

FlexiPrep

CBSE Class 10 Science Important Questions Chapter 10 Light Reflection and Refraction (For CBSE, ICSE, IAS, NET, NRA 2022)

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5-Mark Questions

1. A convex lens has a focal length of 10 cm. At what distance from the lens should the object be placed so that it forms a real and inverted image 20 cm. away from the lens? What would be the size of the image formed if the object is 2 cm high? With the help of a ray diagram show the formation of the image by the lens in this case?

Ans. $f = +10$ cm

$$v = +20 \text{ cm}$$

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

$$\frac{1}{10} = \frac{1}{20} + \frac{1}{V}$$

$$\frac{1}{V} = \frac{1}{10} - \frac{1}{20}$$

$$\frac{1}{V} = \frac{1-2}{20}$$

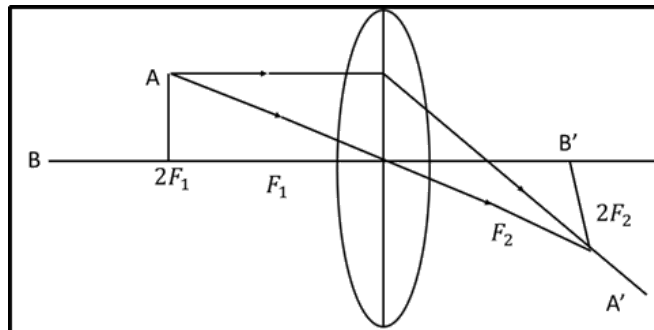
$$\frac{1}{V} = -\frac{1}{20}$$

$$V = -20 \text{ cm}$$

$$m = -\frac{v}{V} = \frac{-20}{-20}$$

$$m = +1$$

Image formed is real



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Object at $2F_1$

Image formed at $2F_2$

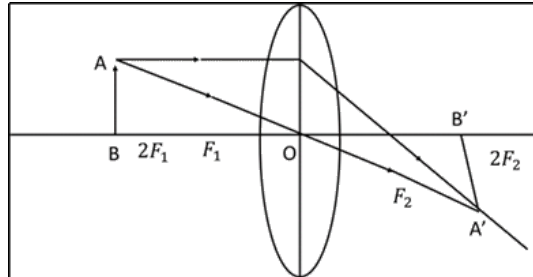
Same size and real and inverted.

Q. 2 Draw a ray diagram to show the use of a convex lens for the formation of images having the following characteristics.

(a) Real & inverted and diminished

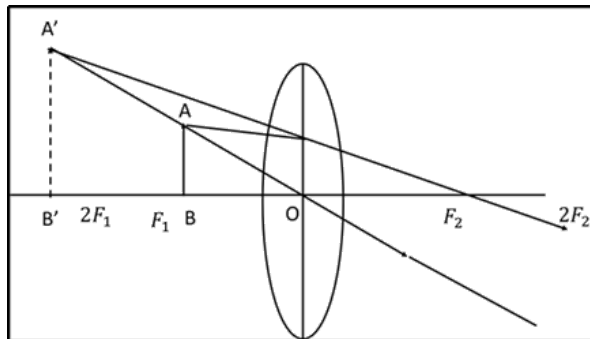
(b) Virtual, erect & magnified.

Ans. (a) Image is formed between F_2 and $2F_2$, Diminished real and inverted.



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(b) Virtual and erect, highly magnified, same side of the lens where the object is placed.



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Q. 3 A convex lens forms a real and inverted image of a needle at distance of 50 cm . From it. Where is the needle placed in front of the convex lens if the image is equal to the size of objects? Also, find the power of lens.

Ans. Image distance (v) = +50 cm, $h_i = h_0$

$$\frac{h_i}{h_0} = \frac{v}{u}$$

$$u = v \times \frac{h_0}{h_i}$$

$$= 50 \times \frac{h_0}{h_i}$$

$$= 50 \text{ cm} .$$

Now, $u = -50$ cm

$$v = +50 \text{ cm} .$$

$$f = ?$$

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

$$\frac{1}{f} = \frac{1}{50} + \frac{1}{50}$$

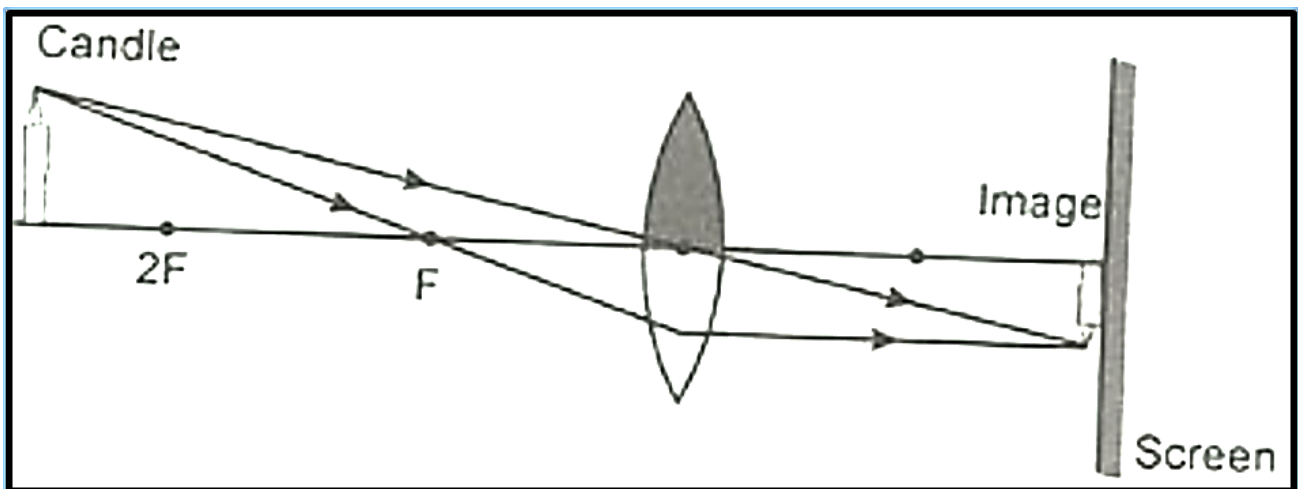
$$f = +25 \text{ cm} = 0.25 \text{ m}$$

$$\text{Power of lens } (p) = \frac{1}{f}$$

$$= \frac{1}{0.25} = +4D.$$

Q. 4 One-half of a convex lens is covered with a black paper. Will this lens produce a complete image of the object? Verify your answers experimentally. Explain your observations.

Ans. When one-half of a convex lens is covered with a black paper, this lens produces a complete image of the object. To prove it we perform experiment:



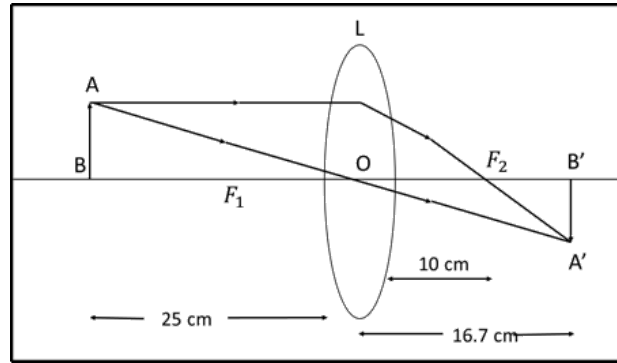
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Take a concave mirror and cover half part of its by using black paper. Place it vertically in a stand. On one side of it place a burning candle. On opposite side of the lens fix a white screen. Adjust the position of candle or screen till clear image of burning candle is formed on the screen. We observe that the image is complete image of the object.

From the experimental observations, we find that image formation does not depend upon the size of a lens. A similar lens can also form complete image of an object placed in front of it. However, brightness of the image decreases when some part of lens is blocked. It is because now lesser number of rays passes through the lens.

Q. 5 An object 5 cm in length is held 25 cm away from a converging lens of focal length 10 cm . Draw the ray diagram and find the position, Size and the nature of the image formed.

Ans:



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$f = +10 \text{ cm}$, $u = -25 \text{ cm}$ and $h_0 = 5 \text{ cm}$

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

$$\frac{1}{10} = \frac{1}{v} - \frac{1}{-25}$$

$$\frac{1}{v} = \frac{3}{50}$$

$$v = \frac{50}{3} \text{ cm}$$

The image is real and inverted at a distance of 16.7 cm from the lens on opposite side.

$$\text{Magnification (m)} = \frac{h_i}{h_0} = \frac{v}{u}$$

$$\frac{h_i}{5} = \frac{16.7}{-25}$$

$$h_i = -\frac{10}{3} \text{ cm.}$$

Image is inverted and diminished.

Q. 6 A convex lens of focal length 15 cm forms an image 10 cm from the lens. How far is the object placed from the lens? Draw the ray diagram.

Ans. $f = 15 \text{ cm}$, $v = -10 \text{ cm}$

(as image distance is less than object distance, the image must be virtual)

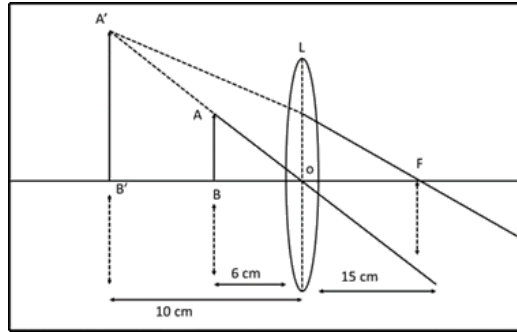
$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow -\frac{1}{10} - \frac{1}{u} = \frac{1}{15}$$

$$\Rightarrow -\frac{1}{u} = -\frac{1}{10} - \frac{1}{15} = -\frac{1}{6}$$

$$\Rightarrow u = -6$$

Ray Diagram:



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