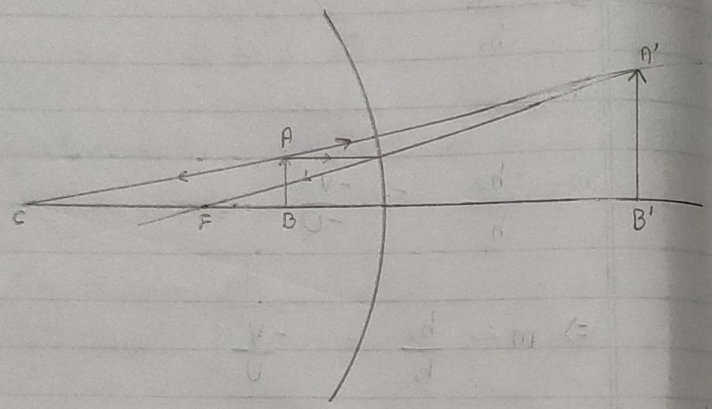
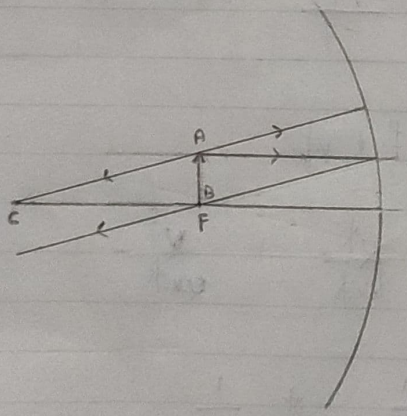
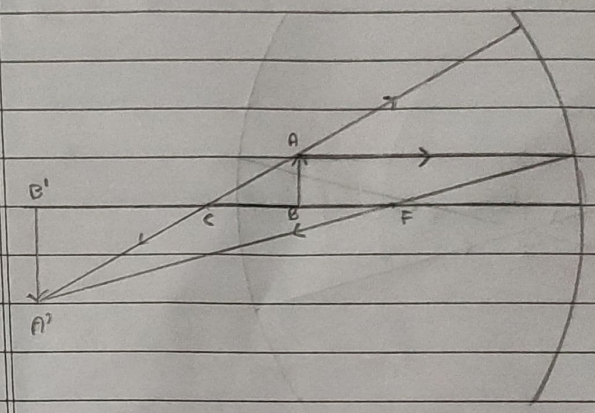
H.W.
17.5.21



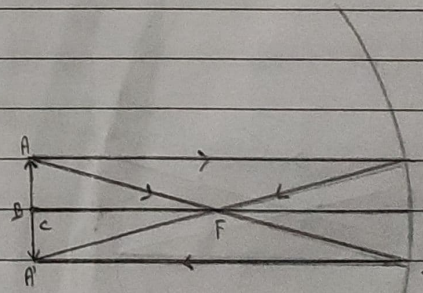
i) Between Pole and Focus



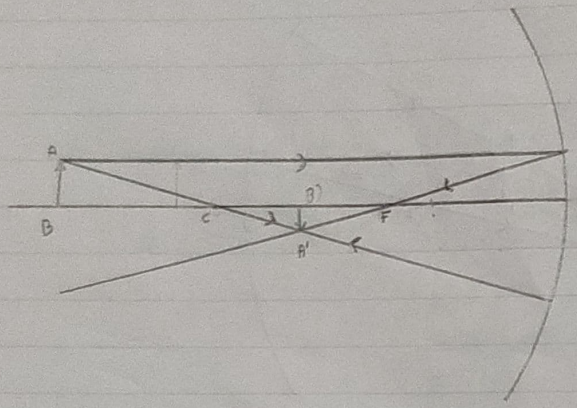
ii) On the Focus



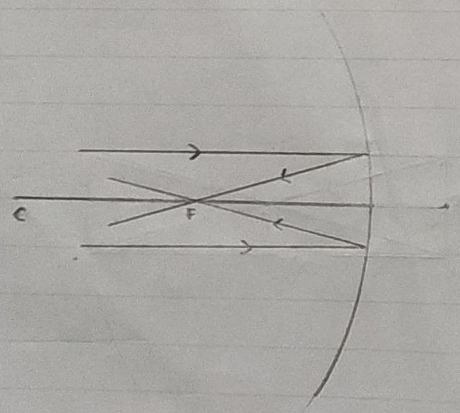
iii) Between COC and Focus



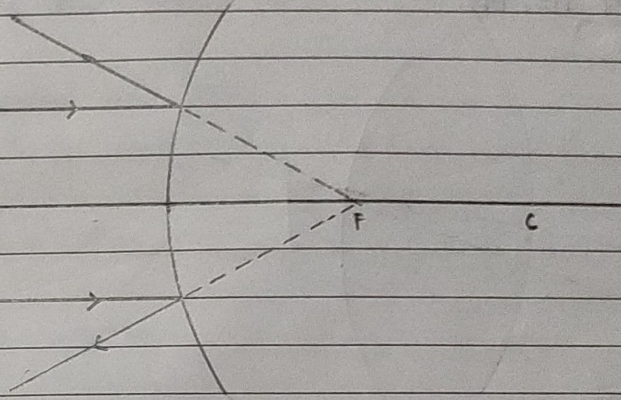
iv) On COC



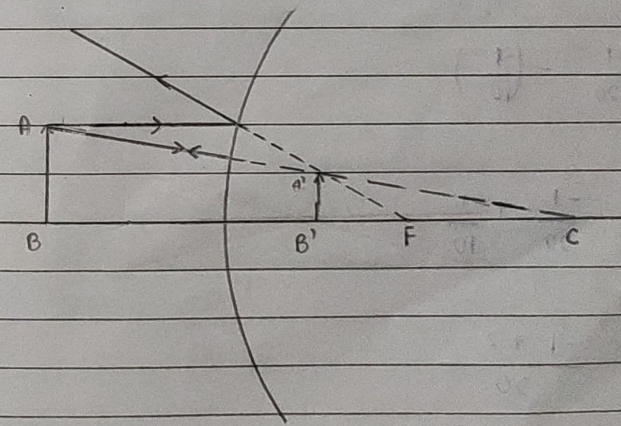
vi) Beyond C



vii) At infinity



ii) At infinity

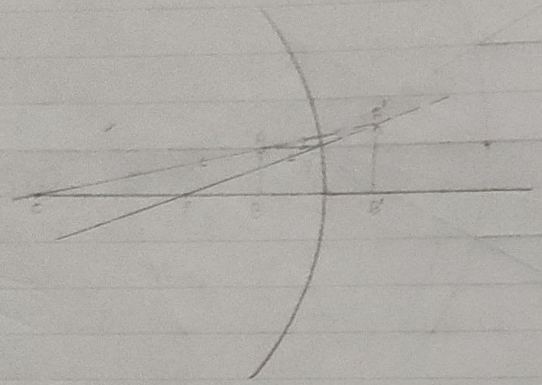


iii) Between pole and infinity

S. Chand Pg- 198, 199.

SAQs

11. a)



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

$\Rightarrow \frac{1}{v} = \frac{1}{-20} - \left(\frac{-1}{10}\right)$

$= \frac{-1}{20} + \frac{1}{10}$

$= \frac{-1+2}{20}$

$\Rightarrow \frac{1}{v} = \frac{1}{20} \Rightarrow v = 20$

c) The image formed is -

Virtual and erect.

It is enlarged

12. $h_o = 10\,cm$

$u = -36\,cm$

$f = -12\,cm$

$\frac{1}{v} + \frac{-1}{36} = \frac{-1}{12}$

$\Rightarrow \frac{1}{v} = \frac{+1-3}{36}$

$\Rightarrow \frac{1}{v} = \frac{-2^{-1}}{\cancel{36}\ 18}$

$\Rightarrow v = -18\,cm$

$\frac{h_i}{h_o} = \frac{-v}{u}$

$\Rightarrow 10 \times -(-36) = h_i(-18)$

$\Rightarrow 360 = -18 h_i$

$\Rightarrow \frac{-360}{18} = h_i$

$\Rightarrow h_i = -20$ cm

Image will be between centre of curvature and Focus.

It will be real and inverted.

It will be 20 cm tall.

(3) $m = \frac{6}{2} = 3$

$m = \frac{f}{f-u}$

$\Rightarrow 3 = \frac{-10}{-10-u}$

$\Rightarrow 3 = \frac{+10}{+(10+u)}$

$\Rightarrow 30 + 3u = 10$

$\Rightarrow 3u = -20$

$\Rightarrow u = \frac{-20}{3}$

$\Rightarrow u = -6.66$ cm

∴ the object should be placed 6.66 cm in front of the mirror.

14. $m = \frac{-v}{u}$

$\Rightarrow m = \frac{+(-15)}{+10}$

$\Rightarrow m = \frac{-3}{2}$

$m = \frac{f - v}{f}$

$\Rightarrow m = \frac{-3}{2} = \frac{f - (-10)}{f}$

$\Rightarrow 2f + 20 = -3f$

$\Rightarrow -20 = f$

15. ~~$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$~~

$m = \frac{h_i}{h_o}$

$\Rightarrow m = \frac{30}{45} = \frac{2}{3}$

A/q,

$m = \frac{f - v}{f}$

$\Rightarrow \frac{2}{3} = \frac{f + 8}{f}$

$\Rightarrow 2f = 3f + 24$

$\Rightarrow -f = 24$

$\Rightarrow f = -24$ cm

∴ the focus is 24 cm in front of the mirror.

16. $h_i = -4cm$

$h_o = 1cm$

$v = -20cm$

Alg: $\frac{h_i}{h_o} = \frac{-v}{u}$

$\Rightarrow \frac{-4}{1} = \frac{+v}{+20}$

$\Rightarrow v = -80\ cm$

According to mirror formula,

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

$\Rightarrow \frac{-1}{20} + \frac{-1}{80} = \frac{1}{f}$

$\Rightarrow \frac{-4-1}{80} = \frac{1}{f}$

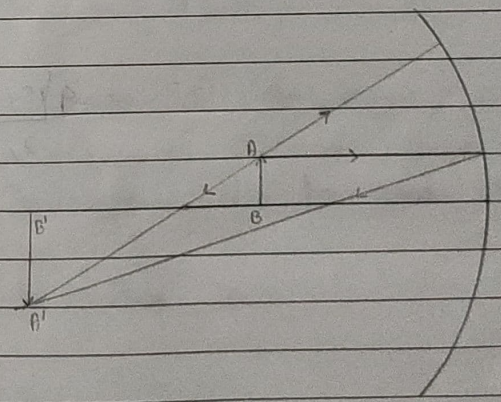
$\Rightarrow \frac{-5}{80} = \frac{1}{f}$

-16

$\Rightarrow f = -16\ cm$

ii) Beyond centre of curvature.

iii)



17. $h_o = 7\,cm$

$v = -27\,cm$

$f = -18\,cm$

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

$$\Rightarrow \frac{1}{v} = \frac{-1}{18} - \left(\frac{-1}{27}\right)$$

$$\Rightarrow \frac{1}{v} = \frac{-1}{18} + \frac{1}{27}$$

$$\Rightarrow \frac{1}{v} = \frac{-3+2}{54}$$

$$\Rightarrow \frac{1}{v} = \frac{-1}{54}$$

$$\Rightarrow v = -54\,cm$$

$9 \overline{)18, 27}$

$2, 3$

So, the screen must be placed 54 cm in front of mirror.

Size of the image,

$$\frac{h_i}{h_o} = \frac{-v}{u}$$

$$\Rightarrow \frac{h_i}{7} = \frac{-(-54)}{+27}$$

$$\Rightarrow 27 h_i = 7 \times -54$$

$$\Rightarrow h_i = 14\,cm$$

$\therefore$ size of the image will be 14 cm.

The image will be real and inverted by nature.

18. $h_o = 3\,cm$

$u = -10\,cm$

$f = -20\,cm$

To find position,

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

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

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

$$\Rightarrow \frac{1}{v} = \frac{+1}{20}$$

$$\Rightarrow v = 20\ cm$$

The image will be 20 cm behind the mirror.

The image will be virtual and erect.

To find the size,

$$\frac{h_i}{h_o} = \frac{-v}{u}$$

$$\Rightarrow \frac{h_i}{3} = \frac{+20}{+10}$$

$$\Rightarrow 10h_i = 60$$

$$\Rightarrow h_i = 6\ cm$$

19. $f = -4\ cm$

$h_o = 2\ cm$

$u = -9\ cm$

The image will be real and inverted by nature.

The image will be between centre of curvature and focus.

$$\frac{h_i}{h_o} = \frac{f}{f-u}$$

$$\Rightarrow \frac{h_i}{2} = \frac{-4}{-4+9}$$

$$\Rightarrow \frac{h_i}{2} = \frac{-4}{5}$$

$$\Rightarrow 5h_i = -8$$

$$\Rightarrow h_i = \frac{-8}{5}$$

$$\Rightarrow h_i = -1.6\ cm$$

∴ the size of the image will be 1.6 cm.

20. $u = -20\ cm$

a) $3 = \frac{f}{f-u}$

$\Rightarrow 3 = \frac{f}{f+20}$

$\Rightarrow f = 3f + 60$

$\Rightarrow -2f = 60$

$\Rightarrow f = -30$

20. $u = -20\ cm$

a) $-3 = \frac{f}{f+20}$

$\Rightarrow f = -3f - 60$

$\Rightarrow +2f = +60$

$\Rightarrow f = 30$

$\Rightarrow 4f = 60$

$\Rightarrow f = 15\ cm$

b) $3 = \frac{f \cdot v}{f - v}$

$\Rightarrow 3 = \frac{-15}{-15 - v}$

$\Rightarrow 3 = \frac{15}{15 + v}$

$\Rightarrow 45 + 3v = 15$

$\Rightarrow 3v = -30$

$\Rightarrow v = -10\ cm$

21. $5 = \frac{f}{f - v}$

$\Rightarrow 5 = \frac{1.5}{1.5 - v}$

$\Rightarrow 7.5 - v = 1.5$

$\Rightarrow 1v = +6$

$\Rightarrow v = 6cm$

22. $f = -0.75 = \frac{-75}{100} = \frac{-3}{4}\ m$

$v = -10m$

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

$\Rightarrow \frac{1}{v} = \frac{1}{\frac{-3}{4}} - \frac{1}{-10}$

$\Rightarrow \frac{1}{v} = \frac{-4}{3} + \frac{1}{10}$

$\Rightarrow \frac{1}{v} = \frac{-40 + 3}{30}$

$\Rightarrow \frac{1}{v} = \frac{-37}{30}$

$\Rightarrow -37v = 30$

$\Rightarrow v = -\frac{30}{37} = 0.8\,m$

23. $h_o = 5\,cm$

$u = -20\,cm$

$f = -15\,cm$

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

$\Rightarrow \frac{1}{v} = \frac{-1}{15} - \frac{-1}{20}$

$\Rightarrow \frac{1}{v} = \frac{-4+3}{60}$

$\Rightarrow \frac{1}{v} = \frac{-1}{60}$

$\Rightarrow v = -60\,cm$

Screen should be placed at 60 cm in front of the mirror.

24. $m = \frac{f}{f-u}$

$\Rightarrow 3 = \frac{f}{f+10}$

$\Rightarrow f = 3f + 30$

$\Rightarrow -2f = 30$

$\Rightarrow f = -15\,cm$

Radius of curvature $= 2xf = 2(-15) = -30\,cm$

25. $h_o = 5\,cm$

$f = -10\,cm$

$u = -30\,cm$

Alg.

$$\frac{h_i}{h_o} = \frac{f}{f-v}$$

$$\Rightarrow \frac{h_i}{5} = \frac{-10}{-10+30}$$

$$\Rightarrow \frac{h_i}{5} = \frac{+10}{10-30}$$

$$\Rightarrow \frac{h_i}{5} = \frac{-10}{20}$$

$$\Rightarrow h_i = \frac{-5}{2}$$

$$\Rightarrow h_i = -2.5\,cm$$

∴ the image will be 2.5 cm or 250 mm high.

26. $\frac{-h_i}{4h_i} = \frac{f}{f-v}$

$$\Rightarrow \frac{-h_i}{4h_i} = \frac{-20}{-20-v}$$

$$\Rightarrow \frac{-h_i}{4h_i} = \frac{20}{20+v}$$

$$\Rightarrow -20h_i - h_i v = 80h_i$$

26. $\frac{-1}{4} = \frac{f}{f-v}$

$$\Rightarrow \frac{-1}{4} = \frac{f}{f-v}$$

$$\Rightarrow \frac{-1}{4} = \frac{+20}{+(20+v)}$$

3 | 50 | 16
3
20
-18

$\Rightarrow 50 = -20 - v$

$\Rightarrow -100 = v$

$\Rightarrow v = -100\,cm$

∴ the object should be placed 100cm away from the pole of the spherical mirror.

27. $\frac{-1}{2} = \frac{f}{f-0}$

$\Rightarrow \frac{-1}{2} = \frac{f}{f+50}$

$\Rightarrow -f-50 = 2f$

$\Rightarrow 50 = -3f$

$\Rightarrow f = \frac{-50}{3}$

Alg,

$\frac{-1}{5} = \frac{(-50/3)}{[(-50/3)-v]}$

$\Rightarrow \frac{50}{3} - v = \frac{-250}{3}$

$\Rightarrow -v = \frac{-250}{3} - \frac{50}{3}$

$\Rightarrow -v = 100$

$\Rightarrow v = -100\,cm$

28. $\frac{-10}{25} = \frac{-2}{5} = m$

$v = -5\,cm$

$$m = \frac{f}{f-u}$$

$$\Rightarrow -\frac{2}{5} = \frac{f}{f+5}$$

$$\Rightarrow -2f + 10 = 5f$$

$$\Rightarrow -10 = 7f$$

$$\Rightarrow f = \frac{-10}{7} \text{ cm}$$

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

$$\Rightarrow \frac{1}{v} = \frac{-7}{10} + \frac{1}{5}$$

$$\Rightarrow \frac{1}{v} = \frac{-7+2}{10}$$

$$\Rightarrow \frac{1}{v} = \frac{-5^{-1}}{10_2}$$

$$\Rightarrow v = -2 \text{ cm}$$

focal length $= \frac{-10}{7}$ cm

$v = -2$ cm between focus and radius of curvature.

30. $f = -30$ cm

$u = -15$ cm

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

$$\Rightarrow \frac{1}{v} = \frac{-1}{30} + \frac{1}{15}$$

$$\Rightarrow \frac{1}{v} = \frac{-1+2}{30}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{30} \quad \Rightarrow v = 30 \text{ cm}$$

magnification: $\frac{-v}{u}$

$\Rightarrow m = \frac{+30}{+15}^{2}$

$\Rightarrow m = 2$

$\therefore$ the size of the image will be double the object.