Q 11) an object is placed at a distance of 10 cm from a concave mirror of focal length 20cm draw the ray diagram for the formation of image calculate the image distance state two characteristics of image formed

ANS-- position of image and and complete ray diagram.

given, focal length of concave mirror, f = -20 cm
distance of object from the mirror, u = -10 cm

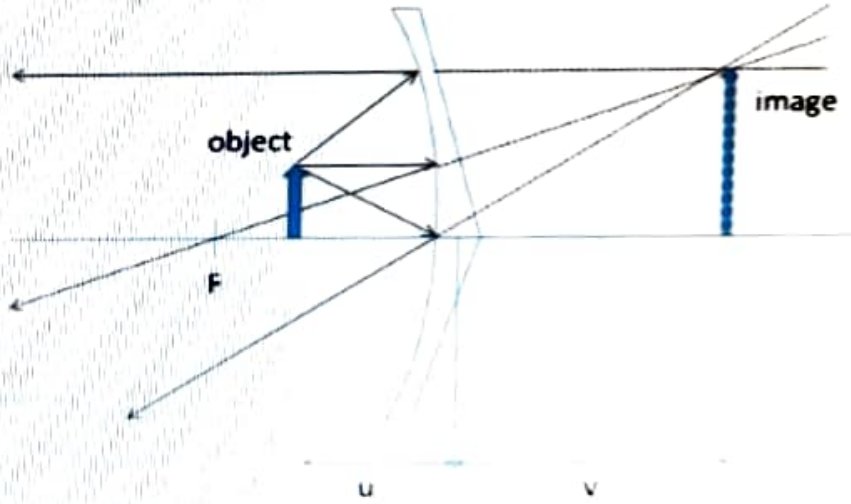
use formula, 1/v + 1/u = 1/f

or, 1/v = 1/f - 1/u

or, 1/v = 1/-20 - 1/-10

or, 1/v = -1/20 + 1/10 = 1/20

or, v = +20cm



Q 12) If an object of 10 cm height is placed at a distance of 36 cm from a concave mirror of focal length 12 cm, find the position, nature and height of image.

Answer

Object distance $u=-36$ cm

Focal length of concave mirror $f=-12$ cm

Using mirror formula : $1/v+1/u=1/f$

Or $1/v+-1/36=-1/12$

$\Rightarrow v=-18$ cm

Magnification

$ho/hi=-v/u$

Or $hi/10=-10-/(-18)$

$\Rightarrow hi=-18$ cm

Image formed is real and inverted

Q13)At what distance from a concave mirror focal length 10 cm should an object 2 cm long be placed in order to get an erect image 6 cm tall?

Ans--Height of the object 'ho' = 2 cm Focal length of the mirror 'f' = −10 cm Height of the image 'hi ' = 6 cm We have to find the distance of the object from the mirror 'u'. Using the magnification formula, we get

m = hi ho = − v/ u

m = 6 2 = − v /u

m = 3 = − v/ u

10 = 1/ 3u − 3/ 3u = −2 /3u

u = −2 × 10 /3

u=-6.67 cm

Thus, the distance of the object from the mirror 'u' is −6.67 cm

Q 14) When an object is placed at a distance of 15 cm from a concave mirror, its image is formed at 10 cm in front the mirror. Calculate the focal length of the mirror?

u=-15cm, v=-10cm

f=?

We know that

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

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

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

$$\therefore \quad f = -6\,\text{cm}$$

Therefore, the focal length of the concave mirror is 6

Q-16) an object 3cm high is placed at a distance of 8cm from a concave mirror which produces a virtual image of 4.5cm

i) Focal length of mirror

ii) What is the position of image

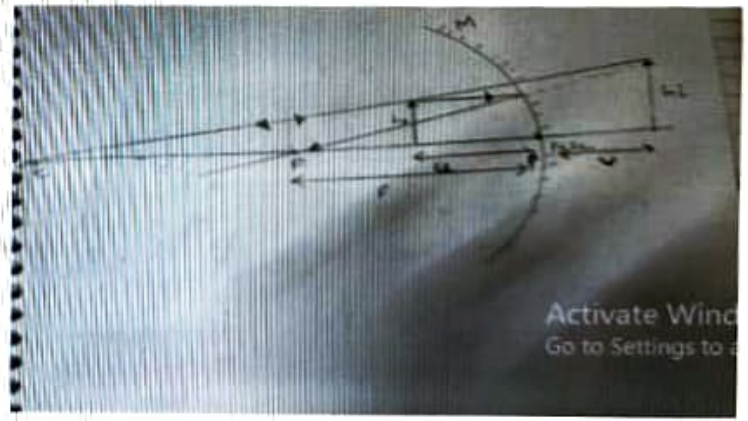
iii) Draw a ray diagram to show the formation of image

height of object = 3cm = H object
the object distance = - 8cm (object distance is always negative)
if the concave mirror produces an image of 4.5cm that means that
⇒ height of image = 4.5cm = H image
magnification = m = hi/ho = -v/u
= 4.5/3 = -(v)/-8cm
= 4.5 × 8 / 3 = v
= 36/3 = v
= v = +12cm

this is the case where the object is placed between focus and pole of concave mirror. the image formed here is behind the miror and s enlarged....

Height of the object (h) = 3 cm
Distance of object from concave mirror (u) = -8 cm
Height of the virtual image formed (h') = 4.5
Let's find 'v' first =
- v/u = h'/h
v = - u × h'/h
v = - (-8) × 4.5 / 3
v = 12 cm(i) Focal length of mirror = ?

1/f = 1/v + 1/u
1/f = 1/12 + 1/ -8
1/f = -1/24
1 × 24 = -f
24 = -f
f = -24 cm



Q 17) An object of size 7.0 cm is placed at 27 cm in front of a concave
distance from the mirror should a screen be placed, so that
a sharp focussed image can be obtained? Find the size and the nature of the

ANS--Size of the object [o] = +7cm
F = -18cm
U= -27cm
V = ?
1/f = 1/v+1/u
1/-18cm = 1/v-1/27
1/v= -1/54 v = -54cm
Since Vis – ve screen should be placed at 54cm in front of the mirror.
Size of the image : m= I/O= -v/u I/7=-[54/27] I= -14cm
Nature of the image : image is real , inverted and magnified.

18)An object 3 cm high is placed at a distance of 10 cm in front of a converging mirror of focal length 20 cm. Find the position, nature and size of the image formed.

Answer

Given: h1=3cm, u=−10cm, f=−20cm
We know that
v1+u1=f1
⇒v1=f1−u1
=(−20)1−(−10)1
=−201+101=20−1+2=201
∴v=20cm
The image is formed at a distance of 20cm behind the mirror,
And
m=−uv=h1h2
⇒(−10)(20)=3h2
⇒h2=6cm
Image is 6 cm in size, virtual and erect.

19) A concave mirror has a focal length of 4 cm and an object 2 cm tall is placed 9 cm away from it. Find the nature, position and size of the image formed

- **ANS---h_1= 2cm, u = -9cm, f = -4cm**
- **We know that**
- **1/v + 1/u = 1/f**
- **1/v = 1/f – 1/u = 1/(-4) – 1/(-9)**
- **= - (1/4) + 1/9 = (-9 + 4)/36 = - (5/36)**
- **V = - 7.2 cm**
- **The image is formed at a distance 7.2 cm in front of the mirror**
- **Again, m = - (v/u) = - (-7.2)/-9 = -0.8**
- **m = h_2/h_1 = -0.8 = h_2/2 = h_2 = -1.6 cm**
- **So, image is 1.6 cm in size, real and inverted.**

Q-20)When an object is placed 20 cm from a concave mirror, a real image magnified three times is formed. Find: (a) the focal length of the mirror. (b) Where must the object be placed to give a virtual images three times the height of the object?

ANS-

Distance of the object 'u' = -20 cm Magnification 'm' = –3 (a)We have to find the focal length of the mirror. Using the magnification formula, we get v=-60cm Advertisement Remove all ads m = – v u –3 = –v –20

1/ f = 1 –60 + 1 –20/ 1
f = – 1/ 60 – 1/ 20 1
f = – 1 /60 – 3 /60 = – 4 /60
1/ f = –1/ 15
f=-15cm

Thus, the focal length of the concave mirror is 15 cm. (b) Now, if the image is virtual and 3 times magnified, then we have to find the position of the object. Given, Focal length of the concave mirror
= –15cm

3 = – v u v = –3u

Therefore, the distance of the image 'v' is –3u

Again, using the mirror formula, we get 1 f = 1 v + 1 u 1 f = 1 –60 + 1 –20
1/ f = – 1/ 60 – 1 /20
1/ f = – 1 /60 – 3 /60 = – 4 60
1/ f = –1 /15 m = – v/ u 3 = – v /u
v = –3u
1 /f = 1 /v + 1 /u
1/ f = 1 –3/u + 3 /3u = 2 /3u

Q21)A dentist's mirror has a radius of curvature of 3 cm. How far must it be placed from a small dental cavity to give a virtual image of the cavity that is magnified five times?

ANS-The dentist's mirror is a concave mirror. Radius of curvature 'R' = -3 cm Therefore, the focal length of the mirror f = R 2 = −3 2 = −1.5 cm Given that magnification 'm' = 5 Therefore, using the magnification formula, we get m = − v/ u

v = −μ V = −5u

Now, using the mirror formula, we get

1 /f = 1 /v + 1 u

u = −1.2cm

The dentist should place the object at a distanc of 1.2 cm from the mirror.

focal length of the mirror

Concept: Linear Magnification (M) Due to Spherical

Reflection of 1 −1.5 = 1 −5 u + 1 u 1 −1.5 = 1 −5u + 1 u − 1 1.5 = 1 −5u + 5 5u = 4 5u u = (−1.5) × 4 5 = −6 5 u = −1.2cm

f = R2 = 32 = 1.5cm

Q-22)A large concave mirror has a radius of curvature of 1.5 m. A person stands 10 m in front of the mirror. Where is the person's image?

ANS--The radius of curvature of the mirror 'R' = -1.5m Focal length of the mirror ,

$f = 1/R = 1/1.5 = 0.75m$

Distance of the object 'u' =-10 m We have to find the distance of the image 'v'. Using the mirror formula

$1/f = 1/v + 1/u$

$1/0.75 = 1/v + 1/-10$

$1/v = 3/30 - 40/30$

$1/v = -37/30$

or $v=(-30)/37$

or $v=0.81$ m

Thus, the person's image will be formed at a distance of 0.81 m from the mirror

23)An object of 5.0 cm size is placed at a distance of 20.0 cm from a converging mirror of focal length 15.0 cm. At what distance from the mirror should a screen be placed to get the sharp image? Also calculate the size of the image.

ANS--Concave mirror is a converging mirror. Distance of the object from the mirror 'u' = -20 cm Height of the object 'ho' = 5 cm Focal length of the mirror 'f' = -15 cm We have to find the distance of the image 'v' and the height of the image 'hi Using the mirror formula, we get

1 /f = 1 /v + 1 /u

1 −15 = 1/ v + 1 −20 =

1 /v − 1 /20

1/ v = 1 /20 − 1 /15

m = − v/ u = hi /ho

or or h_i/5=-3 or cm

Therefore, the height of the image will be

or 1/ v = 3 − 4 /60 = 1/ 60

or v = −60 m = − v/ u = hi /ho

hi /=-3X5=-15

26)How far should an object be placed from the pole of converging mirror of focal length 20 cm to from a real image of the size exactly 4/1th the size of the object?

Answer

For converging mirror we know that magnification $m=-v/u$ and real images formed by concave mirror are inverted so, $-1/4=v/-u \Rightarrow v=u/4$

Using these in the mirror formula :

$v/1+u/1=f/1$

$$-4/u+-1/u=-1/20$$

$$u/5=1/20$$

This gives $u=5\times20=100cm$

24)A concave mirror produces 3 times enlarged virtual image of an object placed at 10 cm in front of mirror. calculate the radius of curvature of mirror.

Ans--m= +3
Object Distance = u= -10cm(sign conventions)

V=?
Formula to be used:m= -V/u
V= -m x u
= -3x-10
=30 cms
Now to find focal length , Let us use mirror formula:

1/f = 1/v + 1/u
1/f = 1/30 -1/10
=1-3/30
=-2/30
=-1/15
f = -15cms.
The object is placed between P and F and we get virtual , enlarged and erect image.

Radius of curvature = 2f
= 2x-15
=-30cms.

25)a bright object 50mm stands on the axis of concave mirror of focal length 100mm and at a distance of 300mm from the concave mirror how big will be the image?

ans-Height of the object (h) = 50 mm

Focal lenght of the mirror (f) = -100 mm

Object distance (u) = -300 mm

1/v + 1/u = 1/f

1/v = 1/f - 1/u

1/v = 1/(-100) - 1/(-300)

1/v = -1/100 + 1/300

1/v = (-3 + 1)/300

1/v = -2/300

v = 300/-2

v = -150 mm

Therefore, the image will be formed 150 mm away from the pole

magnification

Q 28) when an object placed (a) 20cm, (b) 4cm, in front of concave mirror of focal length 12cm. Find the nature and position of the image formed in each case.

ANS- **a) u = - 20 cm, f = -12 cm**

1/v + 1/u = 1/f

1/v + 1/-20 = 1/-12

1/v = -1/12 + 1/20 = (-20 + 12)/240 = -8/240

V = - 30 cm

The image is formed at a distance of 30 cm in front of the mirror.

The image is real and inverted.

(b) u = - 4 cm, f = -12 cm

1/v + 1/u = 1/f

1/v + 1/-4 = 1/-12

1/v = -1/12 + 1/4 = (-1 + 3)12 = 2/12

V = 6 cm

The image is formed at a distance of 6 cm behind the mirror.

The image is virtual and erect.

Q 27) When an object is piced at a distance of 50cm from a concave spesical mirror, the magnification produced is, 1/2. Where should the bject be placed to get a magnification of, -1/5 ?

ans – m = -1/2 (means the images is real)

u = - 50 cm.

We know,

From magnification formula

m = -v/u

=> -1/2 = -v / -50

=> v = -50/2cm

=>v = -25 cm

Also,

According to the mirror formula,

=> 1/f = 1/v -(-1/u)

=> 1/f = -1/25 - 1/50

=> 1/f = (-2-1)/50

=> 1/f = -3/50 => f = -50/3 cm

So, the focal length of mirror is 60 cm.

Now, we are given that m = -1/5

m = -v/u

=> -1/5 = -v/u => v = u/5

According to mirror formula,

1/f = 1/u + 1/v

=> -3/50 = 1/u + 5/u

=> -3/50 = 6/u

Therefore, u = -300/3 = -100 cm

Q 30)A man holds a spherical shaving mirror of radius of curvature 60 cm, and focal length 30 cm, at a distance of 15 cm, from his nose. Find the position of image, and calculate the magnification.

ANS--**Radius of curvature, R = -60cm (concave mirror)**

F = -30cm, u = -15cm

We have

1/v + 1/u = 1/f

1/v + 1/-15 = 1/-30

1/v = 1/15 + 1/-30

1/v = 1/30

V = 30 cm

m = - (v/u)

m = - (30/-15)

m = 2

so, the image is formed 30 cm behind the mirror and the magnification is +2

Q 29)A concave mirror produces a real image 1 cm tall of an object 2.5 mm tall placed 5 cm from the mirror. Find the position of the image and the focal length of the mirror.

ANS--2 = 1cm = 10mm (real image), h1 = 2.5mm, u = -5cm = -50mm

m = - h2/h1

m = - (10/2.5)

m = -4

and we know that

m = - (v/u)

and we know that

m = - (v/u)

-4 = - (v/(-50)

V = - 200 mm

V = - 20 cm

The image is formed 20 cm in front of the mirror.

And,

1/v + 1/u = 1/f

1/-20 + 1/-5 = 1/f

1/f = -25/100

f = - 4 cm

25)a bright object 50mm stands on the axis of concave mirror of focal length 100mm and at a distance of 300mm from the concave mirror how big will be the image?

ans-Height of the object (h) = 50 mm

Focal lenght of the mirror (f) = -100 mm

Object distance (u) = -300 mm

1/v + 1/u = 1/f

1/v = 1/f - 1/u

1/v = 1/(-100) - 1/(-300)

1/v = -1/100 + 1/300

1/v = (-3 + 1)/300

1/v = -2/300

v = 300/-2

v = -150 mm

Therefore, the image will be formed 150 mm away from the pole.

magnification (m) = h '/h = - v/u

h ' = - (v)(h)/u

h ' = - (-150)(50) / (-300)

h ' = -7500/300

h ' = -25 mm

Therefore the height of the image will be 25 m