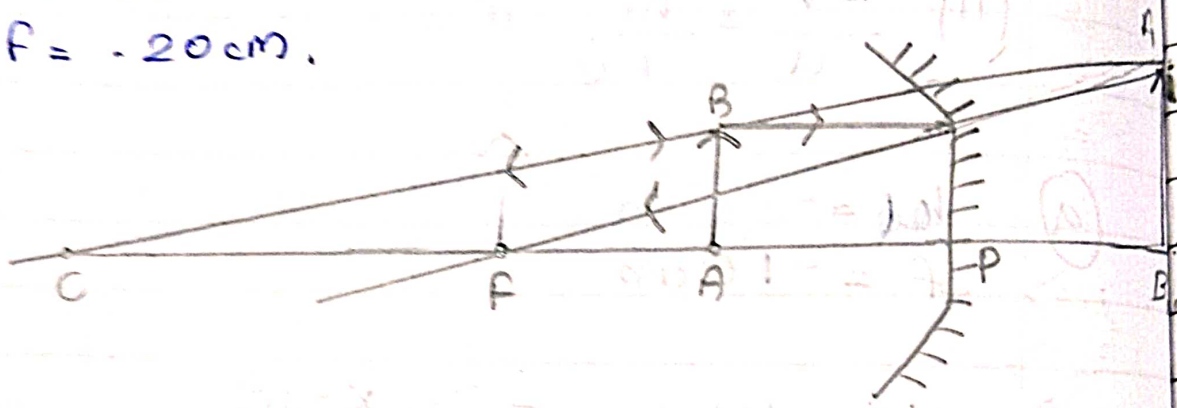


Short Answer Type Question.

(11) $u = +10 \text{ cm}$
 $f = -20 \text{ cm}$.

(a)



(b)
$$v = \frac{-10 \times -20}{-10 + 20} = \frac{200}{10} = 20 \text{ cm}.$$

(c) Characteristics of the image formed is :-

- * Enlarged
- * virtual erect
- * Behind the mirror.

(12) $H_o = 10 \text{ cm}$
 $u = -36 \text{ cm}$
 $f = -12 \text{ cm}$

$$v = \frac{u f}{u - f} = \frac{-36 \times -12}{-36 + 12} = \frac{432}{-24} = -18 \text{ cm.}$$

$$v = -18 \text{ cm.}$$

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

$$\Rightarrow \frac{h_i}{10} = \frac{-18}{-36}$$

$$\Rightarrow 2 h_i = 10$$

$$\Rightarrow h_i = \frac{10}{2} = 5$$

$$\text{Magnification} = \frac{-v}{u} = \frac{-18}{-36} = \frac{1}{2}$$

Nature of image = Real, inverted, diminished.

(13) $f = -10 \text{ cm.}$

$h_o = 2 \text{ cm.}$

$h_i = 6 \text{ cm.}$

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

$$\Rightarrow -3u = v$$

we have,

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

$$= \frac{v}{3} \times 10 \text{ P.}$$

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

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

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

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

$$\Rightarrow u = \frac{-20}{3} = -6.66 \text{ cm.}$$

(14)

$$u = -15 \text{ cm}$$

$$v = -10 \text{ cm}$$

$$f =$$

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

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

$$\Rightarrow \frac{1}{f} = -\frac{1}{10} - \frac{1}{15} = \frac{-3-2}{30} = \frac{-5}{60} = -\frac{1}{6}$$

$$f = -6 \text{ cm}$$

(15)

$$h_i = 3 \text{ cm}$$

$$u = -8 \text{ cm}$$

$$h_2 = 4.5 \text{ (virtual image)}$$

(i)

$$m = \frac{h_2}{h_1} = \frac{4.5}{3} = 1.5$$

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

$$1.5 = \frac{-v}{-8}$$

$$\Rightarrow v = 1.5 \times 8 = 12 \text{ cm}$$

we have,

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

$$\Rightarrow \frac{1}{12} + \left(-\frac{1}{8}\right) = \frac{1}{f}$$

$$\Rightarrow \frac{1}{f} = -\frac{1}{24}$$

$$\Rightarrow f = -24 \text{ cm.}$$

(ii) $v = 12 \text{ cm.}$

(16) $h_2 = -4 \text{ cm}$

$h_1 = 1 \text{ cm}$

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

(17) $m = \frac{h_2}{h_1} = \frac{v}{u}$

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

$$\Rightarrow v = -80 \text{ cm.}$$

* Image is formed in front of concave mirror.

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

$$\Rightarrow \frac{1}{-30} + \frac{1}{-20} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{f} = \frac{1}{30} - \frac{1}{20} = \frac{-1-4}{60} = -\frac{5}{60}$$

$$f = -12 \text{ cm.}$$

(19)

$$h_i = 7 \text{ cm.}$$

$$u = -27 \text{ cm.}$$

$$f = -18 \text{ cm.}$$

we know that,

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

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

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

$$v = -54 \text{ cm}$$

$$m = \frac{-v}{u} = \frac{h_2}{h_1}$$

$$\Rightarrow \frac{-(-54)}{(-27)} = \frac{h_2}{7}$$

$$\Rightarrow h_2 = -4 \text{ cm.}$$

Image is 4 cm in size, real, inverted.

(18)

$$h_1 = 3 \text{ cm}$$

$$u = -10 \text{ cm}$$

$$f = -20 \text{ cm}$$

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

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

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

$$m = \frac{-v}{u} = \frac{h_2}{h_1}$$

$$\Rightarrow \frac{-(20)}{-10} = \frac{h_2}{3}$$

$$h_2 = 6 \text{ cm.}$$

Image is 6 cm in size, virtual, erect.

(19)

$$h_1 = 2 \text{ cm}$$

$$u = -9 \text{ cm}$$

$$f = -4 \text{ cm.}$$

we know that,

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

$$\Rightarrow \frac{1}{v} + \frac{1}{-9} = \frac{1}{-4}$$
$$\Rightarrow \frac{1}{v} = \frac{1}{-4} - \frac{1}{-9} = \frac{-9+4}{36} = \frac{-5}{36}$$

$$v = -7.2 \text{ cm.}$$

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

$$= \frac{-(-7.2)}{-9} = -0.8$$

$$m = \frac{h_2}{h_1} \Rightarrow -0.8 = \frac{h_2}{2}$$

$$h_2 = -1.6 \text{ cm.}$$

so, image is 1.6 cm in size

(20) $u = -20\text{cm}$
 $m = -3$

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

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

$\Rightarrow v = -60\text{cm}$

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

$\Rightarrow \frac{1}{f} = \frac{1}{-60} - \frac{1}{20} = \frac{-1-3}{60} = \frac{-4}{60} = \frac{-1}{15}$

$f = -15\text{cm}$

(b) $M = 3$, $f = -15\text{cm}$

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

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

$\Rightarrow v = -3u$

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

$$\Rightarrow \frac{-1}{3u} + \frac{1}{u} = \frac{1}{-15}$$

$$\Rightarrow \frac{-1+3}{3u} = \frac{1}{15}$$

$$\Rightarrow u = \frac{-2 \times 15}{3} = -10 \text{ cm}$$

(21)

$$R = -3 \text{ cm}$$

$$m = 5$$

$$f = \frac{R}{2} = \frac{3}{2} = -1.5 \text{ cm}$$

$$m = 5 = \frac{-v}{u} \Rightarrow v = -5u$$

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

$$\frac{1}{-1.5} = \frac{1}{-5u} + \frac{1}{u}$$

$$\Rightarrow \frac{4}{5u} = -\frac{1}{1.5}$$

$$\Rightarrow u = \frac{-4 \times 1.5}{5} = -1.2 \text{ cm}$$

(22)

$$R = -1.5 \text{ m}$$

$$u = -10 \text{ m}$$

$$f = \frac{R}{2} = \frac{-1.5}{2} = -0.75 \text{ m}$$

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

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

$$\Rightarrow \frac{1}{v} = \frac{1}{10} - \frac{1}{0.75} = \frac{1}{10} - \frac{100}{75}$$

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

$$v = \frac{30}{37} = -0.81 \text{ m}$$

∴ The person's image will be 0.81 m in front of concave mirror.

(23)

$$h_i = 5 \text{ cm}$$

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

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

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

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

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

$$\Rightarrow \frac{1}{v} = \frac{-5}{300}$$

$$\Rightarrow v = -60 \text{ cm}$$

And,

$$m = \frac{h_2}{h_1} = \frac{-v}{u}$$

$$\Rightarrow \frac{h_2}{5} = \frac{+60}{-20}$$

$$\Rightarrow h_2 = -15 \text{ cm}$$

Height of image = 15 cm

(24)

$$m = 3$$

$$u = -10 \text{ cm}$$

$$R = ?$$

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

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

$$\Rightarrow v = 30 \text{ cm}$$

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

$$\Rightarrow \frac{1}{30} + \frac{1}{-10} = \frac{1}{f}$$

$$\Rightarrow \frac{-20}{300} = \frac{1}{f}$$

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

$$R = 2f = 2 \times (-15) = -30 \text{ cm.}$$

(25)

$$h_i = 50 \text{ mm}$$

$$f = -100 \text{ mm}$$

$$u = -300 \text{ mm}$$

$$h_o = ?$$

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

$$\Rightarrow \frac{1}{v} + \frac{1}{-300} = \frac{1}{-100}$$

$$\Rightarrow \frac{1}{v} = \frac{-2}{300}$$

$$\Rightarrow v = -150 \text{ mm.}$$

$$m = -\frac{v}{u} = \frac{h_2}{h_1}$$
$$= \frac{-150}{-300} = \frac{h_2}{50}$$

$$\boxed{h_2 = 25 \text{ mm}}$$

(26)

$$f = -20 \text{ cm}$$

$$m = -1/4$$

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

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

$$u = 4v$$

So,

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

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

$$\Rightarrow \frac{-1}{20} = \frac{5}{4v}$$

$$\Rightarrow v = \frac{-100}{4} = -25 \text{ cm}$$

$$u = 4v$$

$$u = 4 \times (-25)$$

$$= -100 \text{ cm.}$$

* The object should be placed 100 cm to the left of the mirror.

(27) case 1

$$u = -50 \text{ cm}$$

$$m = -\frac{1}{2}$$

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

$$-\frac{1}{2} = \frac{v}{-50}$$

$$v = -25 \text{ cm.}$$

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

$$\Rightarrow \frac{1}{-25} + \frac{1}{-50} = \frac{1}{f}$$

$$\Rightarrow \frac{-3}{50} = \frac{1}{f}$$

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

CASE 2

$$m = -\frac{1}{5}$$

$$f = \frac{-50}{3} \text{ cm}$$

$$m = \frac{-1}{5} = \frac{-v}{u}$$

$$v = \frac{u}{5}$$

Now,

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

$$\frac{-3}{50} = \frac{5}{u} + \frac{1}{u}$$

$$\frac{6}{u} = \frac{-3}{50}$$

$$u = \frac{600}{-3} = -100 \text{ cm}$$

(298)

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

$$f = -12 \text{ cm}$$

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

$$= \frac{1}{v} + \frac{1}{-20} = \frac{1}{-12}$$

$$\Rightarrow \frac{1}{v} = \frac{-20 + 12}{240} = \frac{-8}{240}$$

$$v = -30 \text{ cm}$$

(b)

$$u = -4 \text{ cm}$$

$$f = -12 \text{ cm}$$

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

$$\Rightarrow \frac{1}{v} = \frac{-1}{12} + \frac{1}{4} = \frac{-1 + 3}{12} = \frac{2}{12}$$

$$v = 6 \text{ cm}$$

* The image is formed at a distance of 6 cm behind the mirror. The image is virtual & erect.

(29)

$$h_2 = 1 \text{ cm} = 10 \text{ mm}$$

$$h_1 = 2.5 \text{ mm}$$

$$u = -5 \text{ cm} = -50 \text{ mm}$$

$$m = \frac{-h_2}{h_1}$$

$$m = \frac{-10}{2.5}$$

$$m = -4$$

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

$$-4 = \frac{v}{-50}$$

$$v = -200 \text{ mm}$$

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

\$\phi\$,

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

$$\Rightarrow \frac{1}{-20} + \frac{1}{-5} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{f} = \frac{-25}{100}$$

$$f = -4 \text{ cm}$$

30. $R = -60 \text{ cm}$
 $f = -30 \text{ cm}$
 $u = -15 \text{ cm}$

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

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

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

$$\Rightarrow v = 30$$

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

$$m = \frac{-30}{-15}$$

$$m = 2$$

So, the image ~~is formed~~ is formed 30 cm behind the mirror & $m = +2$.