Answer on Question 51680, Physics, Optics
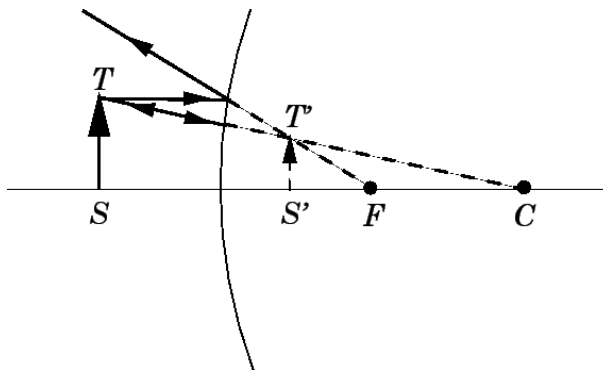
11. What type of image is formed when an object is placed at a distance of 1.5 focal lengths from a convex mirror?

a) erect and virtual

b) inverted and virtual

c) erect and real

d) inverted and real

Answer:

The image on a convex mirror is always virtual, and as we can see when an object is placed at a distance of 1.5 focal lengths from a convex mirror, the image is virtual and erect. Correct answer: a) erect and virtual.

12. Where is the image located when an object is $60cm$ from a convex mirror with a focal length of $20cm$?

a) $15cm$ behind

b) $30cm$ behind

c) $60cm$ behind

d) $15cm$ in front

Solution:

From the mirror equation we have:

$$\frac{1}{d_{image}} + \frac{1}{d_{object}} = \frac{1}{-f},$$

$$\frac{1}{d_{image}} + \frac{1}{60cm} = \frac{1}{-20cm},$$

$$\frac{1}{d_{image}} = -\frac{1}{20cm} - \frac{1}{60cm} = -\frac{1}{15cm},$$

$$d_{image} = -15cm.$$

The negative sign of d_{image} indicate that image is located behind the convex mirror.

Answer: a) $15cm$ behind.

13. If the Sun is 150 million kilometers away from the Earth, how long does it take sunlight to reach the Earth?

a) $0.5s$

b) $1500s$

c) $45s$

d) $500s$

Solution:

In order to find time that needs sunlight to reach the Earth we divide the distance to the Sun by the speed of light and obtain:

$$t = \frac{d}{c} = \frac{1.5 \cdot 10^{11}m}{3 \cdot 10^8 \frac{m}{s}} = 500s.$$

Answer: d) $500s$

14. The critical angle for total internal reflection at an air-water interface is approximately $48°$. In which of the following situations will total internal reflection occur?

a) light incident in water at $40°$

b) light incident in water at $55°$

c) light incident in air at $40°$

d) light incident in air at $55°$

Solution:

The total internal reflection occurs when light attempts to move from a medium having a given refractive index to a medium having a lover refractive index (in our case from water with $n_1 = 1.33$ to air with $n_2 = 1.0$).
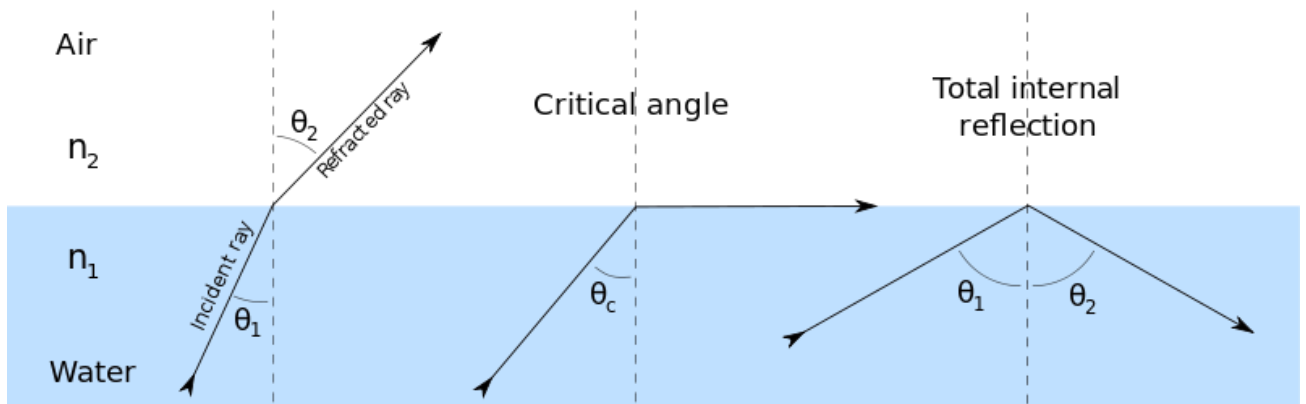
As we can see in the picture for $\theta_1 > \theta_c$ there is no reflected ray. Thus, in order to occur the total internal reflection we need b) light incident in water at $55°$.

Answer: b) light incident in water at $55°$.

15. How many diopters are there for a converging lens with a focal length of $0.4m$?

a) -2.5

b) -0.4

c) $+0.4$

d) $+2.5$

Solution:

The power of a lens is defined as the reciprocal of its focal length in meters:

$$P = \frac{1}{f} = \frac{1}{0.4m} = +2.5 diopters$$

Because we have a converging lens (a positive lens) the correct answer is d) $+2.5$

Answer: d) $+2.5$