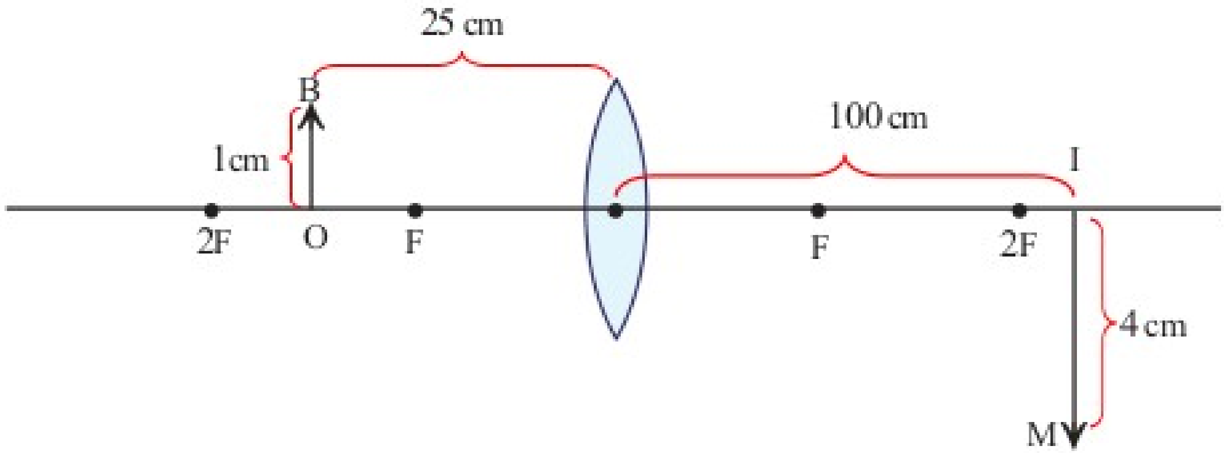
KITE VICTERS ONLINE CLASS 03-01-2021

PHYSICS - X-PART-8 CLASS 46

New Cartesian Sign Conventions



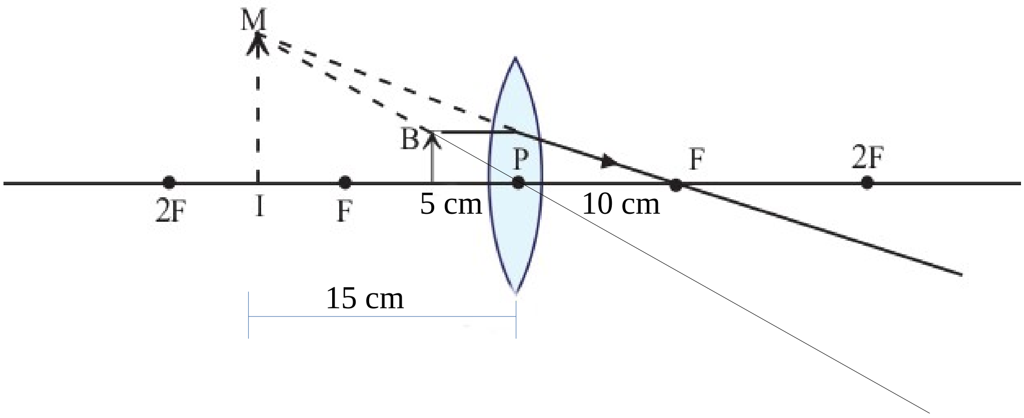
*** In the case of lenses, distances are measured considering the optic centre as the origin. All distances are to be measured from the optic centre. Light ray is assumed to travel from left to right. Therefore all distances measured along the direction of incident light is positive and that in the opposite direction is negative. Distances measured upwards from X-axis are positive and those measured downwards are negative.**

*** The focal length of a convex lens is positive and that of a concave lens, negative.**

Record the measurement shown in the figure as per the Cartesian System.

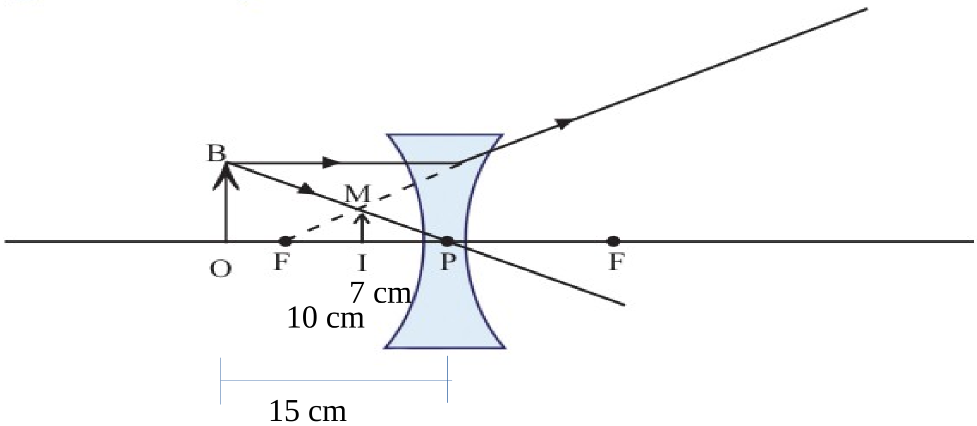
Distance of the object from the lens (u) = -25 cm
Distance of the image from the lens (v) = +100 cm
Height of object (OB) = +1 cm
Height of image (IM) = -4 cm

2.



Distance of the object from the lens (u) = -5 cm
Distance of the image from the lens (v) = -15 cm
Focal length (f) = +10 cm

3.



Distance of the object from the lens (u) = -15 cm
Distance of the image from the lens (v) = -7 cm
Focal length (f) = -10 cm

<u>Let s examine how distances of object and image are related to the focal length of the lens.</u>

Sl. No.	u	v	f =uv / (u − v)
1	-25	+17	+10.11
2	-30	+16	+10.43
3	-35	+15	+10.50

$$\boxed{{}^{1}/_{f} = {}^{1}/_{v} - {}^{1}/_{u} \text{ this is lens equation}}$$

$${}^{1}/_{f} = {}^{(u-v)}/_{uv}$$

$$\boxed{f = {}^{uv}/_{(u-v)}}$$

$${}^{1}/_{v} = {}^{1}/_{u} + {}^{1}/_{f}$$

$${}^{1}/_{v} = {}^{(u+f)}/_{uf}$$

$$\boxed{v = {}^{uf}/_{(u+f)}}$$

$${}^{1}/_{u} = {}^{1}/_{v} - {}^{1}/_{f}$$

$${}^{1}/_{u} = {}^{(f-v)}/_{fv}$$

$$\boxed{u = {}^{fv}/_{(f-v)}}$$

1. The focal length of a convex lens is 10 cm. When an object is placed at a particular distance from the lens an image is formed at a distance of 30 cm. Calculate the distance of object from the lens?

Distance of the image from the lens (v) = +30 cm
Focal length (f) = +10 cm
Distance of the object from the lens (u) = ?

$u = {}^{fv}/_{(f-v)}$

$u = {}^{10x30}/_{(10-30)}$

$u = {}^{300}/_{(-20)}$

Distance of the object from the lens $u = -15$ cm

2. The focal length of a concave lens is 40 cm. If an object is kept at a distance of 30 cm from the lens, find out the distance to the image formed.

Distance of the object from the lens (u) = -30 cm
Distance of the image from the lens (v) = ?
Focal length (f) = -40 cm

$v = {}^{uf}/_{(u+f)}$

$v = {}^{-30x-40}/_{(-30-40)}$

$v = {}^{+1200}/_{(-70)}$

Distance of the image from the lens $v = -17.1$ cm

Worksheet

*** When an object is placed at a distance of 15 cm from a convex lens, a real image is formed at a distance of 30 cm. What is the focal length of the lens?**