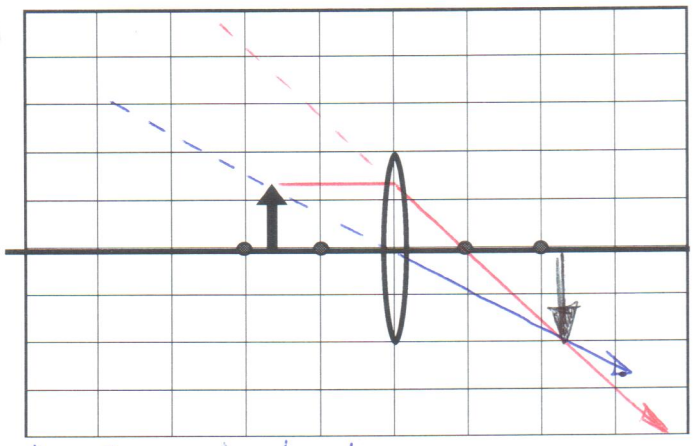
Review for Test 8 Optics

Draw the ray diagrams and describe the images.



Mini ..... ☐
Max ..... ☒
Same ..... ☐

Real ..... ☒
Virtual..... ☐
Upright..... ☐
Inverted..... ☒

The object is located 10 cm from the convex lens having a focus of 6 cm.

Where is the image? 15 cm

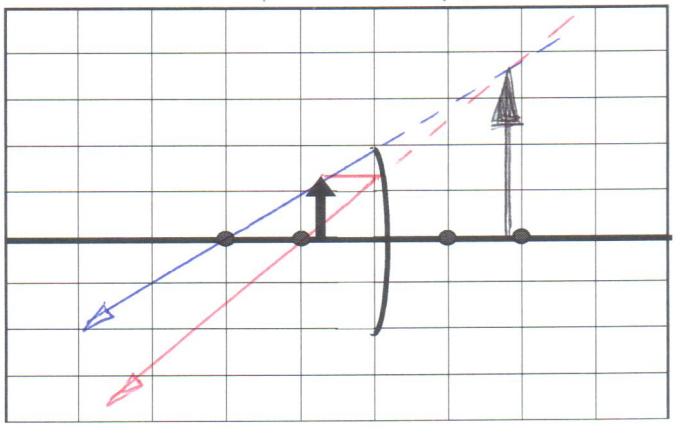
How tall is the image if the object is 5 cm tall? -7.5 cm

$D_o = 10cm$ $\frac{1}{D_i} + \frac{1}{D_o} = \frac{1}{f}$

$f = 6cm$

$D_i = ? = 15cm$ $D_i = (f^{-1} + D_o^{-1})^{-1} = (6^{-1} - 10^{-1})^{-1} = 15cm$

$\frac{-D_i}{D_o} = \frac{H_i}{H_o}$ $\frac{-15}{10} = \frac{H_i}{5}$ $H_i = \frac{(-15)(5)}{10}$



Mini ..... ☐
Max ..... ☒
Same ..... ☐

Real ..... ☐
Virtual..... ☒
Upright..... ☒
Inverted..... ☐

The object is located .75 cm from the concave mirror having a focus of 1 cm.

Where is the image? -3cm

How tall is the image if the object is 3 cm tall? 12 cm

$D_o = 0.75cm$ $D_i = ?$

$f = 1cm$

$D_i = (f^{-1} - D_o^{-1})^{-1}$

$= (1^{-1} - 0.75^{-1})^{-1}$

$= -3cm$

$\frac{-D_i}{D_o} = \frac{H_i}{H_o}$

$\frac{3}{0.75} = \frac{H_i}{3}$

$H_i = \frac{(3)(3)}{0.75}$

$H_i = 12cm$

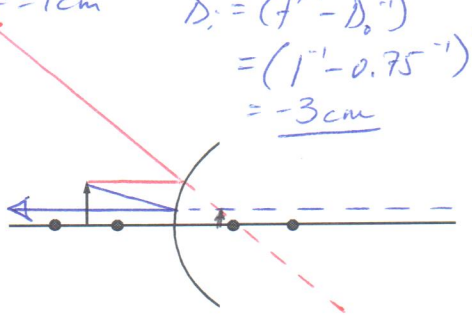


IMAGE IS

1. virtual
2. upright
3. minimized

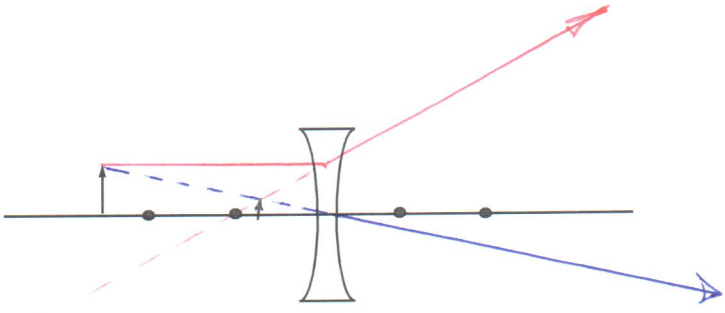


IMAGE IS

1. virtual
2. upright
3. minimized

1. What type of image can a flat mirror produce?

virtual, upright, same sized

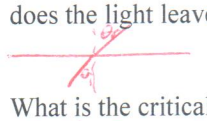
2. For a flat mirror, if the angle of incidence is 37 degrees what is the angle of reflection?

37°

3. What determines the distance to the image produced by a flat mirror?

the distance of the object

4. A diver shines a flashlight upward from beneath the water at a 31 degree angle to the vertical. At what angle does the light leave the water?



$n_1 \sin\theta_i = n_2 \sin\theta_r$

$1.33 \sin(31°) = 1 \sin\theta_r$

$\theta_r = \sin^{-1}(1.33 \sin(31°)) = 43.24°$

5. What is the critical angle if light emerges from a diamond into water? ($n_{diamond} = 2.42$; $n_{water} = 1.33$)

~~$n_1 \sin\theta_i = n_2 \sin\theta_r$~~ ~~$2.42$~~ $\sin\theta_c = \frac{n_2}{n_1}$ $\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right) = \sin^{-1}\left(\frac{1.33}{2.42}\right) = 33.3°$

~~$\sin\theta = \frac{\theta}{\theta}$~~

6. The speed of light in ice is 2.29 E 8 m / s. What is the index of refraction of ice?

$n = \frac{c}{v}$ $n = \frac{3E8}{2.29E8} = 1.31$

7. Using the index of refraction you found in #6, what would the angle of refraction be if a flashlight were frozen in a block of ice and the beam struck the surface at an angle of incidence of 37 degrees?

~~$\theta_i = 37°$~~ $n_1 = 1.31$ $n_1 \sin\theta_i = n_2 \sin\theta_r$ $\theta_r = \sin^{-1}(1.31 \sin(37°))$

$\theta_r = ?$ $n_2 = 1$ $(1.31)(\sin(37°)) = \sin\theta_r$ $= 52°$

8. A beam of light strikes a pane of glass at an angle of incidence of 60 degrees. If the angle of refraction is 35 degrees, find the index of refraction of the glass.

$\theta_i = 60°$ $n_2 = ?$ $n_1 \sin\theta_i = n_2 \sin\theta_r$ $n_2 = \frac{\sin(60)}{\sin(35)} = 1.51$

$\theta_r = 35°$ $n_1 = 1$ $\sin(60°) = n_2 \sin(35°)$

9. When light travels from a less optically dense material to a more optically dense material. Does it speed up or slow down? Does it bend towards or away from the normal?

slow down; bend toward the normal

10. When light travels from a more optically dense material to a less optically dense material. Does it speed up or slow down? Does it bend towards or away from the normal?

speed up; bend away (these two are Snell's Law)

11. What is the critical angle?

12. What is total internal reflection?

13. What is the index of refraction?

14. Why does light refract?

15. What type of image can a convex lens make?

16. Convex lens converge or diverge light rays; positive or negative focal point?

As well as having a comprehensive knowledge of the above topics, you should also review the information on pages 572-575; 580-595; 600 –615; and 619-621 of your text.

$$c = f\lambda \qquad n_1 \sin\theta_i = n_2 \sin\theta_r \qquad n_{air} = 1 \qquad c = 3E8\,m/s$$

$$n = \frac{c}{v} \qquad \sin\theta_c = \frac{n_2}{n_1} \qquad \frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o} \qquad m = \frac{H_i}{H_o} = \frac{-d_i}{d_o}$$