

PH332 - Chapter Three Solutions

P6) Convex mirrors have a negative focal length and therefore always produce virtual images, which are upright. Therefore, the mirror on the left is concave and the mirror on the right is convex.

P13) No. The angle of incidence equals the angle of reflection independent of the wavelength or color of the light.

PM4) (a) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ $d_o = 6 \text{ cm}$ $f = 2 \text{ cm}$ $h_o = 2 \text{ cm}$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{2} - \frac{1}{6} = \frac{3}{6} - \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$$

$d_i = 3 \text{ cm}$ Real image since $d_i > 0$.

(b) $M = -\frac{d_i}{d_o} = -\frac{3}{6} = -\frac{1}{2}$ Inverted since $M < 0$.
Smaller since $|M| < 1$.

PM5) (a) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ $d_o = 1 \text{ cm}$ $f = 2 \text{ cm}$ $h_o = 1 \text{ cm}$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{2} - \frac{1}{1} = \frac{1}{2} - 1 = -\frac{1}{2}$$

$d_i = -2 \text{ cm}$ Virtual image since $d_i < 0$.

(b) $M = -\frac{d_i}{d_o} = -\frac{(-2)}{1} = 2$ Upright since $M > 0$.
Larger since $|M| > 1$.

PM6) (a) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ $d_o = 2 \text{ cm}$ $f = -2 \text{ cm}$ (convex)

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} \quad \frac{1}{d_i} = \frac{1}{-2} - \frac{1}{2} = -1$$

$d_i = -1 \text{ cm}$ Virtual image since $d_i < 0$

(b) $M = -\frac{d_i}{d_o} = -\frac{(-1)}{2} = \frac{1}{2} = 0.5$ Upright since $M > 0$.
Smaller since $|M| < 1$.

PM7) (a) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ $d_o = 10 \text{ cm}$ $f = +5 \text{ cm}$ (converging)

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{5} - \frac{1}{10} = \frac{2}{10} - \frac{1}{10} = \frac{1}{10}$$

$d_i = 10 \text{ cm}$ Real image since $d_i > 0$

(b) $M = -\frac{d_i}{d_o} = -\frac{10}{10} = -1$ Inverted since $M < 0$.
Same size since $|M| = 1$.

PM8) (a) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ $d_o = 2.5 \text{ cm}$ $f = +5 \text{ cm}$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{5} - \frac{1}{2.5} = \frac{1}{5} - \frac{2}{5} = -\frac{1}{5}$$

$d_i = -5 \text{ cm}$ Virtual image since $d_i < 0$

(b) $M = -\frac{d_i}{d_o} = -\frac{(-5)}{2.5} = \frac{5}{2.5} = 2$ Upright since $M > 0$.
Bigger since $|M| > 1$.