

Answer on Question #51685-Physics-Optics

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

- a. 15 cm behind
- b. 30 cm behind
- c. 60 cm behind
- d. 15 cm in front

Solution

Here $u = -ve$, $f = +ve$.

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

$$\frac{1}{-60} + \frac{1}{v} = \frac{1}{20} \rightarrow v = 15cm$$

The $+ve$ sign indicates that image is virtual and behind the mirror.

Answer: a. 15 cm behind.

12 If the sun is 150 million km away from the earth, how long does it take sunlight to reach the earth

- a. 0.5 s
- b. 1500 s
- c. 45 s
- d. 500 s

Solution

$$d = 150 \cdot 10^6 k, = 150 \cdot 10^9 m,$$

$v = 3 \cdot 10^8 \frac{m}{s}$ is the speed of light.

$$time = \frac{distance}{speed}$$

We will divide the distance to the Sun by the speed of light, which will give us the answer in seconds:

$$t = \frac{d}{v} = \frac{150 \cdot 10^9}{3 \cdot 10^8} = 500 s.$$

Answer: d. 500 s.

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

- a. light incident in water at 40 degrees

- b. light incident in water at 55 degrees
- c. light incident in air at 40 degrees
- d. light incident in air at 55 degrees

Solution

Total internal reflection only takes place when both of the following two conditions are met:

- 1) a light ray is in the more dense medium and approaching the less dense medium (therefore it is possible only then light incident from water on air)
- 2) the angle of incidence for the light ray is greater than the critical angle (in this case 48°). Therefore total internal reflection will occur if light incident from water on air at 55°

Answer: b. light incident in water at 55 degrees.

14 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

A lens with a focal length of $f = +0.4 \text{ m}$ (converging lens) has a power

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

Answer: d. +2.5