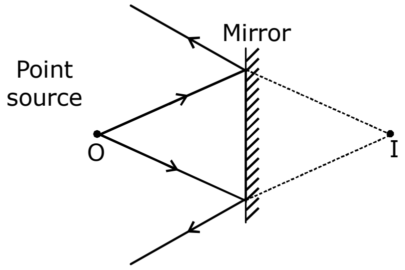
OBJECTIVE - I

Sol 1. A



All the reflected ray meet at a point when produced backward.

Sol 2. B

T.I.R. (Total Internal reflection)

i < C (condition for T.I.R.)

By Snell's Law

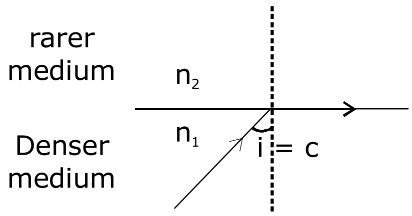
$n_1 \sin i = n_2 \sin 90°$

$$\sin i = \frac{n_2}{n_1} = \sin C$$

Þ C = $\sin^{-1}$

$\because -1 \le \sin i \le 1$

\ $n_1 > n_2$ (so we can conclude that light goes from optically denser medium to rarer medium & incident angle is greater than the critical angle.)



Sol 3. C

In Image formation from spherical mirrors, only paraxial rays are considered because they form nearly a point Image of a point source. Angle of Incidence of Paraxial rays is very small.

Sol 4. A

By mirror formula :-

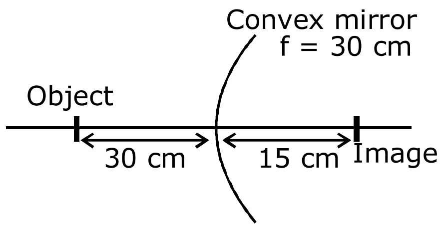
$$\frac{1}{V} + \frac{1}{u} = \frac{1}{f}$$

Here u = - 30 cm

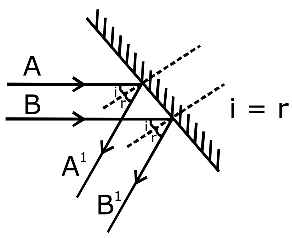
f = + 30 cm

so $$\frac{1}{V} - \frac{1}{30} = \frac{1}{30}$$

Þ v = 15 cm behind the mirror.



Sol 5. A

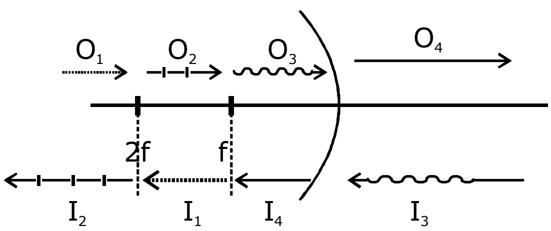


Here initially A & B is parallel to each other after reflection by teh plane mirror A' & B' goes Parallel to each other.

Sol 6. C

Object	Image
O_1	I_1
O_2	I_2
O_3	I_3
O_4	I_4

Here O_4 is virtual object & I_4 is real Image.



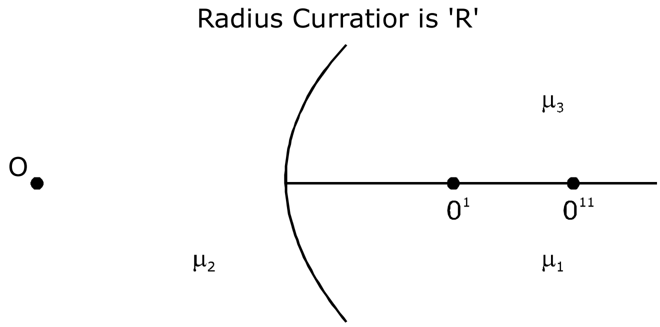
Sol 7. D

(i) m_1, Image is 0^1
(ii) m_3, Image is 0^{11}

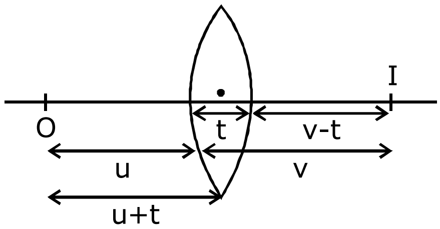
Spherical Surface formula

$$\frac{\mu^{11}}{v} - \frac{\mu_1}{\mu} = \frac{\mu^{11} - \mu^1}{R}$$

If ray goes to m_2 to m_1 than Image is formed at 0^1 and if ray goes to m_2 to m_3 than Image is formed at 0^{11}.

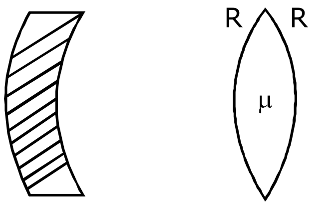


Sol 8. C



$$\frac{1}{v-t} - \frac{1}{u+t} = \frac{1}{f}$$

Sol 9. B



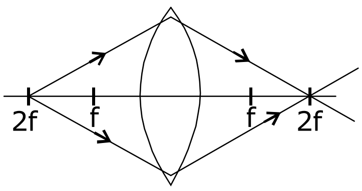
$$\Rightarrow \quad \frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\Rightarrow \quad \frac{1}{f} = \left(\frac{3}{2} - 1\right)\left(\frac{1}{R} - \left(-\frac{1}{R}\right)\right)$$

$$\frac{1}{f} = \frac{1}{R}$$

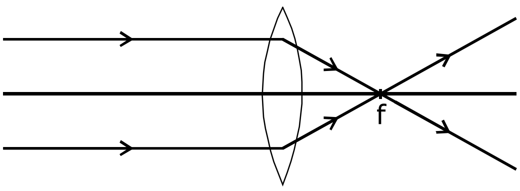
$$f = R$$

Sol 10. C



The Intensity on the other side of the lans is maximum at a distance 2f.

Sol 11. D

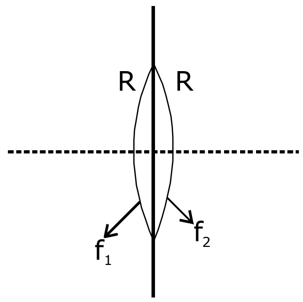


The intensity o light is first increases then decreases.

Sol 12. A

Before cut

$$\frac{1}{f}=(\mu-1)\left(\frac{2}{R}\right)=4D \quad \text{....(1)}$$



After cut

$$\frac{1}{f_1}=(\mu-1)\left(\frac{1}{R}\right)+\frac{1}{f_2}=(\mu-1)\left(\frac{1}{2}\right) \quad \text{....(2)}$$

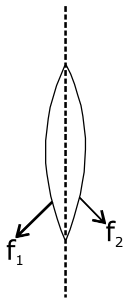
From eq. (1) we get Power of f_1 = power of f_2

$$P=\frac{1}{f_1}=\frac{1}{f_2}=2D$$

Sol 13. C

Before cut :-

$$\frac{1}{f}=(\mu-1)\left(\frac{2}{R}\right)=4D$$



After cut :-

$$\frac{1}{f_1}=(\mu-1)\left(\frac{1}{R}\right)=P_1$$

$$\& \ \frac{1}{f_2}=(\mu-1)\left(\frac{1}{R}\right)=P_2$$

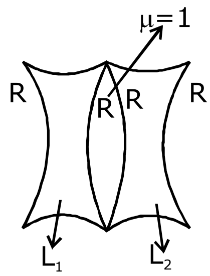
Power of a divided lens will be = $P_1 + P_2$

$$=(\mu-1)\left(\frac{2}{R}\right)$$

$$=4D$$

Sol 14. D

$$\frac{1}{f}=\frac{1}{f_{L_1}}+\frac{1}{f_{L_2}}$$



$$\frac{1}{f_{L_1}}=(\mu-1)\left(\frac{-2}{R}\right)=\frac{1}{f_{L_2}}$$

Local length of the combination :-

$$\frac{1}{f}=(\mu-1)\left(\frac{-2}{R}\right)+(\mu-1)\left(\frac{-2}{R}\right)$$

$$\frac{1}{f}=-4(\mu-1)\left(\frac{1}{R}\right)$$

$$f=\frac{R}{4(\mu-1)}$$

where $f_{L_1}=f_{L_2}=\dfrac{R}{2(\mu-1)}$

$$\left(f_{L_1}=f_{L_2}\right)>f$$

Sol 15. A

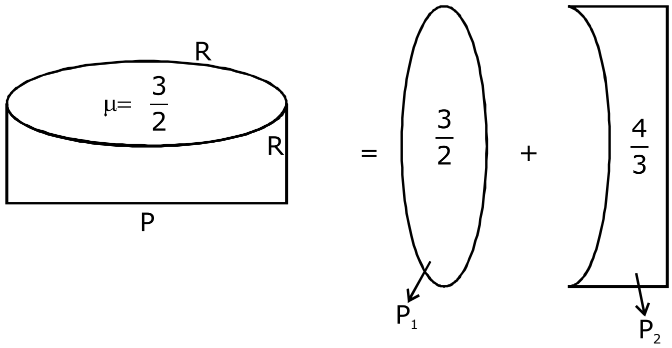
Here P, P_1 & P_2 are the power of Lenses.

$$P = P_1 + P_2$$

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$= (\mu - 1)\left(\frac{2}{R}\right) + (\mu^1 - 1)\left(\frac{-1}{R}\right)$$

$$= \left(\frac{3}{2} - 1\right)\left(\frac{2}{R}\right) - \left(\frac{4}{3} - 1\right)\left(\frac{1}{R}\right)$$



$$\frac{1}{f} = \frac{1}{R} - \frac{1}{3R}$$

$$\frac{1}{f} = \frac{3-1}{3R}$$

$$f = \frac{3R}{2}$$

focal length of combined is positive means it will behave like a canvergent lens.

Sol 16. B

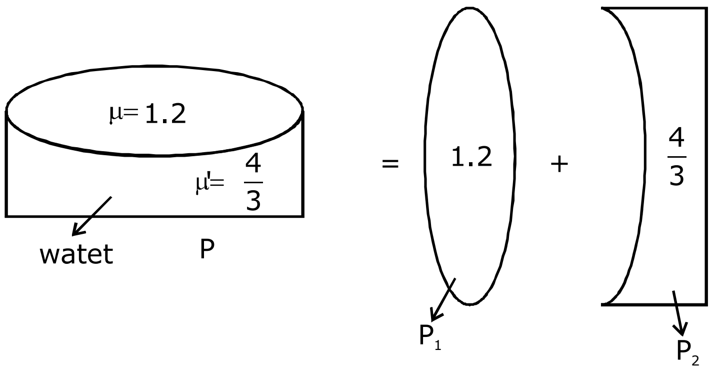
Here P, P_1 & P_2 are the Power of Lenses.

$$P = P_1 + P_2$$

$$\frac{1}{f} = \frac{1}{f_1} = \frac{1}{f_2}$$

$$(\mu - 1)\left(\frac{2}{R}\right) + (\mu' - 1)\left(\frac{-1}{R}\right)$$

$$(1.2 - 1)\left(\frac{2}{R}\right) - \left(\frac{4}{3} - 1\right)\left(\frac{1}{R}\right)$$



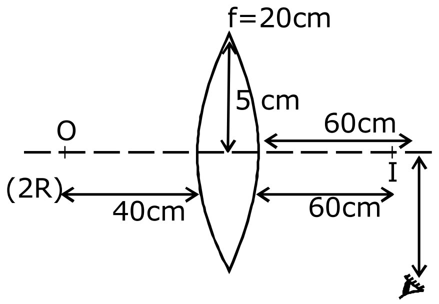
$$\frac{1}{f} = \frac{2}{5R} - \frac{1}{3R}$$

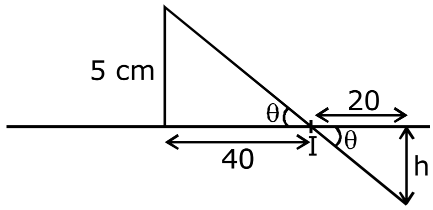
$$\frac{1}{f} = \frac{6-5}{15R}$$

$f = 15R$

Focal lenght of combined is positive, but it's magnitude in capair to f_1 & f_2 is High. So it will be hare like a divergent lens.

Sol 17. **B**





$$\tan\theta = \frac{5}{40} = \frac{h}{20}$$

$$h = \frac{5}{2} = 2.5\,\text{cm}$$

The maximum value of "h=2.5 cm" to see the Image of the object.

Sol 18. **D**

The rays of different colours fail to converge at a Point after going through a converging Lens. This defect is called chromatic oberration.

OBJECTIVE - II

Sol 1. **AB**

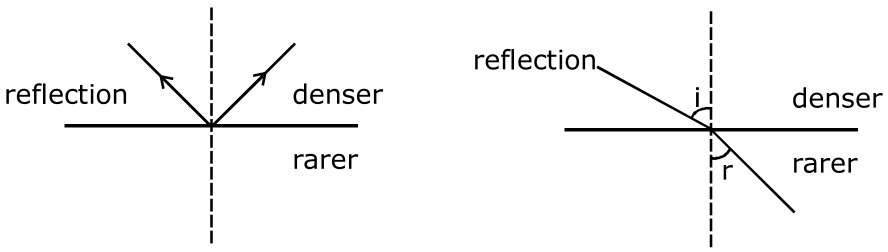
Sol 2. **B**

If the final rays are converging, we have a real Image.

Sol 3. **ACD**

If Paraxial rays comes to parallel to the spherical mirror is pasees to the Focus of the spherical mirror.

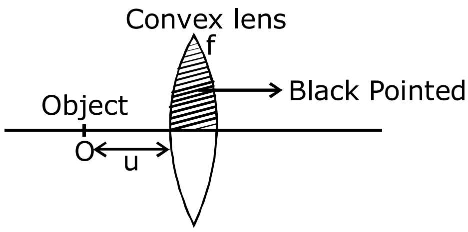
Sol 4. **CD**



$$m = \frac{-v}{\mu} = \frac{h_I}{h_0} \qquad \text{(for mirror)}$$

Image will be erect mean height of the object and Image will e lies in same side. It mean if object isreal then Image in virtual. If object is virtula then Image is real.

Sol 5. **CD**



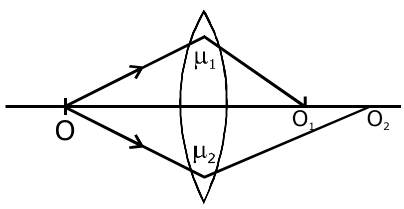
By lens formula

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Due to Black Pointed focal Lenght of the Lens will not change.

So Image will not be shifted due to Black point. But Intensily of Image will decrease.

Sol 6. **AB**



It rays are Passing through m_1 then Image will be form at "O_1" and If rays are Passing through m_2 then Image will be form at "O_2".

Sol 7. **B**

$v = (40 - 4)$

$$\frac{1}{f} = \frac{1}{40-4} - \frac{1}{(-u)}$$

$$\frac{df}{du} = 0 \text{ for f minimum.}$$

$$\frac{df}{du} = 1 - \frac{u}{20} = 0$$

$u = 20$

$f_{min} = 10\text{ cm}$