

Q- A goldfish lives in a 46 cm diameter spherical fish bowl. The fish sees a cat watching it. If the cat's face is 15 cm from the edge of the bowl, how far from the edge does the fish see it as being? (You can ignore the thin glass wall of the bowl.)

When the light is refracting from one medium to another through a curved surface the relation between the object distance u , image distance v and radius of curvature of curvature of the refracting surface R is given by

$$\frac{\mu}{v} - \frac{1}{u} = \frac{\mu-1}{R}$$

Here μ is the refractive index of the second medium with respect to the first medium. Or in terms of absolute refractive indices of the two media it can be given as

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

Using the sign convention here we have

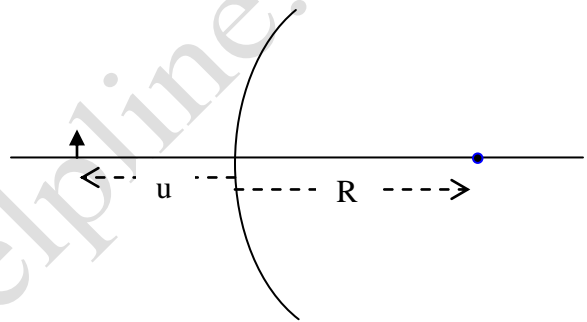
$$u = -15 \text{ cm}$$

$$v = ?$$

$$R = +46/2 = 23 \text{ cm}$$

$$\mu_1 = 1.00$$

$$\mu_2 = 1.33$$



Substituting the values in the equation above we get

$$\frac{1.33}{v} - \frac{1.00}{-15} = \frac{1.33-1.00}{23}$$

Or
$$\frac{1.33}{v} = \frac{0.33}{23} - \frac{1.00}{15}$$

Gives $v = -25.4 \text{ cm}$

Hence the cat will appear 25.4 cm from the edge of the bowl outside it at **25.4 cm**