HOME ASSIGNMENT

Very short Ans Type Questions :-

1. $m = \frac{h_i}{h_o}$ => Here $\frac{h_i}{1m} = 2$

So, $\boxed{h_i = 2m}$

CONCAVE

2. $u = -20cm$

$f = -20cm$

$\boxed{\frac{1}{v} + \frac{1}{u} = \frac{1}{f}}$ ← Mirror formula

So, $\frac{1}{V} = \frac{-1}{20} + \frac{1}{20} = \frac{-1+1}{20}$

$\boxed{V = \infty}$

∴ Image is at infinity.

3. (a) $m = \frac{h_i}{h_o} = \frac{-v}{u}$

Here, v is always (−ve) other than when obj is b/w F & Pole.

u is always (−ve)

So, If m = +ve, ; it means obj is b/w F & Pole.

→ Nature of image = Virtual; erect (as m = +ve)

b/w focus & pole;

larger than obj

(b) $m = -2 = \frac{h_i}{h_o} = \frac{-v}{u}$

Here, ~~m~~ → (+ve) so; image is inverted.

4. $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ → focal length

u → obj dist, v → img dist

all with sign.

5. Mirror formula ⇒ $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$.

6. $\frac{\text{Ht of img}}{\text{Ht of obj}} = m$

7. Linear magnification produced by a mirror is ratio of img to obj dist in the spherical mirror

8. (a) $m = \frac{h_i}{h_o}$

(b) $m = \frac{-v}{u}$

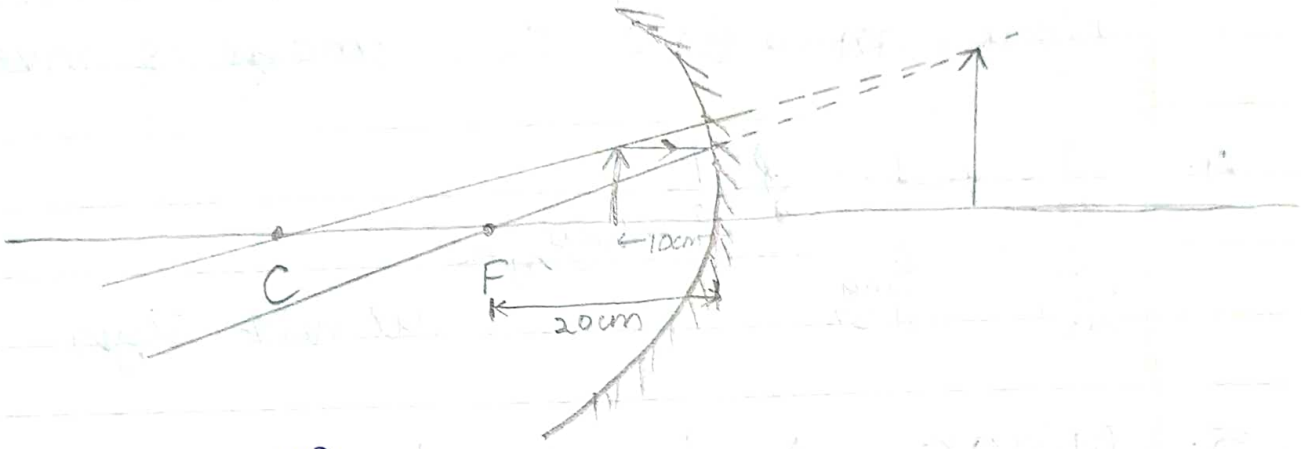
9. Same size as obj, ~~very very small~~, inverted, ~~real~~ real at ~~between~~ F & C.

10) (a) erect & virtual

(b) real & inverted

SHORT ANS TYPE

11) (a)



(b) Here $u = -10$ cm

$f = -20$ cm

By mirror formula,

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

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

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

$$v = 20 \text{ cm}$$

$\therefore$ Img dist is 20 cm behind the mirror.

(c) characteristics of img formed -

(1) Virtual

(2) Erect

(3) Magnified.

12) Obj height = $(h_o) = 10\ cm$
Obj dist = $(u) = -36\ cm$
focal length $(f) = -12\ cm$

By mirror formula; $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{v} = \frac{-1}{12} + \frac{1}{36} = \frac{-3+1}{36} = \frac{-1}{18}$$

So, $v = -18\ cm$

Posn: ∴ Obj is placed at a dist 18cm in front of mirror (b/w F & C)

$$m = \frac{-v}{u} = \frac{+18}{-36} = \frac{-1}{2}$$

Nature: So, Img is inverted, real & smaller than obj.

Let ht of img be h_i

Then $\frac{h_i}{10} = \frac{-1}{2} \Rightarrow h_i = -5$

Height: ∴ Ht of img is 5cm below Principal axis

13) focal length (f) $= -10$ cm

Obj ht (h_o) $= 2$ cm.

Img ht to be produced (h_i) $= 6$ cm

Let obj dist be (u)

* Magnification $= \frac{h_i}{h_o} = \frac{6}{2} = \boxed{3}$

$\Rightarrow 3 = \frac{-v}{u} \Rightarrow 3 = \frac{f}{f-u}$

$\Rightarrow 3 = \frac{-10}{-10-u} \Rightarrow -30 - 3u = -10$

$\Rightarrow -3u = 20$

$\Rightarrow \boxed{u = \frac{-20}{3}}$ cm.

$\therefore$ Obj should be placed at a dist $\frac{20}{3}$ cm infront of the mirror

14) $u = -15$ cm

$v = -10$ cm

Let focal length be f.

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

$= \frac{-1}{10} - \frac{1}{15} = \frac{-3-2}{30} = \frac{-1}{6}$

$f = 6$cm $\Rightarrow$ Ans.

15) Obj height = h_o = 3 cm

Obj dist = u = −8 cm.

Ht of virtual img : h_i = +4.5 cm (as it is erect.)

(i) magnification (m) = $\frac{h_i}{h_o}$

$\Rightarrow m = \frac{4.5}{3} = 1.5$.

Now $m = \frac{f}{f-u}$ where $f \rightarrow$ focal length

So, $1.5 = \frac{f}{f-(-8)} = \frac{f}{f+8}$

$\Rightarrow 1.5f + 12 = f$

$\Rightarrow 0.5f = -12$

$\Rightarrow f = \frac{-120}{5} = \boxed{-24 \text{ cm}} \Rightarrow$ focal length

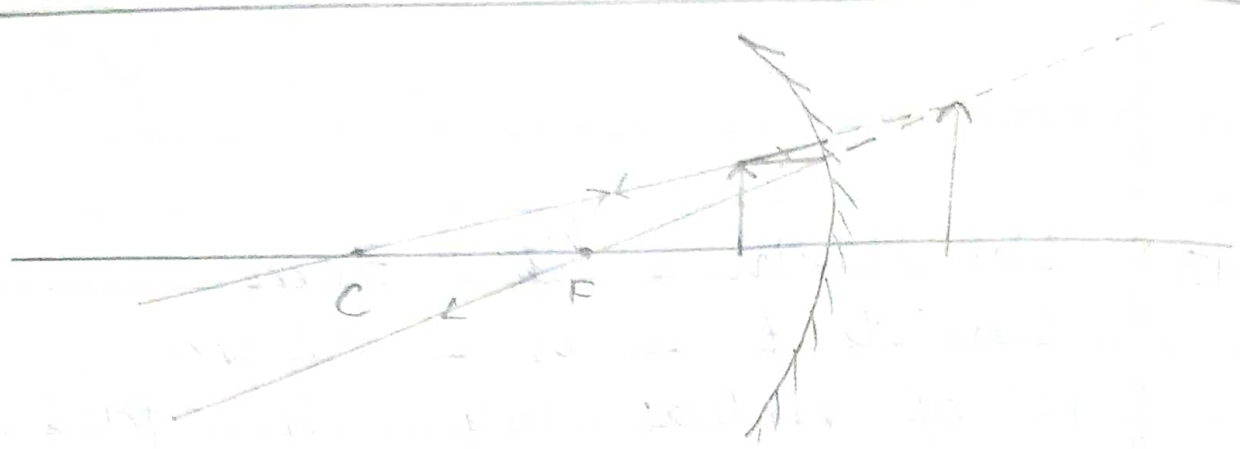
(ii) $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{-1}{24} + \frac{1}{8} = \frac{-1+3}{24}$

$= \frac{-2}{24} = \frac{-1}{12}$

$\boxed{v = -12 \text{ cm}} \Rightarrow$ Img dist. infront of mirror from pole

(iii)



16) Img ht $(h_i) = -4$ cm
↳ As img is real so, inverted

Obj ht $(h_o) = 1$ cm

Obj distance $(u) = -20$ cm

(i) Let img dist be v

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

$\Rightarrow \frac{-4}{1} = \frac{-v}{-20} \Rightarrow$ $v = -80$ cm

⇓

Img dist = 80cm

(ii) focal length → (f)

$$\frac{1}{f} = \frac{-1}{80} + \frac{1}{-20} = \frac{-1-4}{80} = \frac{-1}{16}$$

$\Rightarrow f = -16$ cm

∴ Focal length of mirror = 16cm

3 | 22 18
3 | 9 - 6
3 | 3
1

Date
Page

17) Size of obj (ho) = 7 cm
Obj dist from concave mirror (u) = -27 cm
focal length of mirror (f) = -18 cm

From mirror formula,

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

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

$$\Rightarrow \frac{1}{v} = \frac{1}{27} - \frac{1}{18} = \frac{2-3}{54} = \frac{-1}{54}$$

$\Rightarrow$ v = -54 cm (Present beyond C)

* The screen from mirror should be placed at the pt from the obj where the img from concave mirror is formed

Because img is → Real → can be obtained on screen
Its intensity will be highest if the screen is placed where it is formed

→ So, the screen should be placed at a dist of 54 cm from pole of mirror.

18) Obj ht (h_o) = 3cm

Obj dist (u) = -10cm

focal length (f) = -20cm

As per mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

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

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

$$\Rightarrow \boxed{v = 20cm}$$

∴ Image is formed 20cm behind the mirror

Now; $m = \frac{f}{f-u} = \frac{h_i}{h_o}$

$$\Rightarrow h_i = \frac{h_o f}{f-u} = \frac{3\times(-20)}{-20-(-10)}$$

$$= \frac{-60}{-10} = \boxed{6}\ cm$$

∴ Img ht = 6cm and is double ht of Obj

→ Img formed is virtual, erect, magnified & behind the mirror.

19) focal length (f) = -4cm

Ht of obj (h_o) = 2cm.

Obj dist (u) = -9cm

By mirror formula,

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

$$\Rightarrow \frac{1}{-4} = \frac{-1}{9} + \frac{1}{v} \Rightarrow \frac{1}{v} = \frac{1}{9} - \frac{1}{4}$$

$$= \frac{4-9}{36} = \frac{-36}{5}$$

$$-v$$

So, $v = -7.2\text{m}$

∴ Obj is placed 7.2 cm in front of the mirror.

$$\rightarrow m = \frac{-v}{u} = \frac{7.2}{-9} = -0.8$$

So, $-0.8 = \frac{h_i}{2} \Rightarrow h_i = -1.6\text{cm}$

∴ Img formed is inverted, real & 1.6cm in size below principal axis.

The obj is also 7.2 cm in front of the mirror.

20) $u = -20\text{cm}$.

$m = -3$ as img is real.

So, $-3 = \frac{-v}{-20} \Rightarrow v = -60\text{cm}$

∴ The image is 60cm in front of mirror.

(a) By mirror formula,

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

$$\Rightarrow -\frac{1}{60} - \frac{1}{20} = \frac{1}{f} \Rightarrow \frac{1}{f} = \frac{-1-3}{60} = \frac{-1}{15}$$

$\Rightarrow f = -15$ cm. $\Rightarrow \therefore$ focal length $= \underline{15 \text{ cm}}$

(b) Let the obj be placed at a dist(u)

Then given ~~$v = +60$ cm~~ $f = -15$ cm

$m = +3 \rightarrow$ as img is virtual

$$m = \frac{f}{f-u} \Rightarrow 3 = \frac{-15}{-15-u}$$

$$\Rightarrow -45 - 3u = -15$$

$$\Rightarrow 30 = -3u \Rightarrow u = -10 \text{ cm}$$

$\therefore$ Obj should be placed at a dist 10 cm infront of mirror

21) * Dentists use concave mirror.

So, Radius of curvature = 3 cm

focal length $(f) = -\frac{3}{2} = -1.5$ cm

Let it be placed at a dist (u)

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

$\Rightarrow 3 = \frac{-1.5}{-1.5+u}$ $\Rightarrow -4.5 - 3u = -1.5$

$\Rightarrow -3 = 3u$

$\Rightarrow u = -1$ cm.

∴ The mirror should be placed at a dist 1 cm in front of the dental cavity.

22) Radius of curvature $(R) = -1.5$m

focal length $= (f) = \frac{-1.5}{2} = \frac{-3}{4}$ m

Dist of person from mirror (u)

$= -10$m.

Let the img be formed at a dist v

Then

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

$$\Rightarrow \frac{1}{v} = \frac{-4}{3} + \frac{1}{10} = \frac{-40+3}{30} = \frac{-37}{30}$$

$\Rightarrow v = \frac{-30}{37}$ cm ∴ Img is formed at a dist $\frac{30}{37}$ cm infront

23) Size of obj $(h_o) = 5$cm.

Dist of obj from mirror $(u) = -20$cm

focal length of mirror $(f) = -15$cm

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

$$\frac{1}{v} = -\frac{1}{15} + \frac{1}{20} = \frac{-4+3}{60} = \frac{-1}{60}$$

$v = -60\text{cm}$ → Img is formed at a dist of 60cm infront of mirror.

→ So, a screen should be placed at a dist 60cm infront of mirror to capture a real, intensified image of the obj

24) Obj dist $(u) = -10\text{cm}$.

$m = +3$ img is virtual.

Let focal length be f

then $3 = \frac{f}{f+10}$ ⇒ $3f + 30 = f$

⇒ $2f = -30$

⇒ $f = -15\text{cm}$

Radius of curvature $= 2f$

$= -30\text{cm}$ Ans:

25) focal length of mirror $(f) = -100\text{mm}$

Ht of of obj $(h_o) = 50\text{mm}$

Dist of obj from mirror $(u) = -300\text{mm}$

* $m = \frac{f}{f-u} = \frac{-100}{-100+300} = \frac{-100}{200} = -\frac{1}{2}$

Now; $m = \frac{h_i}{h_o}$ So, $\frac{-1}{2} = \frac{h_i}{50}$

$\Rightarrow \boxed{h_i = -25\text{ mm}}$

∴ Image will be 25mm tall

26) Let the obj be placed at a dist (u)
focal length of concave mirror (f) = -20 cm
Given height of img = $\frac{1}{4}$ (ht of obj)

So, $m = \frac{h_i}{h_o} = \boxed{-\frac{1}{4}}$ → as it is real

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

$\Rightarrow \frac{-1}{4} = \frac{-20}{-20-u}$

$\Rightarrow 20+u = -80$

$\Rightarrow \boxed{u = -100\text{ cm}}$ ∴ Obj should be placed at a dist of 100 cm from the Pole of the mirror

27) Obj dist (u) $= -50$ cm

$m = -1/2$

Let focal length of mirror be $= f$

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

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

$\Rightarrow 3f = -50$

$\Rightarrow f = -50/3$ cm

So, Let obj be placed at dist (u_1)

Then $m = -1/5$

$-\frac{1}{5} = \frac{-50/3}{-50/3 - u_1} \Rightarrow \frac{50}{3} + u_1 = -\frac{250}{3}$

$\Rightarrow u_1 = \frac{-250}{3} - \frac{50}{3} = \frac{-300}{3} = -100$ cm

∴ Obj should be placed at a dist of 100 cm in front of the concave mirror.

28) (a) $u = -20$ cm

$f = -12$ cm

By mirror formula, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$$\Rightarrow \frac{1}{v} = \frac{-1}{12} + \frac{1}{20} = \frac{-5+3}{60} = \frac{-1}{30}$$

$v = -30$ cm

∴ Obj is formed 30cm infront of mirror.

* Magnification, $m = \frac{-v}{u} = \frac{30}{-20} = \boxed{\frac{-3}{2}}$

Img is real, inverted, magnified

(b) $u = -4$cm

$f = -12$cm

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{-1}{12} + \frac{1}{4} = \frac{-1+3}{12}$$

$v = 6$cm ∴ Obj is formed ~~bot~~ 6cm behind the mirror.

* $m = \frac{-v}{u} = \frac{-6}{-4} = \frac{3}{2} = \boxed{1.5}$

Img is virtual, erect & magnified

29)

ht of obj = h_o = 2.5mm

Obj dist = u = −5cm = −50mm

ht of img formed = h_i = −1cm = (−)10mm

↳ As it is real & inverted

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

So, $\frac{-V}{-50} = \frac{-10}{2.5}$

$\Rightarrow V = -\frac{5000}{25} = -200\,mm$

$= -20\,cm$

$\therefore$ Obj is formed 20 cm infront of mirror

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

$= \frac{-1}{20} + \left(\frac{-1}{5}\right) = \frac{-1 + (-4)}{20} = \frac{-1}{4}$

So, $f = -4\,cm$ → focal length of mirra

30) Radius of curvature $(R) = -60\,cm$

focal length $(f) = -30\,cm = R/2$

Obj distance $(u) = -15\,cm$

* $\frac{1}{V} = \frac{1}{f} - \frac{1}{u} = \frac{-1}{30} + \frac{1}{15} = \frac{-1+2}{30}$

$= \frac{1}{30}$.

$V = 30\,cm$ → Image is produced 30cm behind mirror

* $m = \frac{-V}{u} = \frac{-30}{-15} = +2$ → magnification (Ans)