A Two Lens Optical System

Lens A on left has \( f = +40 \text{ cm} \), Lens B on right has \( f = -10 \text{ cm} \). Distance between lenses is 30 cm.

An object 3 cm tall is placed 80 cm to the left of lens A. Find the type, location and size of image made by lens B.

Object \( f = 40 \text{ cm} \) \( f = -10 \text{ cm} \)

\[ \frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f} \]

\[ \frac{1}{d_o} + \frac{1}{80} = \frac{1}{40} \]

\[ d_o = 80 \text{ cm} \]

\[ d_i = 80 \text{ cm} \]

\[ m_A = \frac{d_i}{d_o} = \frac{80}{80} = -1 \]

The image created by lens A becomes the object for lens B. Since the image is 80 cm to the right of lens A, it is 50 cm to the right of lens B.

Lens B \( f = -10 \text{ cm} \)

\[ \frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f} \]

\[ \frac{1}{50} + \frac{1}{d_i} = \frac{1}{10} \]

\[ d_i = 12.5 \text{ cm} \]

\[ m_B = \frac{d_i}{d_o} = \frac{-12.5}{50} = -0.25 \]

\[ m = m_A \times m_B = -1 \times (-0.25) = +0.25 \]

\[ h_i = m \times h_o = 0.25 \times 3 = 0.75 \text{ cm} \]

Image is Virtual (di40), Upright (m>0), 0.75 cm tall located 12.5 cm to the left of lens B.