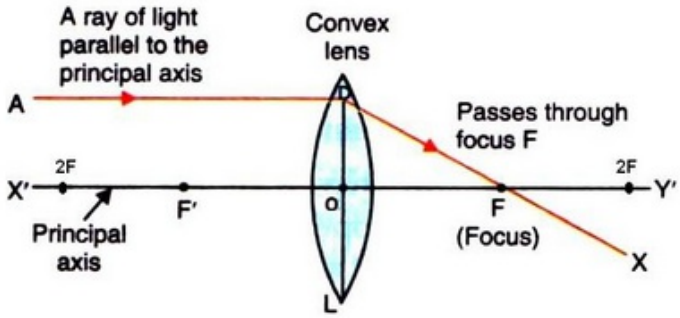
PAGE 239

Q1.
Converging lens.
Q2.
Optical center.
Q3.
1 cm (same as the height of the object).
Q4.
At 2F (At twice the focal length).
Q5.
The image is formed at infinity (at very large distance).
Q6.
Object should be placed at a distance less than focal length.
Q7.
The object should be placed within focus.
Q8.
Object should be placed between f and 2f.

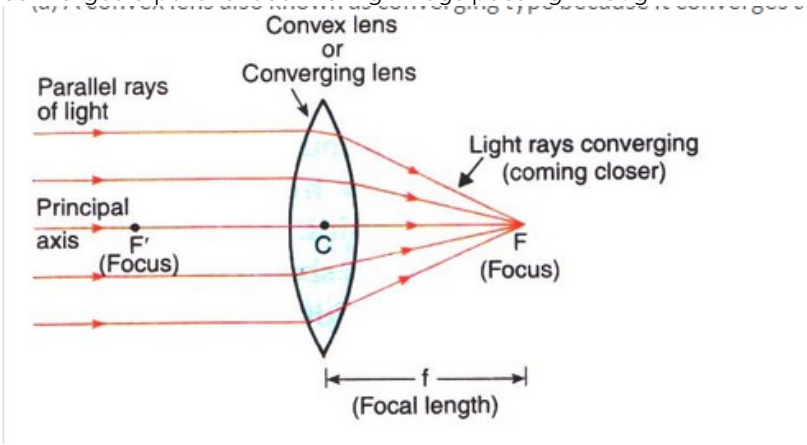
PAGE 240

Q9.
Beyond 2F.
Q10.
At focus F.
Q11.

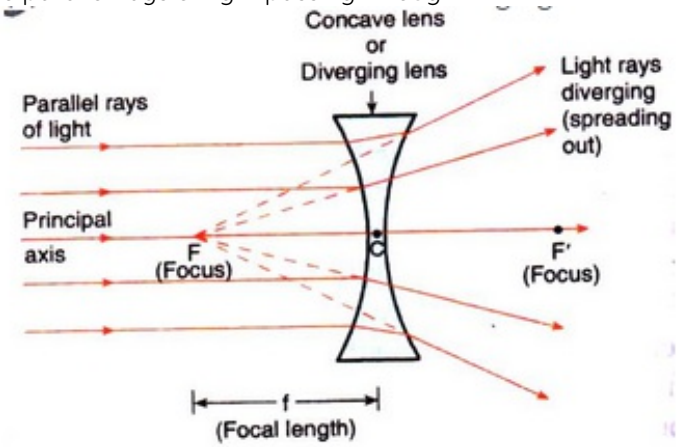


Q12.
Convex lens
The object must be withing the focus of the lens.
Q13.
Focal length of a lens depends on the refractive index of the glass from which it is made, and on the curvature of its two surfaces.
Q14.
Two uses of convex lenses:
1. As a magnifying glass.
2. For making a simple camera.
Q15.
a) focus.
b) object.
Q16.
A lens is a piece of transparent glass bound by two spherical surfaces.

A convex lens is thicker at the middle as compared to the edges; while a concave lens is thicker at the edges as compared to the middle.
Convex lens is converging lens.
Q17.
(a) A convex lens also known as converging type because it converges a parallel beam of light rays passing through it.

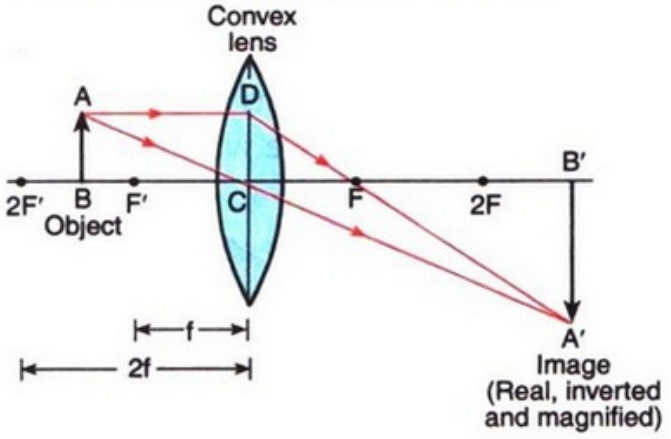


(b) Principle axis: The principal axis of a lens is a line passing throught the optical centre of the lens and perpendicular to both the faces of the lens.
Principle focus: The principal focus of a convex lens is a point on its principal axis to which light rays parallel to the principal axis converge after passing through the lens.
Focal length: The distance of the principle focus from the optical center of a lens is called its focal length.
Q18.
(a) A concave lens is known as diverging lens because it diverges the parallel rays of light passing through it.

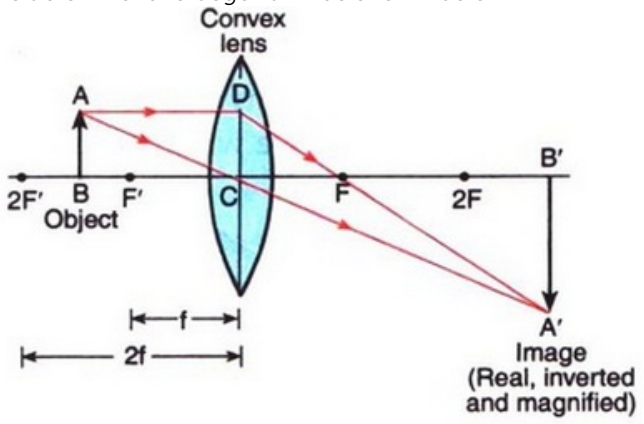


(b) The principal focus of a concave lens is a point on its principal axis from which light rays, originally parallel to the axis, appear to diverge after passing through the lens.
Q19.
Formation of real magnified image by a convex lens.

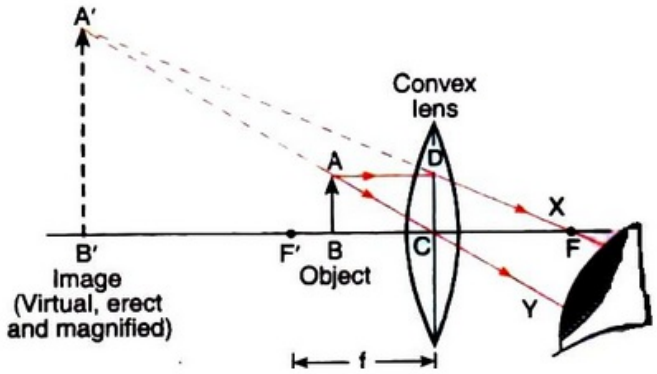
Formation of real magnified image by a convex lens.



Q20.
If object is placed in between f and 2f, the image will form on the other side of the lens beyond 2f as shown below.



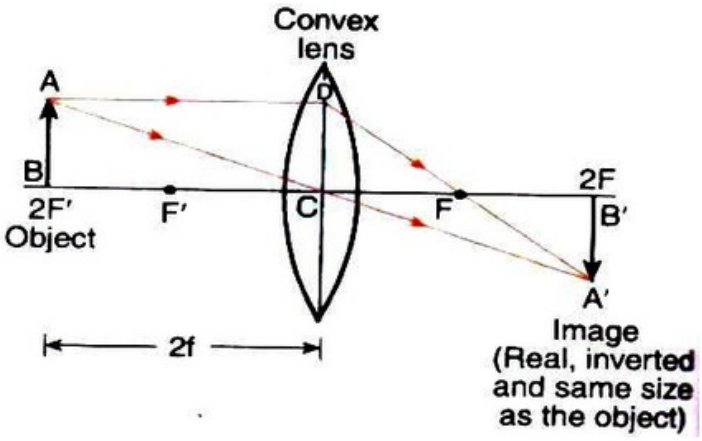
Characteristics of image formed:
Image formed is real and inverted.
Image formed is magnified.
Q21.
In the diagram, the object is placed in front of a convex lens between focus and optical centre. The image is formed on the same side as the object as shown below.



Characteristics of image formed:

1. Image is virtual and erect.
2. Image is larger than the object
3. Image is formed behind the object.

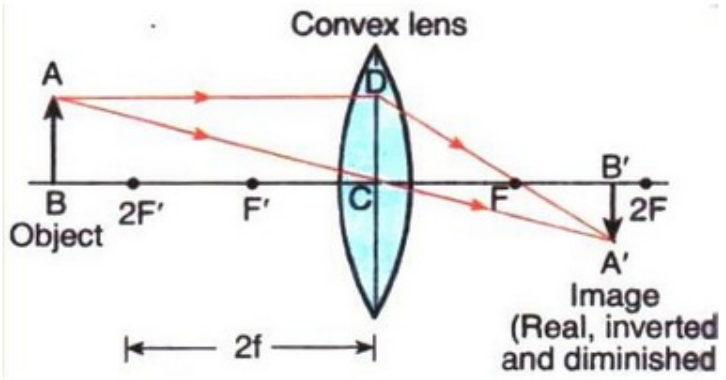
Q22.



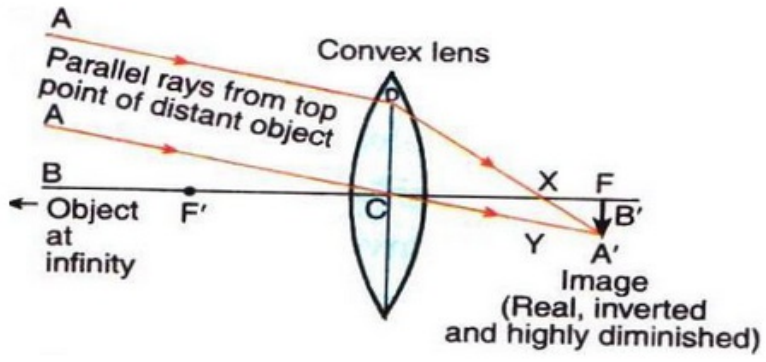
Characteristic of image formed:

1. Image formed is real and inverted.
2. Image is of same size as the object

Q23.
When an object is placed beyond 2f in front of a convex lens, then the image formed is between f and 2f on the other side of the lens, it is real, inverted and smaller than the object.



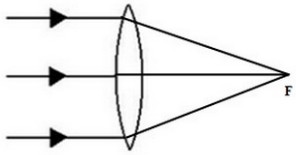
Q24.
When an object is placed at infinity in front of a convex lens, the image is formed at the focus on the other side of the lens.



Characteristics of image formed:

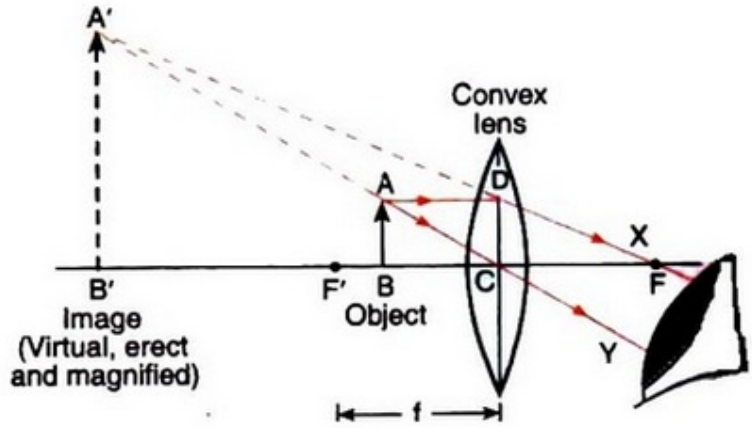
1. Image is real.
2. Image is inverted.
3. Image is highly diminished.

Q25.
(a) The lens shown in convex. the parallel rays will converge to a point called focus (F).

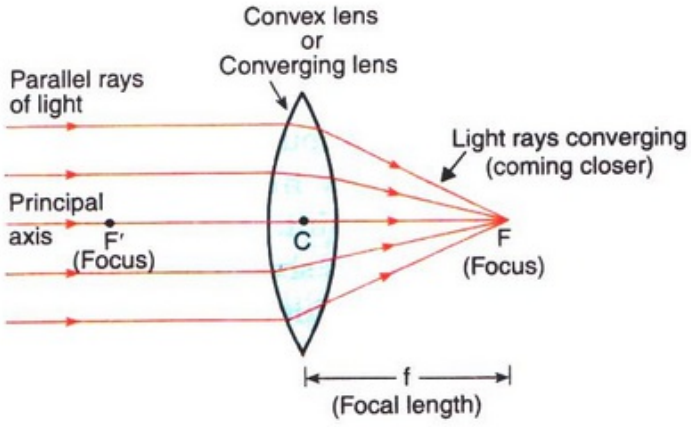


(b) It is unwise to look at the sun because the convex lens focusses a lot of sun rays into our eyes and this may damage them.

Q26.
a) Beyond 2F
b) At 2F
c) Between F and 2F
d) Between F and optical centre
Q27.
Converging lens as a magnifying glass:



It is usual to choose a lens of short focal length for this purpose rather than one of long focal length because smaller the focal length of a convex lens, greater will be its magnifying power.
Q28.
To determine the focal length of a convex lens, we put the convex lens in a holder and keep it in front of a distant object like a window or tree, so that the rays coming from the window pass through it. A cardboard screen is put behind the lens. We change the distance of the screen from the convex lens until a clear inverted image of the window is formed on the screen. Measure the distance of the screen from the lens with a scale. This distance will be the focal length of convex lens.
Q29.
(a) When a beam of light rays parallel to one another and also to the principal axis of the convex lens fall on the lens, the incident rays pass through the lens and get refracted according to the laws of refraction. All the rays, after passing through the lens, converge at the same point F (focus) on the other side of the lens.



(b) A convex lens has a real focus.
(c) Both, convex lens and concave mirror, converge parallel rays of

light coming from infinity (parallel to the principal axis) at the focus.

PAGE 241

Q30.

(a)

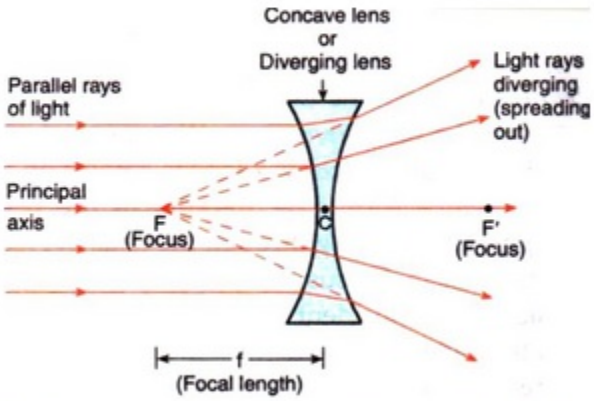
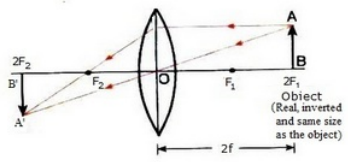


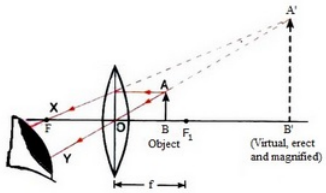
Figure — A concave lens diverges (spreads out) a parallel beam of light rays.

When a beam of light rays parallel to one another and also to the principal axis of the concave lens fall on the lens, the incident rays pass through the lens and get refracted according to the laws of refraction. All the rays spread out after passing through the lens. These diverging rays when produced backwards appear to meet at a point F (focus) on the left side of the lens.
(b) A concave lens has a virtual focus.
(c) Both, concave lens and convex mirror, diverge parallel rays of light coming from infinity (parallel to the principal axis).
Q31.

(a) Object at $2F_1$:



(b) Object between F_1 and the optical centre O of the lens :



The case when object is between F_1 and the optical centre O of the lens shows the use of convex lens as a magnifying glass. This is because here the image formed is erect and magnified.

Q32.
(a)

a)

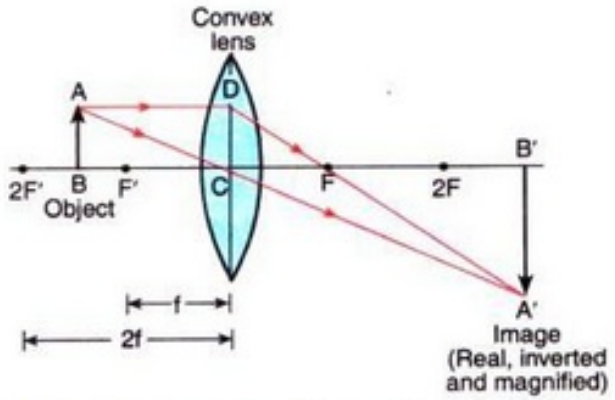


Figure — Formation of image by a convex lens when the object is placed between F′ and 2F′ (or between *f* and 2*f*)

(b)

(i) If object is moved towards the lens, the image size will keep on increasing till the object reaches focus. After that, the size decreases but the image remains magnified. The image keeps movingvaway from the lens (on the opposite side of the lens) till the object reaches focus; after that the image is formed on the same side of the lens as the object.

(ii) If object is moved away from the lens, the size will keep on decreasing and the image keeps on shifting towards the lens.

Q33.

(a) A virtual magnified image is the one which cannot be taken on a screen and whose size is larger than that of the object.

(b)

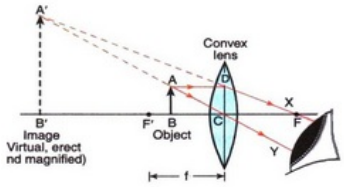


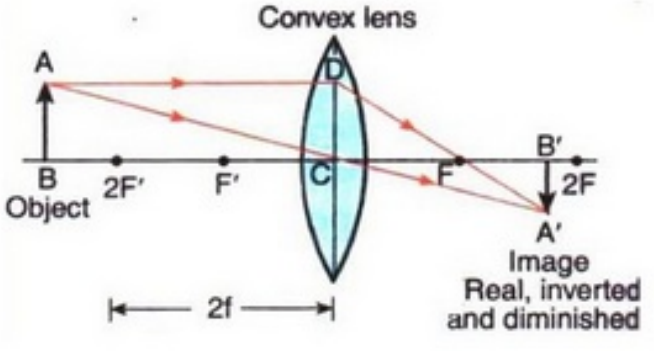
Figure – Formation of image by a convex lens when the object is placed between its optical centre (*C*) and focus (*F'*).

(c) Convex lens having 4 cm focal length - because it will produce greatest magnification.

Q34.

a) A real image can be projected on a screen but a virtual image cannot because a real image is formed when light rays coming from an object actually meet at a point after refraction through a lens while a virtual image is formed when light rays coming from an object only appear to meet at a point when produced backwards (but do not actually meet) after refraction through a lens.

b)



c) A simple camera

PAGE 242

Q46.

(b) 16 cm

Magnification, $m = \frac{v}{u}$

$3 = \frac{v}{u}$

$\Rightarrow v = 3u$

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{3u} - \frac{1}{u} = \frac{1}{12}$

$\frac{-2}{3u} = \frac{1}{12}$

$\Rightarrow u = -8\,cm$

$v = 3 \times -8 = -24\,cm$

Distance between object and image=u-v=-8-(-24) $= -8 + 24 = 16\,cm$

Q47.

(b) 10 cm

The image is slightly smaller than the object when the object lies beyond 2f; and the image is slightly larger than the object when the object between f and 2f. This means that between 21 cm and 19 cm lies 2f. Out of the given options, 20 cm lies between 21 cm and 19 cm.

So, 2f = 20 cm.

f = 10 cm.

Q48.

Here, f=15cm and 2f=30cm

(i) 20 cm (Because a magnified real image is formed when the object is placed between f and 2f).

(ii) 10cm (Because a magnified virtual image is formed when the object is placed between f and the lens).

(iii) 35cm (Because a diminished real image is formed when the object is placed beyonf 2f).

(iv) 30cm (Because an image of same size as the object is formed when the object is placed at 2f).

Q49.

Here, 2f = 36 cm, f = 18 cm.

(a) When the object is placed at a distance of 10 cm from the lens, the object lies within the focus. Hence, the image formed is virtual, erect and magnified.

(b) When the object is placed at a distance of 20 cm from the lens, the object lies between f and 2f. Hence, the image formed is real, inverted and magnified.

Q50.

(a) A converging lens focusses parallel ray of light as shown below:

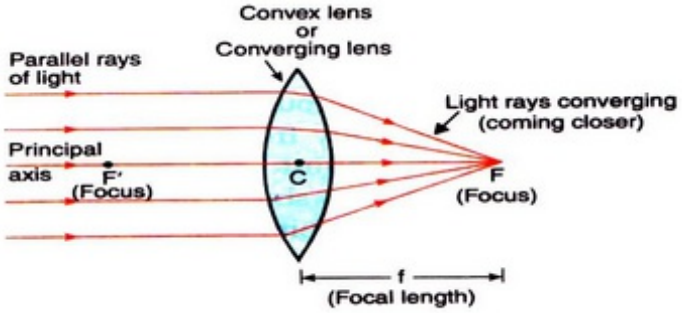


Figure — A convex lens converges (brings closer) a parallel beam of light rays to a point *F* on its other side (right side).

(b) Place a source of light at the focus of the converging lens.

********** END **********