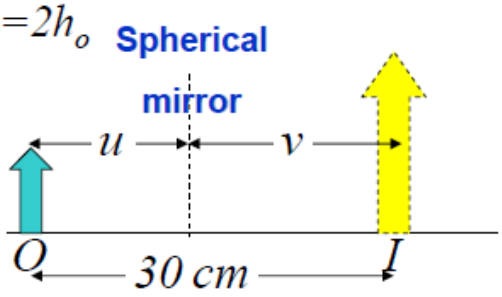
Example 4:

An upright image is formed 30 cm from the real object by using the spherical mirror. The height of image is twice the height of object.

a. Where should the mirror be placed relative to the object?

b. Calculate the radius of curvature of the mirror and describe the type of mirror required.

Solution: $h_i = 2h_o$



a. From the figure above,

$$u + |v| = 30\ cm \quad \text{.....(1)}$$

By using the equation of linear magnification, thus

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

$$v = -2u \quad \text{.....(2)}$$

By substituting eq. (2) into eq. (1), hence

$$u = 10\ cm$$

The mirror should be placed 10 cm in front of the object.

b. By using the equation of spherical mirror,

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

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{(-2u)}$$

$$f = +20\ cm$$

and $f = \frac{r}{2}$ therefore $r = 40\ cm$

The type of spherical mirror is **concave** because the positive value of focal length.

Example 5:

A mirror on the passenger side of your car is convex and has a radius of curvature 20.0 cm. Another car is seen in this side mirror and is 11.0 m behind the mirror. If this car is 1.5 m tall, calculate the height of the car image . (Similar to No. 34.66, pg. 1333, University Physics with Modern Physics,11th edition, Young & Freedman.)

Solution: $h_o=1.5x10^2\ cm,\ r=-20.0\ cm,\ u=+11.0x10^2\ cm$

By applying the equation of spherical mirror,

$$\frac{1}{f}=\frac{1}{u}+\frac{1}{v} \quad \text{and} \quad f=\frac{r}{2}$$

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

$$v=-9.91\ cm$$

From equation of linear magnification,

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

$$h_i=-\left(\frac{v}{u}\right)h_o$$

$$h_i=1.35\ cm$$

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Example 6: (H.W.)

a. A concave mirror forms an inverted image four times larger than the object. Find the focal length of the mirror, assuming the distance between object and image is 0.600 m.

b. A convex mirror forms a virtual image half the size of the object. Assuming the distance between image and object is 20.0 cm, determine the radius of curvature of the mirror.

Ans. : 160 mm, -267 mm