LIGHT - REFLECTION AND REFRACTION

IMAGE FORMATION BY CONVEX LENS

CONVEX LENS :

(a) Rules for the formation of images by Convex Lens :

The positions of the image formed by a convex lens can be found by considering two of the following rays (as explained below).

(i) A ray of light coming parallel to principal axis, after refraction through the lens, passes through the principal focus (F) as shown in the figure.

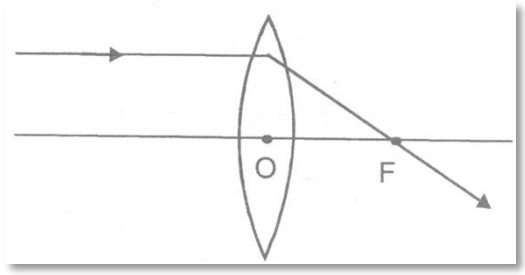
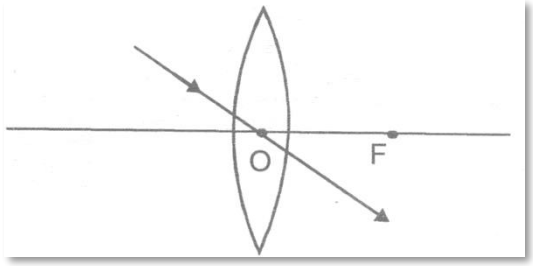
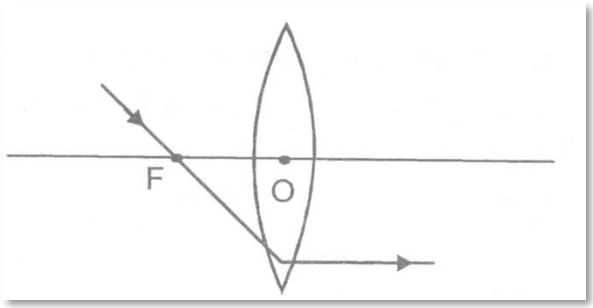


Figure : Convex Lens

(ii) A ray of light passing through the optical centre O of the lens goes straight without suffering any deviation as shown in the figure.



(iii) A ray of light coming from the object and passing through the principal focus of the lens after refraction through the lens, becomes parallel to the principal axis.



(b) Image formed by Convex Lens :

The position, size and nature of the image formed by a convex lens depends upon the distance of the object from the optical centre of the lens. For a thin convex lens, the various case of image formation are explained below :

(i) When object at infinity :

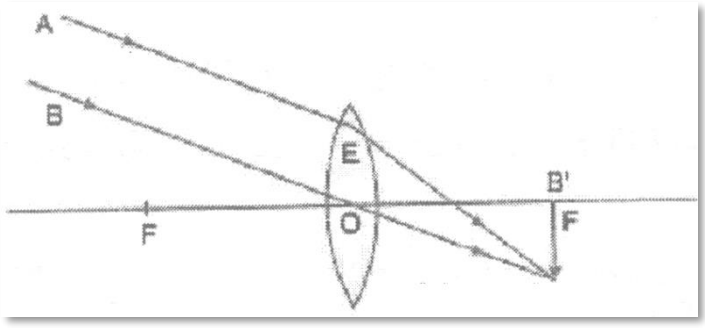
When an object lies at infinity, the rays of light coming from the object may be regarded as a parallel beam of light. The ray of light BO passing through the optical centre O goes straight without any deviation. Another parallel ray AE coming from the object, after refraction, goes along EA'/ Both the refracted rays meet at A' in the focal plane of the lens. Hence, a real, inverted and highly diminished image is formed on the other side of the lens in its focal plane.

Object at Infinitly

Real, Inverted A'

And nightly

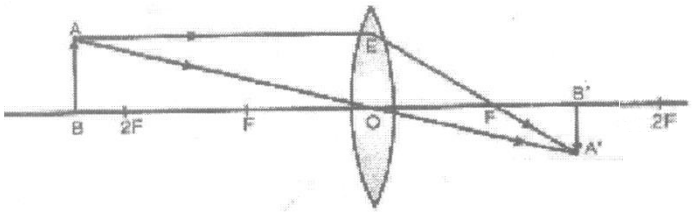
Diminished image



(ii) When object lies beyond 2F :

When an object lies beyond 2F, its real, invert and diminished image is formed between F and 2F on the other side of the lens as explained below :

A ray of light AE coming parallel to the principal axis, after refraction, passes through the principal focus F and goes along EF. Another ray AO passing through the optical centre O goes straight without suffering any deviation. Both the refracted rays meet at A'. hence a real, inverted an diminished image is formed between F and 2F on the other side of the convex lens.



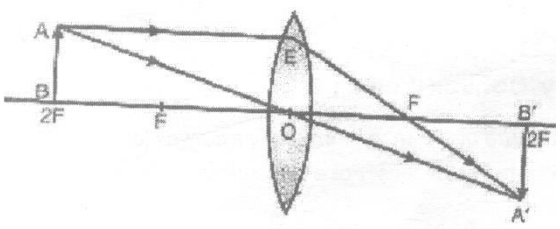
REAL, INVERTED

AND DIMINISHED IMAGE

(iii) When object lies at 2F :

When an object lies at 2F, its real, inverted image having same size as that of the object is formed on the other side of the convex lens as explained below :

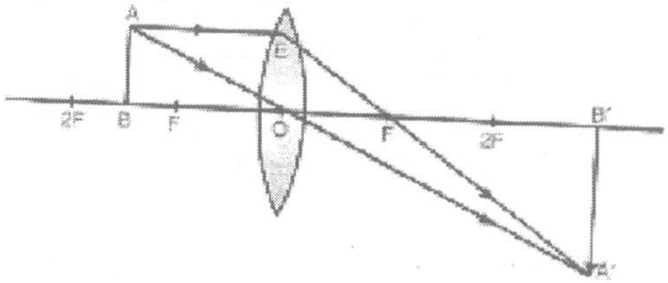
A ray of light AE coming parallel to the principal axis, after refraction, passes through the principal focus F and goes along EF, Another ray AO passing through the optical centre O goes straight without suffering any deviation. Both the refracted rays meet at A'. Hence a real, inverted image having the same size as the of the object is formed at 2F on the other side of the lens.



(iv) When object lies between F and 2F.

When an object lies between F and 2F in front of a convex lens, it real, inverted and magnified image is formed beyond 2F on the other side of the lens an explained below :

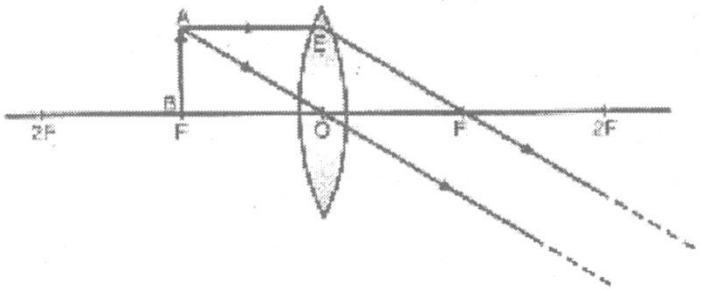
A ray of light AE coming parallel to the principal axis, after refraction, passes through the principal focus F and goes along EF. Another ray of light AO passing through the optical centre goes straight without any deviation. Both these refracted rays meet at A'. Hence a real, inverted and magnified image is formed beyond 2F on the other side of the lens.



(v) When object lies at F :

When an object lies at the principal focus F of a convex lens, then its real, inverted and highly magnified image is formed at infinity on the other side of the lens as explained below :

A ray of light AE coming parallel to the principal axis, after refraction, passes through the principal focus F and goes along EF. Another ray of light AO passing through the optical centre O goes straight without any deviation. Both these refracted rays are parallel to each other and meet at infinity. Hence a real, inverted, highly magnified image is formed at infinity on the other side of the lens.

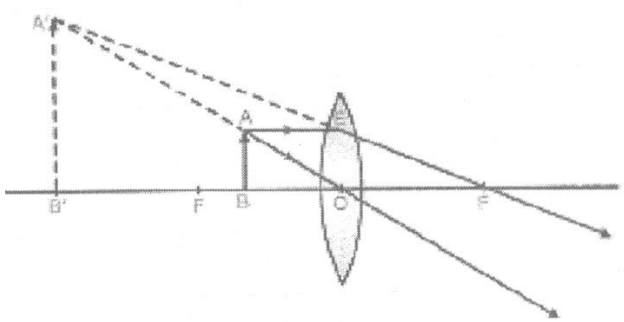


Meet at infinity

(vi) When object lies between O and F :

When an object lies between the optical centre O and the principal focus F of a convex lens, then its virtual, erect and magnified image is formed on the same side as that of the object as explained below :

A ray of light AE coming parallel to the principal axis, after refraction, passes through the principal focus F and goes along EF. Another ray of light AO passing through the optical centre goes straight without any deviation. Both these refracted rays appears to meet at A'. When produced backward. Hence virtual, erect and enlarged image is obtained on the same side of the lens.



The results of image formation by a convex lens are summarised in the table: