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TENDER HEART HIGH SCHOOL, SEC-33B, CHD

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Teacher: - Charanjit Saur

CLASS - VIII

Subject - PHYSICS

Ch-7(c) Numericals

* For Numericals Learn few terms :→

For Concave mirror

u - Object distance

v - Image distance

f - focal length

$u = -ve$ (always)

$v = -ve$ (for real image)

$v = +ve$ (for virtual image)

$f = -ve$ (always)

For Convex mirror

$u = -ve$ (always)

$v = +ve$ (always)

($\because$ Convex mirror always form virtual image)

$f = +ve$ (always)

Q1 At what distance from a Concave mirror of focal length 25cm should an object be placed so that size of image is equal to the size of the object

Ans:→ Concave mirror so; $f = -ve$
 $f = -25cm$

$I = O$ (both are equal)

I - Image Size

O - Object Size

$$\text{as } m = -\frac{v}{u} = \frac{I}{O} = \frac{I}{I} = -\frac{v}{u} = 1$$

$$\boxed{v = -u}$$

So by using mirror formula;

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

$f = -25\text{cm}$, $v = -u$ So;

Take u as $-u$ $\frac{1}{-u} + \frac{1}{-u} = \frac{1}{-25} \Rightarrow -\frac{1}{u} - \frac{1}{u} = \frac{1}{-25}$

$$-\frac{2}{u} = -\frac{1}{25}$$

by cross-multiplication;

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

_____ X _____ X _____ X _____

Q2 An Object 5cm high is placed at a distance 60cm in front of a Concave mirror of focal length 10cm. find (i) the position and (ii) Size, of the image.

Ans Concave mirror; $f = -ve$
 $f = -10\text{cm}$
 height of Object = $o = 5\text{cm}$
 $u = -60\text{cm}$ ($\because u = -ve$ for concave mirror)
 $I = ?$
 $v = ?$

So; $m = \frac{I}{o} = -\frac{v}{u}$ ($\because u = -60\text{cm}$)

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

$$\frac{1}{v} + \frac{1}{-60} = \frac{1}{-10} \Rightarrow \frac{1}{v} - \frac{1}{60} = -\frac{1}{10}$$

or $\frac{1}{v} = \frac{1}{-10} + \frac{1}{60}$

$$\frac{1}{v} = \frac{-6+1}{60} = \frac{-5}{60 \times 12}$$

$$\frac{1}{v} = -\frac{1}{12} \quad \text{So } \boxed{v = -12\text{cm}}$$

So image is in front of mirror because v is $-ve$.

$$\text{So, } m = -\frac{v}{u} = \frac{I}{O}$$

$$-\left(\frac{-12}{-60}\right) = \frac{I}{5}$$

$$-\frac{12}{60} = \frac{I}{5}$$

$$\begin{cases} u = -60\text{cm} \\ v = -12\text{cm} \\ O = 5\text{cm} \end{cases}$$

After cross-multiplication; $60I = -60$
 $I = \frac{-60}{60} = -1\text{cm}$

So Size of Image $\Rightarrow 1\text{cm}$ $I = -1\text{cm}$

x — x — x — x — x — x — x —

Q3: $\rightarrow$ An object of length 4cm is placed in front of a concave mirror at a distance 30cm. The focal length of a mirror is 15cm. (a) Where will be the image form
 (b) What will be the length of image?

Ans: — Concave mirror; $u = -30\text{cm}$
 $O = 4\text{cm}$
 $f = -15\text{cm}$

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

Using ; $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$; $\frac{1}{v} + \frac{1}{-30} = \frac{1}{-15}$

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

$$\frac{1}{v} = -\frac{1}{15} + \frac{1}{30} = \frac{-2+1}{30}$$

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

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

So image is formed in front of the mirror

As $m = \frac{I}{O} = -\frac{v}{u}$

or image is of size 4cm $\Rightarrow \frac{I}{4} = -\left(\frac{-30}{-30}\right)$ or $\frac{I}{4} = -1 \Rightarrow \boxed{I = 4\text{cm}}$

Q4 The image formed by a Convex mirror is of size one-third the size of Object. How are u and v related?

Ans

$$m = \frac{v}{u} = \frac{I}{O} \quad \text{--- (1)}$$

$$\frac{I}{O} = \frac{1}{3} O, \text{ using (1)}$$

$$S_o \frac{v}{u} = \frac{1}{3} O$$

$$-\frac{v}{u} = \frac{1}{3}$$

$$\text{or } \frac{v}{u} = -\frac{1}{3}$$

$$\boxed{v = -\frac{1}{3}u}$$

Q5 A concave mirror forms a virtual image of size twice that of object placed at a distance 5cm from it. find (a) the focal length of the mirror. (b) Position of the image

Ans

Concave mirror,

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

Virtual image

$$I \Rightarrow 2O$$

$$m \Rightarrow \frac{v}{u} \Rightarrow \frac{I}{O}$$

$$-\frac{v}{u} \Rightarrow \frac{2O}{O}$$

$$\text{or } \boxed{v = -2u}$$

$$v = -2 \times -5 = +10\text{cm}$$

as for virtual image

v is +ve

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

using;

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{2u} + \frac{1}{u}$$

$$\frac{1}{f} = \frac{1}{10} + \frac{1}{-5}$$

$$\frac{1}{f} = \frac{1}{10} - \frac{1}{5}$$

$$\frac{1}{f} = \frac{1-2}{10}$$

$$\text{or } \boxed{f = -10\text{cm}}$$

as $v = 10\text{cm}$; so

image is formed behind the mirror as v is +ve.

$$(u = -5\text{cm})$$

[$\because f$ is -ve for Concave mirror]