Answer on Question 64607, Physics, Other

Question:

An object is $2\ cm$ in length is placed at a distance of $10\ cm$ in front of convex mirror of radius of curvature $30\ cm$. Find the position and nature of the image.

Solution:

We can find the position of the image from the mirror equation:

$$\frac{1}{d_o}+\frac{1}{d_i}=\frac{1}{-f},$$

here, d_o is the distance from the object to the mirror, d_i is the distance from the image to the mirror and f is the focal length (since we have the convex mirror, the focal length will be with sign minus).

By the definition, the focal length of the curved mirror is half a radius of curvature:

$$f=\frac{R}{2}=\frac{30\ cm}{2}=15\ cm.$$

Then, from the mirror equation, we get:

$$\frac{1}{d_i}=-\frac{1}{f}-\frac{1}{d_o},$$

$$\frac{1}{d_i}=-\frac{1}{15\ cm}-\frac{1}{10\ cm}=-\frac{5}{30}\ cm=-\frac{1}{6}\ cm,$$

$$d_i=-6\ cm.$$

The sign minus indicates that the image is located behind the convex mirror.

Let's find the nature of the image. We can find the magnification of the image from the formula:

$$M=\frac{h_i}{h_o}=\frac{-d_i}{d_o},$$

here, h_i is the height of the image, h_o is the height of the object.

Then, we get:

$$M = \frac{-d_i}{d_o} = \frac{-(-6\ cm)}{10\ cm} = 0.6$$

As we can see, the magnification of the mirror is positive, so the image is upright.

We can find the height of the image from the same formula:

$$M = \frac{h_i}{h_o},$$

$$h_i = Mh_o = 0.6 \cdot 2\ cm = 1.2\ cm.$$

Therefore, the image is virtual (located behind the convex mirror), upright and reduced in size (smaller than the object).

Answer:

$d_i = -6\ cm.$

The image is virtual, upright and reduced in size.