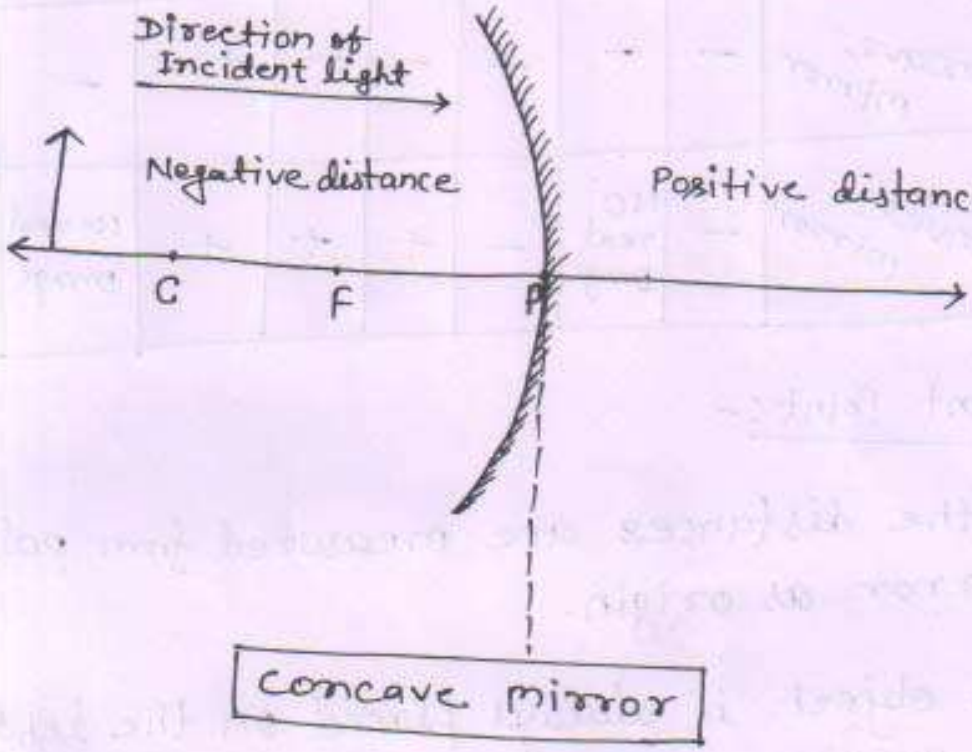
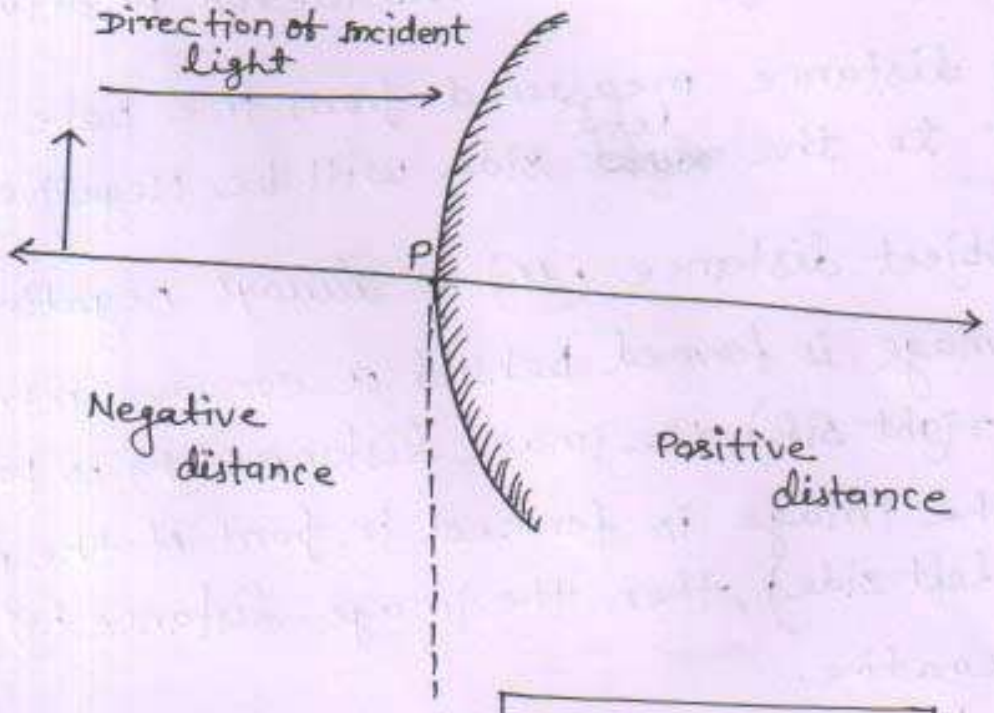
SIGN convention for spherical mirrors



Concave mirror



Convex mirror

'Sign Convention' table

Type of mirror	u	v		f	R	Height of the object (h_2)	Height of the Image (h_1)	
		Real	Virtual				Real	Virtual
Concave mirror	−	−	−	−	−	+	−	+
Convex mirror	−	No real Image	−	+	+	+	No real Image	+

Important Point :-

1.) All the distances are measured from pole of the mirror as origin.

2.) The object is always placed on the left side of the mirror.

3.) All the distances measured from the pole of mirror to the right side will be considered positive.

4.) All the distance measured from the pole of mirror to the ~~right~~ left side will be Negative.

5.) The object distance (u) is always negative.

6.) If an image is formed behind a concave mirror (to the right side), the image distance (v) is positive but if the image is formed in front of the mirror (to the left side), then the image distance (v) will be negative.

7.) In a convex mirror, the image is always formed on the right side (behind the mirror). The image distance (v) for a convex mirror will be always positive.

8.) The focal length of a concave mirror is considered negative.

9.) The focal length of a convex mirror is positive.

10.) The height of an object is always positive.

11.) If an image is formed above the principal axis, its height is taken as positive.

12.) If an image is formed below the principal axis then its height is taken as negative.

13.) The height of all the virtual and erect image is considered positive.

14.) The height of all the real and inverted image is taken as negative.

Mirror formula :—

$$\frac{1}{\text{Image distance}} + \frac{1}{\text{Object distance}} = \frac{1}{\text{focal length}}$$

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

where,

v = Image distance
u = Object distance
f = focal length

* Magnification :-

The ratio of the height of Image (h_2) to the height of Object (h_1) is known as Magnification.

$$\therefore \text{Magnification} = \frac{\text{height of image}}{\text{height of object}}$$

or $$\boxed{m = \frac{h_2}{h_1}}$$

Where,

m = magnification
h_2 = height of Image
h_1 = height of object

And,

$$\text{magnification} = -\frac{\text{Image distance}}{\text{Object distance}}$$

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

Now,

to ~~the~~ Solving problem :-

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

* Important Point of Magnification

i) The height of object (h_1) will always be Positive.

ii) The height of virtual image (h_2) will be Positive.

iii) The height of real image will be Negative.

iv) If the magnification has a plus sign (+), then the image is virtual and erect.

v) If the magnification has a minus (−), sign then the image is real and inverted.

vi)

Notes:-

(1.) A concave mirror can produce virtual image as well as real images, the magnification produced by a concave mirror can be either positive or negative.

(2.) A convex mirror, forms only virtual image, so the magnification produced by a convex mirror is always positive.

Q→ Find the size, nature and position of image formed when an object of size 1 cm is placed at a distance of 15 cm from a concave mirror of focal length 10 cm.

Ans:-

Given that,

Object distance, $u = -15$ cm

Image distance, $v = ?$

focal length, $f = -10$ cm

by mirror formula,

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

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

$$\Rightarrow \frac{1}{v} = \frac{1}{-10} - \frac{1}{-15}$$

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

$$= \frac{-3+2}{30}$$

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

$\therefore v = -30$ cm

⇒ Position of image is 30 cm to the left side of mirror.

⇒ Nature of image is Real and inverted

⇒ $\because m =$.