EXAMPLE 9.1

Example 9.1 Suppose that the lower half of the concave mirror's reflecting surface in Fig. 9.5 is covered with an opaque (non-reflective) material. What effect will this have on the image of an object placed in front of the mirror?

Solution You may think that the image will now show only half of the object, but taking the laws of reflection to be true for all points of the remaining part of the mirror, the image will be that of the whole object. However, as the area of the reflecting surface has been reduced, the intensity of the image will be low (in this case, half).

Intensity of image is directly proportional to the area of Reflecting surface

EXAMPLE 9.2

Example 9.2 A mobile phone lies along the principal axis of a concave mirror, as shown in Fig. 9.7. Show by suitable diagram, the formation of its image. Explain why the magnification is not uniform. Will the distortion of image depend on the location of the phone with respect to the mirror?

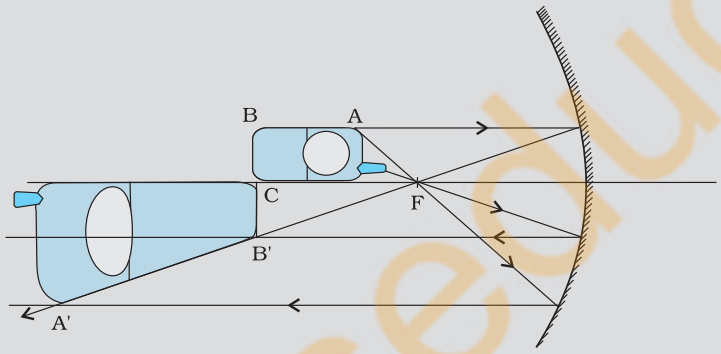

FIGURE 9.7

Solution

The ray diagram for the formation of the image of the phone is shown in Fig. 9.7. The image of the part which is on the plane perpendicular to principal axis will be on the same plane. It will be of the same size, i.e., B′C = BC. You can yourself realise why the image is distorted.

Since $m = \frac{h'}{h} = -\frac{v}{u}$

Size of real image (h') depends upon the position of object (u).

EXAMPLE 9.3

Example 9.3 An object is placed at (i) 10 cm, (ii) 5 cm in front of a concave mirror of radius of curvature 15 cm. Find the position, nature, and magnification of the image in each case.

Solution

The focal length $f = -15/2$ cm $= -7.5$ cm

(i) The object distance $u = -10$ cm. Then Eq. (9.7) gives

$$\frac{1}{v} + \frac{1}{-10} = \frac{1}{-7.5}$$

or $$v = \frac{10 \times 7.5}{-2.5} = -30 \text{ cm}$$

The image is 30 cm from the mirror on the same side as the object.

Also, magnification $m = -\frac{v}{u} = -\frac{(-30)}{(-10)} = -3$

The image is magnified, real and inverted.