

Question:

How far should an object be placed from a concave spherical mirror of radius 38cm to form a real image of one-ninth its size?

Solution:

If radius of spherical mirror is $R=38\text{cm}$ then focal length of mirror is

$$F=R/2=19\text{cm}$$

Because we have real image of one-ninth its size we get the object's position as $S>2*F$,

We have $D/S=m$, $D=S*m$ (here $m=1/9$ is the magnification, D is image position) and

$$1/S+1/D=1/F$$

So, we arrive at

$$\frac{1}{S}\left(1 + \frac{1}{m}\right) = \frac{1}{F}$$

And substituting values we get the answer:

$$S = F \frac{m+1}{m} \approx 21\text{cm}$$