

A dentist uses a small mirror with a radius of 36 mm to locate a cavity in a patient's tooth. If the mirror is concave and is held 15 mm from the tooth, what is the magnification of the image? Please explain your answer.

Solution

The Gaussian mirror equation relates the object distance d_o and image distance d_i to the focal length f :

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

Magnification is defined as:

$$m = -\frac{d_i}{d_o}$$

http://en.wikipedia.org/wiki/Curved_mirror#Analysis

For the concave mirror focal length related with radius as:

$$f = \frac{R}{2}$$

We are given

$$R = 36 \text{ mm}$$

$$d_o = 15 \text{ mm}$$

$$\frac{2}{R} = \frac{1}{d_o} + \frac{1}{d_i}$$

So

$$d_i = \frac{1}{\frac{2}{R} - \frac{1}{d_o}}$$

Thus magnification is:

$$m = -\frac{\frac{1}{\frac{2}{R} - \frac{1}{d_o}}}{d_o} = -\frac{1}{\frac{2d_o}{R} - 1} = \frac{1}{1 - \frac{2d_o}{R}}$$

Calculation

$$m = \frac{1}{1 - \frac{2 * 15}{36}} = 6$$

Answer:

$$m = 6$$