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Homework

11) B) Distance of the object from the mirror 'u' = -10cm.

⇒ Focal length of the concave mirror 'f' = -20cm.

⇒ Mirror formula

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

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

⇒ $\frac{-1}{20} + \frac{2}{20}$

⇒ $\frac{1}{v} = \frac{1}{20}$

⇒ $v = 20cm$.

c) Two characteristics of the image :-

i) It is virtual and erect.

ii) It is magnified.

12) Distance of the object from the mirror 'u' = -36cm

→ Height of the object 'h' = -10cm.

→ Focal length of the mirror 'f' = -12cm.

→ Distance of the image 'v' =

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

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

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

→ $\frac{1}{v} = \frac{1-3}{36} = \frac{-2}{36}$.

⇒ $v = -18\,cm$ (Distance of the image)

⇒ Height of the image :

⇒ $m = \frac{h_i}{h_o} = \frac{v}{u}$

⇒ $\frac{h_i}{10} = \frac{-(-18)}{-36} = \frac{-1}{2}$

⇒ $\frac{h_i}{10} = \frac{-1}{2}$

⇒ $h_i = -5\,cm$. (Height of the image)

⇒ $m = \frac{-v}{u} = \frac{-(-18)}{36}$

⇒ $m = \frac{-1}{2}$

⇒ The image is real, inverted and small in size.

18) Height of the object 'h_o' = 2cm

⇒ Focal length of the mirror 'f' = −10cm

⇒ Height of the image 'h_i' = 6cm.

⇒ Distance of the object from the mirror 'u' =

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

⇒ $m = \frac{6}{2} = \frac{-v}{u}$

⇒ $m = 3 = \frac{-v}{u}$

⇒ $v = -3u$.

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

⇒ $\frac{1}{10} = \frac{1}{-3u} + \frac{1}{u}$

$$\Rightarrow \frac{1}{10} = \frac{1}{3u} - \frac{3}{3u}$$

$$\Rightarrow \frac{1}{10} = \frac{-2}{3u}$$

$$\Rightarrow u = \frac{-2 \times 10}{3}$$

$$\Rightarrow u = -6.67 \text{ cm}, \text{ (Distance of the object from the mirror)}$$

(4) Distance of the object from the mirror 'u' = -15 cm.

⇒ Distance of the image 'v' = -10 cm.

⇒ focal length of the mirror 'f' =

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

$$\Rightarrow \frac{1}{f} = \frac{1}{-10} + \frac{1}{-15}$$

⇒ $\frac{1}{f} = \frac{-1}{10} - \frac{1}{15}$

⇒ $\frac{1}{f} = \frac{-3 - 2}{30}$

⇒ $\frac{1}{f} = \frac{-5}{30}$

⇒ $f = -6\,cm$.

15) i) Distance of the object from the mirror 'u' = $-8\,cm$.

⇒ Height of the object = $3\,cm$

⇒ Height of the image = $4.5\,cm$

⇒ focal length = .

⇒ $m = \frac{hi}{ho} = \frac{-v}{u}$.

⇒ $m = \frac{4.5}{3} = \frac{-v}{-8}$

1.5

$v = \frac{1.5 \times 8}{3.1}$

$v = 12\,cm.$

ii) Distance of the image $= 12\,cm.$

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

$\frac{1}{f} = \frac{1}{12} + \frac{1}{-8}$

$\frac{1}{f} = \frac{2}{24} - \frac{3}{24} = \frac{-1}{24}$

$f = -24\,cm.$

16) Distance of the object from the mirror (u) $= -20\,cm.$

Height of the object $= 1\,cm.$

Height of the image $= -4\,cm.$

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⇒ Distance of the object from the mirror. 'u' = -20cm.

⇒ Height of the object = 1cm

⇒ Height of the image = -4cm

⇒ Distance of the image =

⇒ $m = \frac{hi}{ho} = \frac{-v}{u}$

⇒ $\frac{-4}{1} = \frac{-v}{-20}$

⇒ $v = \frac{20 \times (-4)}{1} = -80cm.$

⇒ focal length =

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

⇒ $\frac{1}{f} = \frac{1}{-80} + \frac{1}{-20} = \frac{-1}{80} - \frac{4}{80} = \frac{-5}{80}$

⇒ $f = -16cm.$

17) Distance of object from the mirror 'u' = -2 cm.

⇒ Height of the object = 4cm

⇒ Focal length of the mirror = -18 cm

⇒ Distance of the image

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

⇒ $\frac{1}{-18} = \frac{1}{v} - \frac{1}{2f}$.

⇒ $\frac{1}{v} = \frac{1}{2f} - \frac{1}{18}$

⇒ $\frac{-1}{54} = \frac{1}{v}$.

⇒ v = -54 cm.

⇒ Height of the image -

⇒ $m = \frac{hi}{ho} = \frac{-v}{u}$

⇒ $\frac{hi}{7} = \frac{-(-54)}{(-27)} = \frac{-2}{1}$

⇒ $hi = -14cm$.

⇒ The image is real, inverted and large in size.

18) Distance of the object from the mirror = -10mcm.

⇒ Height of the object 'ho' = 3cm.

⇒ Focal length of the mirror 'f' = -20cm

⇒ Distance of the image =

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

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

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

$\frac{1}{v} = \frac{1}{20\,cm}$.

$v = 20\,cm$.

19) Distance of the object from the mirror (u) = $-9\,cm$.

Height of the object = $2\,cm$.

Focal length of the mirror = $-4\,cm$.

Distance of the image =

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

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

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

$\frac{1}{36} = \frac{1}{v}$

→ $\frac{-5}{36} = \frac{1}{v}$

→ $\frac{-1}{7.2}$

→ $v = 7.2\,cm$.

→ Height of the image =

→ $m = \frac{h_i^0}{h_0} = \frac{-v}{u}$

→ $\frac{h_2^0}{h_0} = \frac{-(-7.2)}{-9}$

→ $m = -0.8$

2) Distance of the object = $-20\,cm$.

Magnification = -3

Focal length of the mirror =

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

$$-3 = \frac{-v}{-20}$$

$v = -60\,cm$. (Distance of the image)

focal length =

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

$$\frac{1}{f} = \frac{1}{-60} + \frac{1}{-20}$$

$$\frac{1}{f} = \frac{-1}{60} - \frac{1}{20}$$

$$\frac{1}{f} = \frac{-1 - 3}{60} = \frac{-4}{60}$$

$$\frac{1}{f} = \frac{-1}{15}$$

22) Radius of curvature of the mirror = -1.5 m.

→ Focal length of the mirror =

→ 'f' = $\frac{1}{R} = \frac{1}{-1.5} = -0.75m$.

→ Distance of the object = -10m

→ Distance of the image =

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

→ $\frac{1}{0.75} = \frac{1}{v} + \frac{1}{-10}$

→ $\frac{-100}{75} = \frac{1}{v} - \frac{1}{10}$

→ $\frac{1}{v} = \frac{1}{10} - \frac{100}{75}$

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

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

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

$v = 0.81m$.

24) Distance of the object = $-10cm$.
Magnification 'm' = 3

Distance of the image =

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

$3 = \frac{-v}{-10}$

$v = 30cm$.

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

$\frac{1}{f} = \frac{1}{30} + \frac{1}{-15}$

$\frac{1}{f} = \frac{1}{30} - \frac{2}{30} = \frac{-2}{30}$

$\frac{1}{f} = \frac{-1}{15}$

$f = -15\text{cm}$.

25) Focal length of the ~~concave~~ concave mirror = 20cm.

Magnification = $\frac{-v}{u}$

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

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

$v = u$

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

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

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

$$\Rightarrow u = -100\ cm .$$

50) Distance of the object = −15 cm .

Focal length = −30 cm .

Distance of the image = .

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

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

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