

3) An object is at a distance of 10 cm from a mirror and the image of the object is at a distance of 30 cm from the mirror on the same side as the object. Is the mirror concave or convex? What is the focal length?

↳ Given

$$u = -10 \text{ cm}$$

$$v = -30 \text{ cm} \text{ (--- in the Q)}$$

NKT

for Mirror

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

$$\Rightarrow \frac{1}{-30} + \frac{1}{-10} = \frac{1}{f}$$

$$\Rightarrow \frac{-1-3}{30} = \frac{1}{f}$$

$$\Rightarrow \frac{-4}{30} = \frac{1}{f}$$

$$\Rightarrow f = -\frac{30}{4}$$

$$= -7.5 \text{ cm}$$

∴ focal length is -ve, the mirror is concave.

4) Find the radius of curvature of a spherical mirror of focal length 15 cm?

↳ NKT

$$R = 2f$$

$$\Rightarrow R = 2 \times 15 \\ = 30 \text{ cm}$$

(only magnitude is considered here)

⑤ A glass prism has a refracting angle of 60° . The angle of min^m deviation is 40° . Find the refractive index?

↳ Given $\delta_m = 40^\circ$
 $A = 60^\circ$

WKT

$$\mu = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin A/2}$$

$$= \frac{\sin\left(\frac{60 + 40}{2}\right)}{\sin 60/2}$$

$$= \frac{\sin 50^\circ}{\sin 30^\circ}$$

$$= \frac{0.766}{1/2}$$

$$\mu = 1.532$$

⑥ Velocity of light in a liquid is $(2.5 \times 10^8 \text{ m/s})$ while in air is $3 \times 10^8 \text{ m/s}$. A ray of light passes from liquid to air. Calculate the critical angle?

↳ Given $v = 2.5 \times 10^8 \text{ m/s}$
 $c = 3 \times 10^8 \text{ m/s}$

$$\therefore \mu = \frac{c}{v} = \frac{3 \times 10^8}{2.5 \times 10^8} = \frac{30}{25} = \frac{6}{5}$$

WKT

$$\mu = \frac{1}{\sin c}$$

$$\Rightarrow c = \sin^{-1}\left(\frac{1}{\mu}\right) = \sin^{-1}\left(\frac{5}{6}\right)$$

$$= 56.45^\circ$$