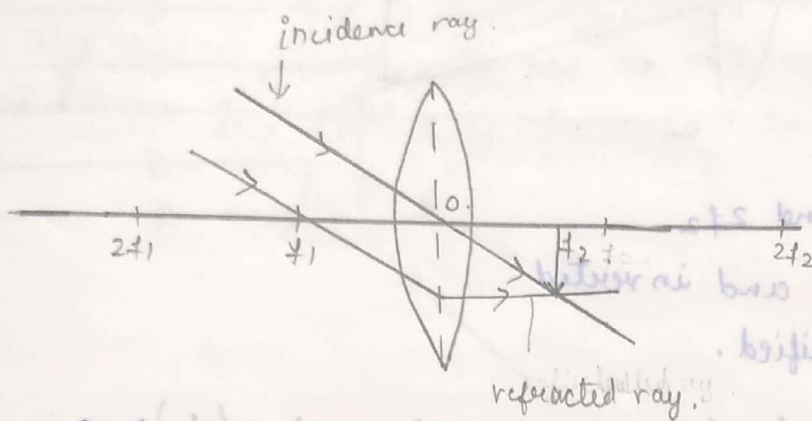
Diagram :-



1. Position: Behind the mirror at Focus (F)
2. Nature: virtual and erect
3. Size: highly diminished (Point sized).

Convex lens

1. when object is placed at infinity

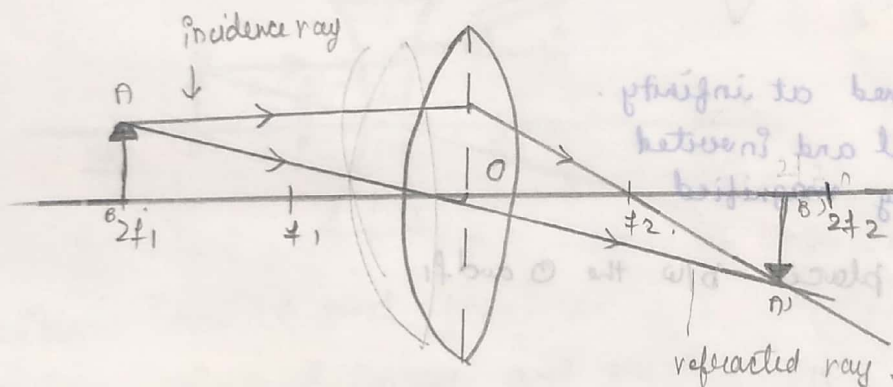


(i) Position: At f_2 .

(ii) Nature: Real and inverted

(iii) size: Highly diminished.

2. when object is placed at $2f_1$, beyond $2f_1$.

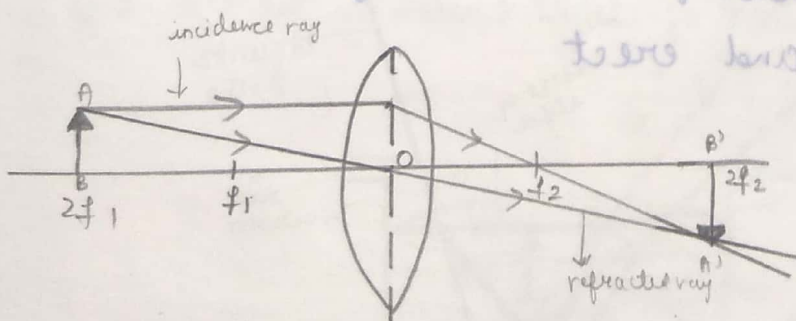


(i) Position - b/w f_2 and $2f_2$

(ii) Nature - Real and inverted

(iii) size - Diminished.

3. when the object is at $2f_1$.

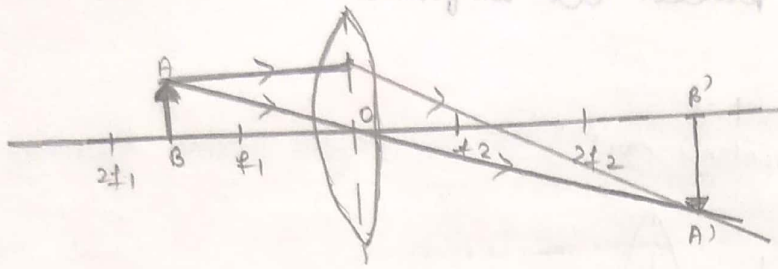


(i) Position: At $2f_2$.

(ii) Nature: Real and inverted

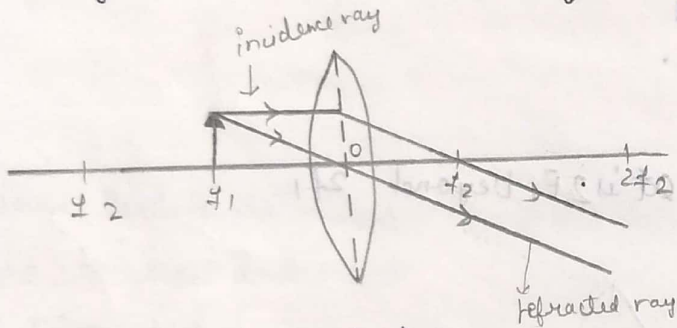
(iii) size: Same as the object.

4. when the object is placed b/w f_1 and $2f_1$.



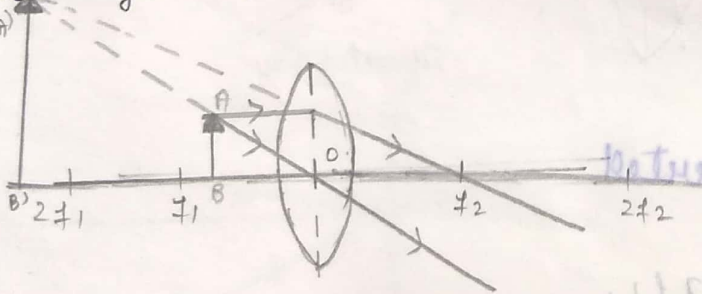
- (i) Position: beyond $2f_2$
- (ii) Nature: Real and inverted
- (iii) Size: magnified.

5. when object is placed at focus of a convex lens (f_1).



- (i) Position: formed at infinity.
- (ii) Nature: Real and inverted
- (iii) Size: highly magnified.

6. when object is placed b/w the \odot and f_1

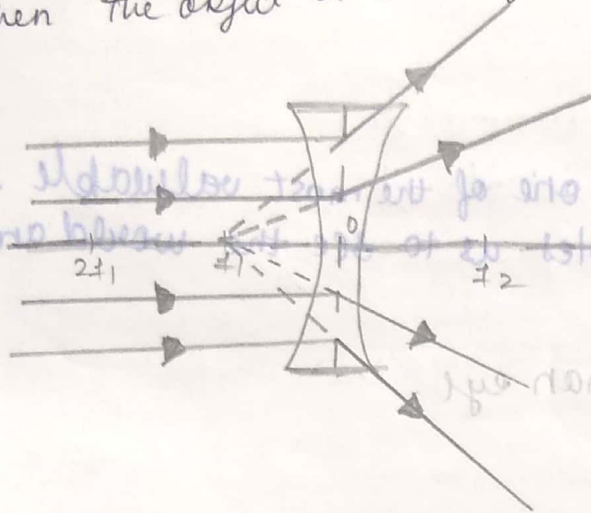


- (i) Position: At same side of lens, behind the object
- (ii) Nature: virtual and erect
- (iii) Size: Magnified.

#

Concave lens

1. when the object is at infinity.



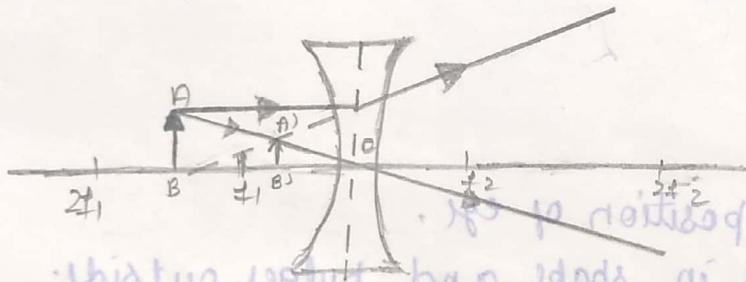
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(i) Position: At F_1

(ii) Nature: virtual image and erect.

(iii) Size: highly diminished.

2. when the object is b/w O and infinity.



(i) Position: b/w O and F_1

(ii) Nature: virtual image and erect

(iii) Size: Diminished.

Bending of stick in water

