

A reflecting, spherical Christmas tree ornament has a diameter of 7.0 cm. A child looks at the ornament from a distance of 21 cm. Describe the image she sees.

Solution:

Spherical Christmas tree ornament is a curved mirror in this problem.

Focus of the curved mirror is located halfway between the center and the pole of the mirror, that is, the distance (f) is equal to half mirror radius (R):

$$f = \frac{R}{2}, R = \frac{D}{2} = 3.5\text{cm}(1)$$

Formula of the convex curved mirror (v - the distance from the image to the mirror, $u = 21\text{cm}$ - the

distance from the mirror to the object):

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}(2)$$

$$(1) \text{ in } (2): \frac{1}{u} + \frac{1}{v} = \frac{2}{R}$$

$$\frac{1}{v} = \frac{2u - R}{uR}$$

$$v = \frac{uR}{2u - R} = \frac{21\text{cm} \cdot 3.5\text{cm}}{2 \cdot 21\text{cm} - 3.5\text{cm}} = 1.91\text{cm}$$

The image is virtual and upright, because the distance to the image more than the focal length ($v > \frac{R}{2}, 1.91\text{cm} > 1.75\text{cm}$)

Answer: the distance from the image to the mirror is 1.91cm, the image is virtual and upright.

