

UNIT 4

Reflection of Light

15/12/2020 – Class 37

Assignment Answer

1. An object is placed in front of a concave mirror 40 cm away from it. If its focal length is 80 cm, locate position of the image and find the nature of the image?

Object distance (u) = - 40 cm

Focal length (f) = - 80 cm

Image distance (v) = $uf / (u-f)$

$v = (-40 \times -80) / (-40 - -80)$

= + 3200 / +40 = + 80 cm

Since v is positive, the image is virtual and erect.

Activity 1

Is there any relationship between the position of image and the size of the image?

Discussion

- What you mean by magnification? **It is the ratio of height of the image to the height of the object.**

Magnification

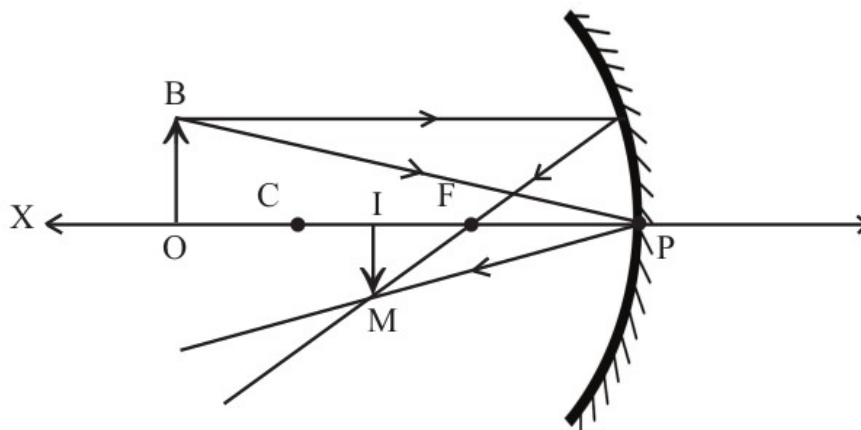
Magnification is the ratio of height of the image to the height of the object

Magnification (m) = Height of the image / Height of the object = h_i / h_o

Activity 2

Does magnification has any relation with the value of v/u ?

Ray diagram showing the image formation of a concave mirror is given?



Discussion

- Where is the position of the object (OB)? **Beyond C**
- Where is the position of the image (IM)? **Between F and C**
- What is the peculiarity of the triangles OBP and IMP? **They are similar triangles.**
- Write down the ratio of corresponding sides of the similar triangles? **$IM / OB = IP / OP$**

In the figure,

IM = Height of image (**h_i**)

OB = Height of the object (**h_o**)

IP = Image distance (**v**)

OP = Object distance (**u**)

Substituting the above values, we get

$$h_i / h_o = v / u$$

According to New Cartesian Sign convention,

h_i = **negative**

h_o = **positive**

v = **negative**

u = **negative**

Apply the New Cartesian Sign convention in the above equation,

$$- h_i / h_o = - v / - u$$

$$- h_i / h_o = v / u$$

But magnification $m = h_i / h_o$,

$$- m = v / u$$

$$m = - (v / u)$$

Inference

$$\text{Magnification (m)} = h_i / h_o = - (v / u)$$

Activity 3

When an object of height 6 cm is placed in front of a concave mirror at a distance 10 cm away from it, an image is obtained 16 cm away, on the same side. Find out the height of image and magnification?

Height of object (h_o) = + **6 cm**

Object distance (u) = **-10 cm**

Image distance (v) = **-16 cm**

Magnification (m) = - (v / u)

$$m = - (-16 / -10)$$

$$m = - **1.6**$$

Magnification (m) = -1.6 (since magnification is a ratio, it has no unit)

Magnification (m) = h_i / h_o

$$- 1.6 = h_i / +6$$

$$h_i = - 1.6 \times 6 = -9.6 \text{ cm}$$

Height of image (h_i) = - 9.6 cm

Height of the image is negative. So image is real and inverted.

Assignment

An object is placed 8 cm away in front of a concave mirror of focal length 5 cm. Find the position of image and magnification?