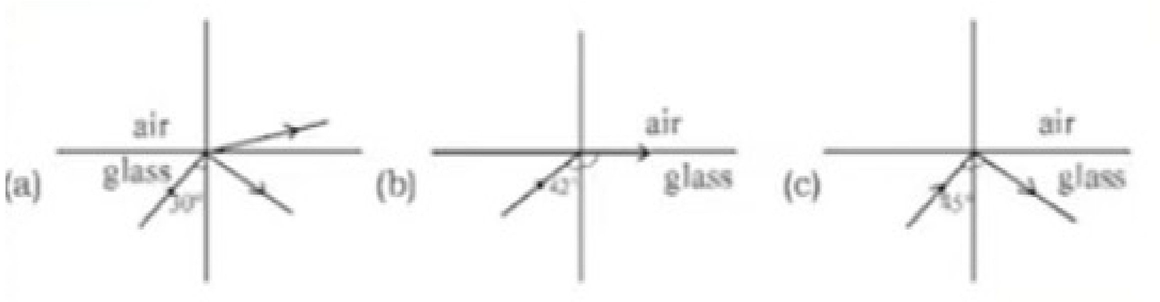
UNIT 5

Refraction of Light

28/12/2020 – Class 43

Assignment Answer



Observe the figure and answer the following question.

1) What is the critical angle of glass? **42^0**

2) Define critical angle? **When a ray of light passes from a medium of greater optical density to that of lower optical density, the angle of incidence at which the angle of refraction becomes 90^0 is the critical angle.**

3) Write the condition under which a light ray undergoes total internal reflection?

- **The light ray should travel from a medium of higher optical density to lower one.**
- **The angle of incidence must be greater than the critical angle.**

4) Write any two practical applications of total internal reflection in our day to day life?

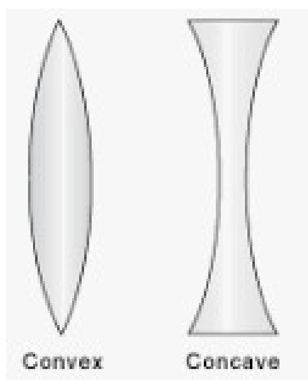
- **Medical field.**
- **In the field of communication.**

Activity 1

Let's see how the refraction of light is made use of in lenses.

Discussion

- What is a lens? **A lens is a transparent medium having spherical surfaces.**
- What are the different types of lenses, we mainly use? **Convex lens and concave lens.**
- What is the shape of a convex lens? **It's surface is relatively thick across the middle and thin at the lower and upper edges.**
- What is the shape of a concave lens? **Surface is thinner at its centre than at its edges.**

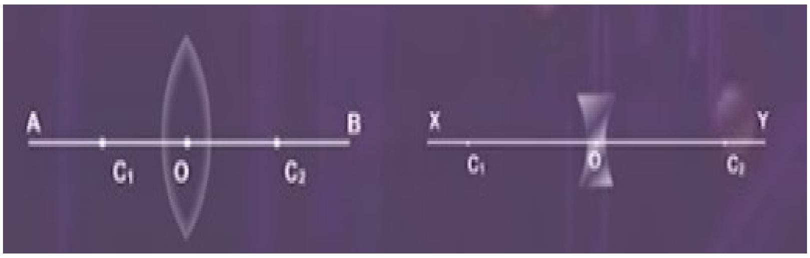


Inference

- A **lens** is a transparent medium having spherical surfaces.
- **Convex** and **concave** lenses are the lenses that we mainly use.

Activity 2

Let's see what are the terms associated with convex and concave lenses. Observe the figure.



C_1, C_2 – Centre of curvatures
O – Optic centre.
AB, XY – Principal axis.

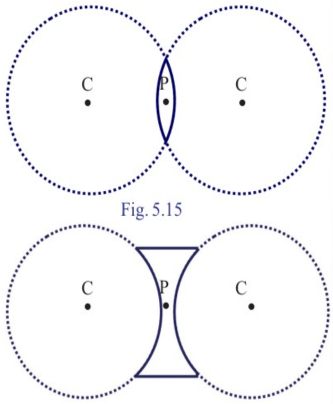


Fig. 5.15

Discussion

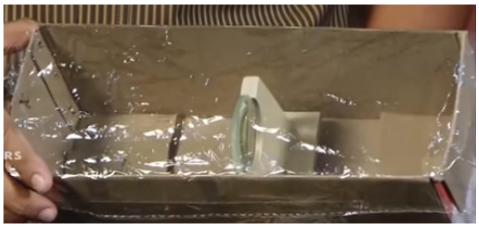
- Which is the midpoint of a lens? **Optic centre (P).**
- What is centre of curvature of a lens? **It is the centre of the imaginary spheres of which the sides of the lens are parts.**
- The imaginary line that passes through the optic centre joining the two centres of curvature is called? **Principal axis.**

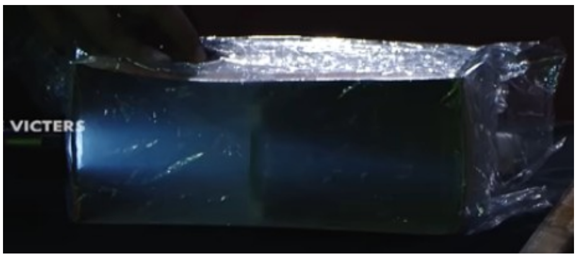
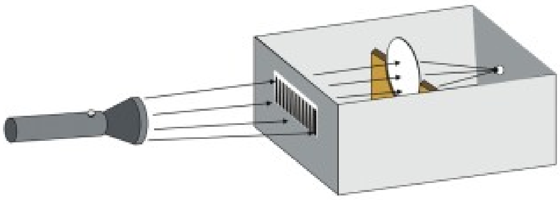
Inference

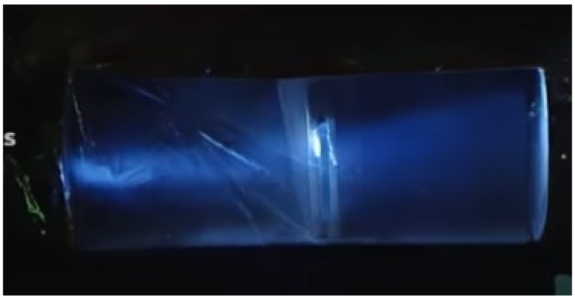
➔ **Optic centre** is the midpoint of a lens (P).
➔ **Centre of curvature** (C) is the centre of the imaginary spheres of which the sides of the lens are parts.
➔ **Principal axis** is the imaginary line that passes through the optic centre joining the two centres of curvature.

Activity 3

Take a rectangular box, the upper part of which is covered with a glass sheet. Place a lens stand at its centre. Fill the box with smoke from an incense stick.

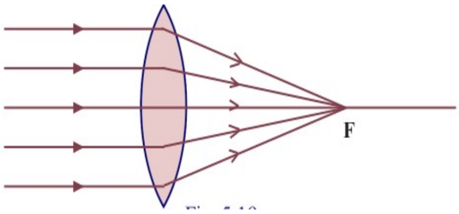


Activity	Observation
Keeping the convex lens on the stand, pass intense light from a torch through the lens. 	Light rays are converging. 

Repeat the experiment using a concave lens. 	Light rays are diverging.

Discussion

- When light rays are passes through the convex lens, what happens? **Converging to a point.**
- This point is called? **Principal focus of the convex lens.**

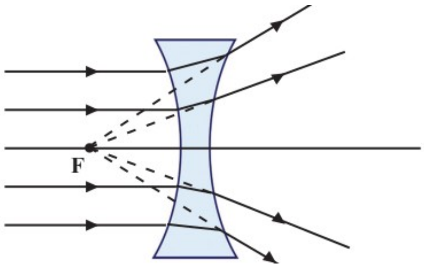


Inference

Light rays incident parallel and close to the principal axis after refraction converges to a point on the principal axis of a convex lens. This point is the **principal focus of a convex lens.**

Discussion

- What happens to the light rays, passes through the concave lens? **Diverges from one another.**
- The refracted rays are appear to originate from a point on the same side. This point is called? **Principal focus of the concave lens.**
- Why is it said that the principal focus of a concave lens is virtual? **It is impossible to produce real convergence of light using a concave lens. Therefore the principal focus of a concave lens is virtual.**



Inference

- Light rays incident parallel and close to the principal axis diverge from one another after refraction. These rays appear to originate from a point on the same side. This point is the **principal focus of a concave lens.**
- It is impossible to produce real convergence of light using a concave lens. Therefore the principal focus of a concave lens is **virtual.**

Activity 4

- Distance from the optic centre to the principal focus is called? **Focal length.**

Focal length (f)

Focal length is the distance from the optic centre to the principal focus.

- How to find the focal length of a convex lens? **Cast the image of a distant object on the screen using a convex lens. Measure the distance between the lens and the screen. Repeat the experiment with different distant objects. Find the average of the distances measured. This gives the focal length of the convex lens.**

<u>Activity 5</u>

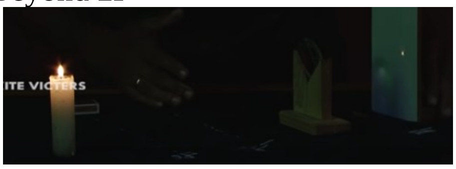
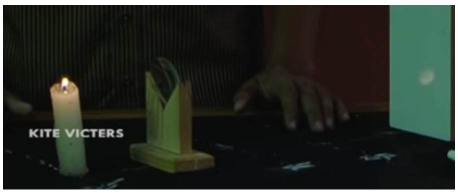
Formation of image using a convex lens.

<u>Experiment.</u>

Materials required – Convex lens of focal length 10 cm, Lens stand, Screen, Candle, Scale.

Procedure – Draw principal axis on a table. Mark the position of lens on this line. Then mark **F** and **2F** on both sides of it. Place the lighted candle (object) on different positions and observe the position and features of the images formed.

<u>Observations</u>

Position of the Object	Position of the Image	Features of Image
Beyond 2F 	Between F and 2 F on other side of the lens.	Real, Inverted, Diminished.
At 2F. 	At 2 F on other side of the lens.	Real, Inverted, Same size.
Between 2F and F. 	Beyond 2F on other side of the lens.	Real, Inverted, Magnified.
At F 	At Infinity. (Image cannot be seen on the screen)	Real, Inverted, Magnified.
Between F and Lens. 	At the same side of the object.	Virtual, Erect, Magnified.

Activity 6

Based on the above experiment, complete the table 5.7.

Position of object	**Position of image**	**Nature of image/ size**		
		Real/ virtual	**Inverted/ erect**	**Magnified/ diminished/ same size**
1. At infinity	At F	Real	Inverted	Diminished
2. Beyond 2F	Between 2F and F on other side.	*Real*	*Inverted*	*Diminished*
3. At 2F	At 2F on other side.	*Real*	*Inverted*	*Same size*
4. Between 2F and F	Beyond 2F on other side.	*Real*	*Inverted*	*Magnified.*
5. At F	At infinity.	*Real*	*Inverted*	*Magnified.*
6. Between F and lens.	Same side of the object	*Virtual*	*Erect*	*Magnified.*

Assignment.

Complete the figure by drawing refracted rays and mark the principal focus of the convex lens and concave lens.