



**SUBJECT:-PHYSICS**

**CHAPTER: LIGHT – REFLECTION AND REFRACTION**

**GUIDELINES:**

Dear Students,

- There are total **2 Assignments**, details of which are as follows:
  - ❖ Assignment 3: Multiple Choice questions
  - ❖ Assignment 4: Based on image formation by concave mirror and uses of concave mirror.
- Complete the Assignments in Physics Notebook.
- **A video link** has been provided for better understanding of the concept through visuals. Watch the videos carefully as these will help you in doing the assignments.
- Read the lesson from **NCERT textbook** also.
- Link for NCERT Chapter 'LIGHT- REFLECTION AND REFRACTION' :- <http://ncert.nic.in/textbook/pdf/jesc110.pdf>

**SUB TOPICS:**

1. **Ray diagrams for image formation by Concave Mirror.**
2. **Uses of concave mirror.**

**INTRODUCTION**

In the previous e-lesson we learnt about four rules for image formation by concave mirror. Kindly note that **the intersection of at least two reflected rays gives the position of image of the point object..** So you have to use any of the two rules to draw ray diagrams for image formation by concave mirror.

The image formed by a concave mirror varies in size depending upon the position of the object with respect to the mirror. **The image can be real or virtual, erect or inverted and magnified, diminished or of the same size as that of the object, all depending on the position of the object.**

Let's begin the journey of learning:

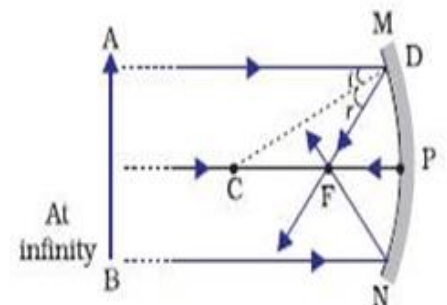
**1. RAY DIAGRAMS FOR IMAGE FORMATION BY CONCAVE MIRROR**

Consider the following cases:

(i) **When the Object is at Infinity:**

When the object is placed at infinity, the rays coming from it are parallel to principal axis. These parallel rays, after reflection from the mirror, converge at focus (F).

- Position of image:** At F (Focus)  
**Nature of image:** Real and Inverted.  
**Size of Image:** Highly diminished, point sized



**Real Life Practical Application:** Used in solar Cookers to concentrate the Sun's heat onto the vessel (kept at F).

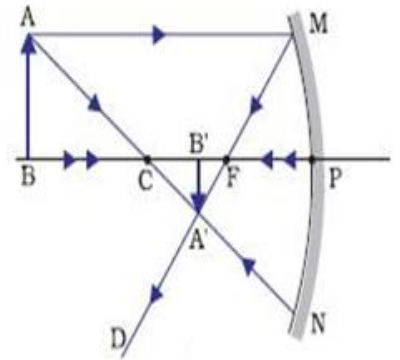
(ii) **When the Object is Placed beyond C (Centre of curvature):**

Consider an object AB placed beyond C. The incident ray AM, parallel to principal axis, after reflection from mirror passes through F (Focus). Another ray AN passing through C (Centre of curvature) gets reflected back along the same path. The two reflected rays MD & NA intersect at A'. Now A'B' is the image of the object AB.

**Position of image:** Between C (Centre of curvature) and F (focus)

**Nature of image:** Real and Inverted.

**Size of Image:** Diminished



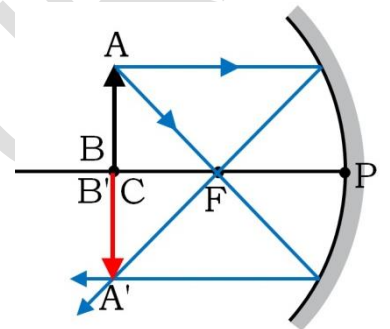
(iii) **When the Object is Placed at C (Centre of curvature):**

Consider an object AB placed at C. The incident ray, parallel to principal axis, after reflection from mirror passes through F (Focus). Another ray passing through F (Focus) after reflection becomes parallel to principal axis. The two reflected rays intersect at A'. Now A'B' is the image of the object AB.

**Position of image:** At C (Centre of curvature)

**Nature of image:** Real and Inverted.

**Size of Image:** Same size



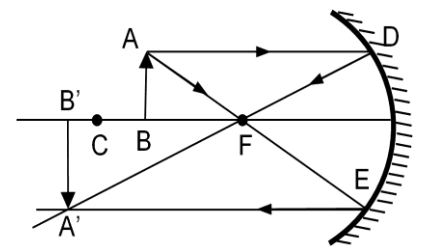
(iv) **When the Object is Placed Between C (Centre of curvature) and F (focus)**

Consider an object AB placed between C (Centre of curvature) and F (focus). The incident ray AD, parallel to principal axis, after reflection from mirror passes through F (Focus). Another ray AE passing through F (Focus) after reflection becomes parallel to principal axis. The two reflected rays DA' and EA' intersect at A'. Now A'B' is the image of the object AB.

**Position of image:** Beyond C (Centre of curvature)

**Nature of image:** Real and Inverted.

**Size of Image:** Enlarged.



(v) **When the Object is Placed at F (Focus)**

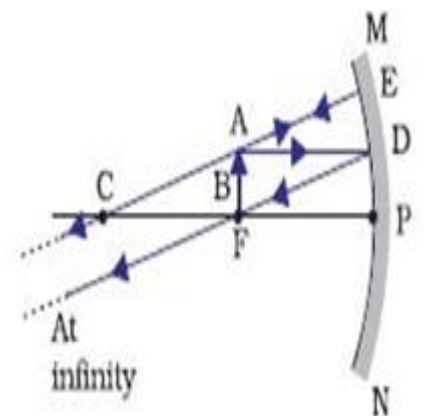
Consider an object AB placed at F (focus). The incident ray AD, parallel to principal axis, after reflection from mirror passes through F (focus). Another ray AE passing through C (Centre of curvature) gets reflected back along the same path.

The two reflected rays EC and DF are parallel to each other and would meet only at infinity. So, the image is formed at infinity.

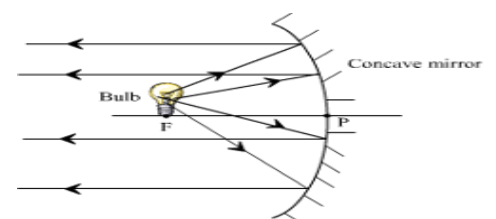
**Position of image:** At infinity.

**Nature of image:** Real and Inverted.

**Size of Image:** Highly enlarged.



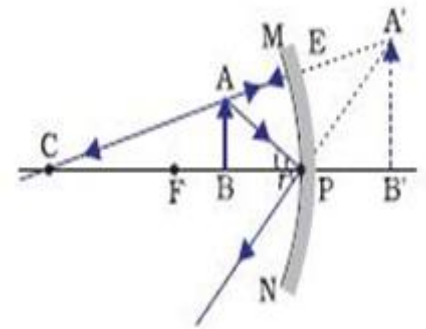
**Real Life practical Application:** Used in headlights of vehicles, search lights and torches to get powerful parallel beam of light. The source of light is placed at the focus of the concave mirror.



(vi) **When the Object is Placed Between F (Focus) and P (Pole):**

Consider an object AB placed between F (focus) and Pole (P). The incident ray AP, making a certain angle with the principal axis, gets reflected along the direction which makes the same certain angle with the principal axis. Another ray AE passing through C (Centre of curvature) gets reflected back along the same path.

The two reflected rays appear to meet behind the mirror when the reflected rays are extended backward. A'B' is the image of the object AB.



**Position of image:** Behind the mirror

**Nature of image:** Virtual and erect

**Size of Image:** Enlarged

**Real Life Practical Application:**

- ❖ Used as make-up and shaving mirror. The face of the person is kept closer to the mirror i.e. between pole and focus, to see the enlarged image of the face.
- ❖ Used by dentists to examine the teeth of the patients. It produces the enlarged image of the teeth.

POSITION OF OBJECT	POSITION OF THE IMAGE	SIZE OF THE IMAGE	NATURE OF THE IMAGE
At infinity	At the focus	Highly diminished	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

## 2. USES OF CONCAVE MIRROR

In real world, concave mirror is:

- 1) used in headlights of vehicles, search lights and torches to get powerful parallel beam of light (fig. 1)
- 2) used as make-up and shaving mirror (fig 2)
- 3) used by dentists to examine the teeth of the patients. It produces the enlarged image of the teeth (fig.3)
- 4) used in solar cookers to concentrate sunlight to produce heat (fig. 4)



Fig.

1 Fig. 2



Fig. 3



Fig. 4



For better understanding, kindly go through the video link given below:

- For image formation by Concave Mirror: <https://youtu.be/j5ZoLuzfq2Q>

<https://youtu.be/COvg4OvXd4Y>

- Uses of concave mirror: <https://youtu.be/ozsoHKeKkM8>

I hope you enjoyed learning through these videos. Now it's time for **SELF ASSESSMENT**. Please attempt the questions given below in your Physics note book to see how much fruitful learning has taken place.

### **ASSIGNMENT 3**

#### **MULTIPLE CHOICE QUESTIONS**

- Q.1** The image formed by concave mirror is real, inverted and diminished in size as that of the object. The position of the object is:
- (a) At F                      (b) between F and C                      (c) at C                      (d) beyond C.
- Q.2** Which of the following mirror is used by a dentist to examine a small cavity:
- (a) Convex mirror                      (b) Plane mirror  
(c) Concave mirror                      (d) Combination of convex and concave mirror
- Q.3** An object at a distance of 30 cm from a concave mirror gets its image at the same point. The focal length of the mirror is:
- (a) – 30 cm                      (b) 30 cm                      (c) – 15 cm                      (d) +15 cm
- Q.4** A concave mirror of focal length 20 cm forms an image twice the size of the object. For the virtual position of the object, the position of the object will be at:
- (a) 25 cm                      (b) 40 cm                      (c) 10 cm                      (d) At infinity
- Q.5** The image formed by the concave mirror is real, inverted and of the same size as that of the object. The position of the object should be:
- (a) at the focus                      (b) at the centre of curvature  
(c) between focus and centre of curvature                      (d) beyond centre of curvature

### **ASSIGNMENT 4**

- Q.1 Match the Columns:**

<b>Column A (uses of concave mirror)</b>	<b>Column B (corresponding position of the object)</b>
1. as a make up mirror	a. at infinity
2. used in search light, headlights of car	b. between pole and focus
3. used in solar cooker	c. at focus

- Q.2** What should be the position of an object when concave mirror is to be used as:
- (a) a shaving mirror                      (b) a torch
- Q.3** What should be the position of the object placed in front of the concave mirror to obtain:
- (a) a real image twice the size of the object                      (b) a virtual image twice the size of the object
- Q.4** We wish to obtain an erect, magnified image of an object using a spherical mirror of focal length 12 cm.
- (a) What is the nature of the spherical mirror used?  
(b) What should be the range of the distance of the object from the mirror?
- Q.5** Name the type of mirror used in the following situations:

- (a) Headlights of car.
- (b) Solar furnace.

Support your answer with a reason.

**Q.6** Why is a concave mirror preferred over a plane mirror for shaving?

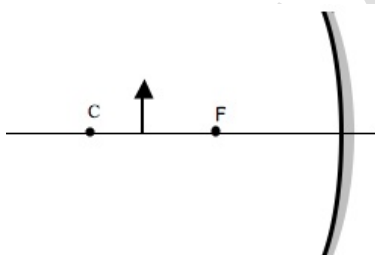
**Q.7** Draw the ray diagram for concave mirror when the object is placed:

- (a) beyond C
- (b) at C
- (c) at F.

**Q.8** Shalini wants to project the image of a pointed needle on the wall by using a mirror.

- (a) Which type of mirror should she use and why?
- (b) To get an enlarged image on the wall, where should the pointed needle be placed in front of the mirror?
- (c) Can she project the diminished image of the pointed needle on the wall with the same mirror? Why/why not?

**Q.9** An object is kept in front of a concave mirror as shown in the figure:



- (i) Complete the ray diagram showing image formation of the object.
- (ii) How will the position and intensity of the image be affected if the lower half of the mirror's reflecting surface is painted black?

**Q.10** It is desired to obtain an erect image of an object using a concave mirror of focal length, 20 cm. Will the image be smaller or larger than the object? Draw the ray diagram to show the formation of the image in this case.

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S. NO.	CONTENT	VIDEO LINK
1	Ray diagrams for image formation by Concave Mirror	<a href="https://youtu.be/j5Zoluzfq2Q">https://youtu.be/j5Zoluzfq2Q</a> <a href="https://youtu.be/COvg4OvXd4Y">https://youtu.be/COvg4OvXd4Y</a>
2.	Uses of Concave Mirror	<a href="https://youtu.be/ozsoHKeKkM8">https://youtu.be/ozsoHKeKkM8</a>