Answer on Question #46398, Physics, Optics

Question

Calculate the distance and magnification of an object placed 20cm from a converging lens

60cm and 0.3 times the size of object
20cm and 0.3 times the size of object
60cm and 3 times the size of object
80cm and 3 times the size of object

Solution

The lens equation expresses the quantitative relationship between the object distance (d_o), the image distance (d_i), and the focal length (f). The equation is stated as follows:

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

The magnification equation relates the ratio of the image distance and object distance to the ratio of the image height (h_i) and object height (h_o). The magnification equation is stated as follows:

$$M = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$$

These two equations can be combined to yield information about the image distance and image height if the object distance, object height, and focal length are known.
Thus, when

- $d_i = 60$ cm, then $M = -\frac{60}{20} = -3$, so the image is inverted and is 3 times of original height.
- $d_i = 20$ cm, then $M = -\frac{20}{20} = -1$, so the image is inverted and has original height.
- $d_i = 80$ cm, then $M = -\frac{80}{20} = -4$, so the image is inverted and is 4 times of original height.

Thus, the correct variant of answer is **60cm and 3 times the size of object**

Answer: 60cm and 3 times the size of object