

The focal length of a concave mirror is 40cm. where should an object be placed so as to get its real image magnified four times.

Solution:

The mirror equation:

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

where:  $d_o$  the object distance,  $d_i$  the image distance,  $f$  the focal length.

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

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

The magnification of mirror:

$$y' = y \frac{d_i}{d_o}$$

On assignments:

$$\frac{d_i}{d_o} = 4 \Rightarrow d_i = 4d_o$$

$$\frac{d_o * 4d_o}{d_o + 4d_o} = 40$$

$$\frac{4d_o^2}{5d_o} = 40$$

$$\frac{4}{5}d_o = 40, d_o = 40 * 5/4$$

$$d_o = 50 \text{ cm.}$$

$$d_i = 50 * 4 = 200 \text{ cm.}$$

**Answer: the object should be placed at 50 cm. from the mirror.**