DPP 05

1. For the refraction at spherical surface

$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R} \Rightarrow \frac{2}{v} - \frac{1}{-10} = \frac{2-1}{+20}$

$\Rightarrow \quad \frac{2}{v} + \frac{1}{10} = \frac{1}{20}$

$\Rightarrow \quad \frac{2}{v} = -\frac{1}{20} \Rightarrow v = -40$ cm. (virtual)

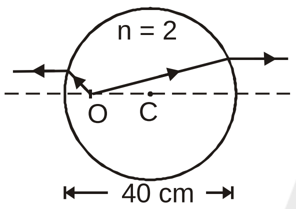
Magnification formula

$m = \frac{h_2}{h_1} = +\left(\frac{\mu_1}{\mu_2}\right)\left(\frac{v}{u}\right)$

$\Rightarrow \quad \frac{h_2}{2} = \frac{1\times(-40)}{2\times(-10)}$

$\Rightarrow \quad h_2 = +4$ cm. (erect)

2. When seen from air through nearest surface,



$\frac{1}{-5} - \frac{2}{u} = \frac{1-2}{-20}$

$\frac{2}{u}\ \frac{2}{u} = \frac{-1}{20} - \frac{1}{5} = \frac{-1-4}{20}$

u = – 8 cm.-

For second case,

$u = -(40 - 8) = -32$ cm

$\frac{1}{v} - \frac{2}{-32} = \frac{1-2}{-20}$

$\frac{1}{v} = -\frac{1}{16} + \frac{1}{20} = \frac{-5+4}{80} \quad v = -80$ cm.

3. For first refraction:

$\frac{1.5}{v_1} - \frac{1}{-10} = \frac{1.5-1}{10} \quad \Rightarrow \quad v_1 = -30$ cm.

For second refractions

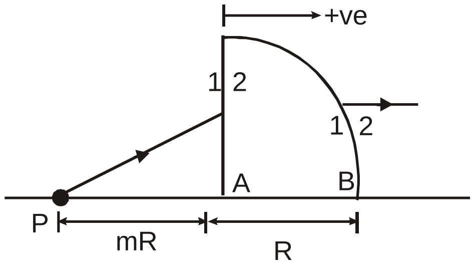
$u = -(30 + 20) = -50$ cm

$\therefore \quad \frac{1}{v_2} - \frac{1.5}{-50} = \frac{1-1.5}{-10}$

$\Rightarrow \quad v_2 = 50$ cm

Hence, final image is formed 50 cm right of B.

4.



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

First on plane surface

$\frac{1.5}{v_1} - \frac{1}{(-mR)} = \frac{1.5-1}{\infty}$ $(R = \infty)$

$\therefore v_1 = -1.5\ mR$

Then on curved surface

$= \frac{1}{\infty} - \frac{1.5}{-(1.5mR+R)}$ [$v = \infty$, because final image is at infinity]

$\Rightarrow \frac{1.5}{(1.5m+1)R} = \frac{0.5}{R}$ $\Rightarrow$ $3 = 1.5\ m + 1$

$\Rightarrow \frac{3}{2}m = 2$ (or) $m = 4/3$

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

$v = -R$ for all values of μ.

$v = -R\ \mu$

6. $\frac{1}{v} - \frac{3}{2\times30} = \frac{1-\frac{3}{2}}{+20}$ $\frac{1}{v} = -\frac{1}{40} + \frac{1}{20} = +\frac{1}{40}$ $v = 40$ cm.

7. For refraction by upper surface

$\frac{1.6}{v_1} - \frac{1}{-2} = \frac{1.6-1}{1}$

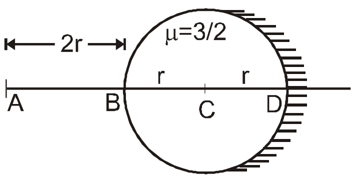
$\Rightarrow$ $\frac{1.6}{v_1} = 0.6 - 0.5 = 0.1$ $\Rightarrow$ $v_1 = 16$ m

For refraction by lower surface

$\frac{2}{v_2} - \frac{1}{-2} = \frac{2-1}{1}$ $\Rightarrow$ $\frac{2}{v_2} = 1 - 0.5 = 0.5$ $\Rightarrow$ $v_2 = \frac{2}{0.5} = 4$m

Distance between images = (16 – 4) = 12m.

8.



The object be placed at A

Then for refraction at the unsilvered part $u = -2r$,

$R = r$.

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

$= \quad \frac{3/2}{v} - \frac{1}{(-2r)} = \frac{\frac{3}{2} - 1}{r} \quad \Rightarrow \quad v = \infty$

So, image formed at infinity will act as an object for the silvered part and hence the image will be formed at the focus of the concave mirror i.e., at $\frac{r}{2}$ distance left ward from D.

Again, for refraction at the unsilvered surface $u = \left(r + \frac{r}{2}\right) = \frac{3r}{2}$

$\therefore \quad \frac{1}{v} - \frac{\frac{3}{2}}{\frac{3r}{2}} = \frac{1 - \frac{3}{2}}{r} \quad$ or, $\quad v = 2r$