Name : ___KEY___
Period: _____ Date: _____

Formula's:

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

$$\frac{S_i}{S_o} = -\frac{d_i}{d_o}$$

$$n_1 Sin\theta = n_2 Sin\theta$$

In each of the problems below, draw the ray diagram and label the <u>Image</u> and solve for the blanks, showing all of your work. Ray Diagrams 3 pts. each. Blanks 1 pt. each. Work for Calculations 3 pts each problem.

1.   Draw the Ray Diagram for the Object and/or Image in each of the following diagrams. Use a straight edge and pencil for each of the drawings. Label <u>Image</u> & Solve the blanks.

d_o = 12 cm $\frac{1}{4} = \frac{1}{12} + \frac{1}{d_i}$ s_o = 2 cm $\frac{S_i}{S_o} = \frac{d_i}{d_o}$

d_i = __6__ cm s_i = __-1__ cm

f = 4 cm $\frac{S_i}{2} = -\frac{6}{12}$

Object   F   F   i
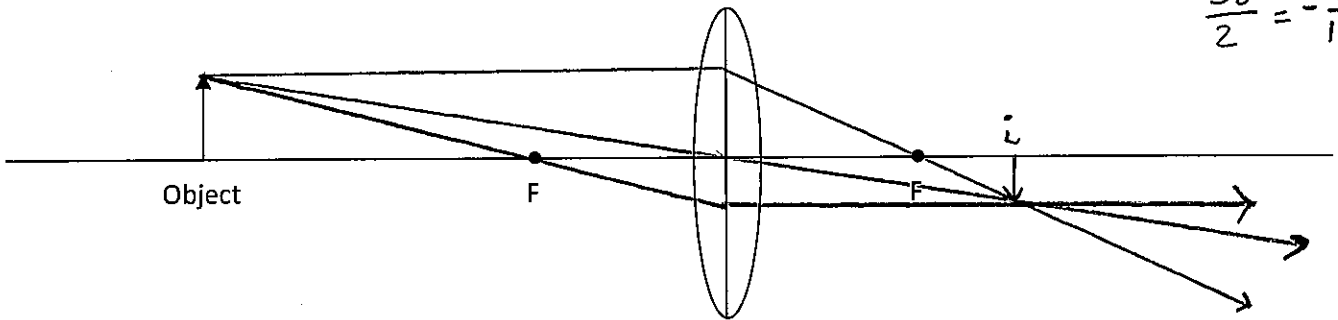
Image = __REAL__ (Real, Virtual)

Name of this type of Lens is __CONVEX__ , __CONVERGING__ , or __MAGNIFYING__ .

2.   Draw the Ray Diagram for the Object and/or Image in each of the following diagrams. Use a straight edge and pencil for each of the drawings. Label <u>Image</u> & Solve the blanks. Show Work!

d_o = 6 cm s_o = 1.5 cm

d_i = __-15__ cm s_i = __3.75__ cm

f = 10 cm

$$\frac{S_i}{1.5} = -\frac{-15}{6}$$

$$\frac{1}{10} = \frac{1}{6} + \frac{1}{d_i}$$
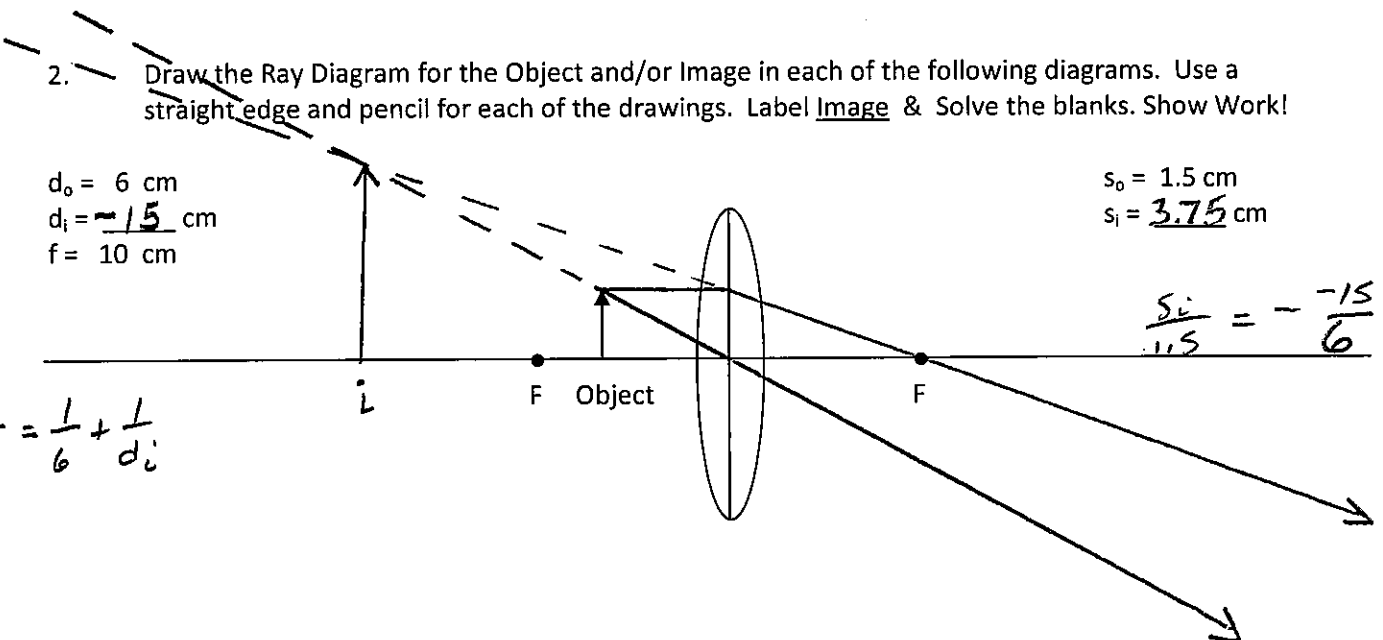
i   F   Object   F

Image = __Virtual__ (Real, Virtual)

3. Draw the Ray Diagram for the Object and/or Image in each of the following diagrams. Use a straight edge and pencil for each of the drawings. Label <u>Image</u> & Solve the blanks. Show Work.
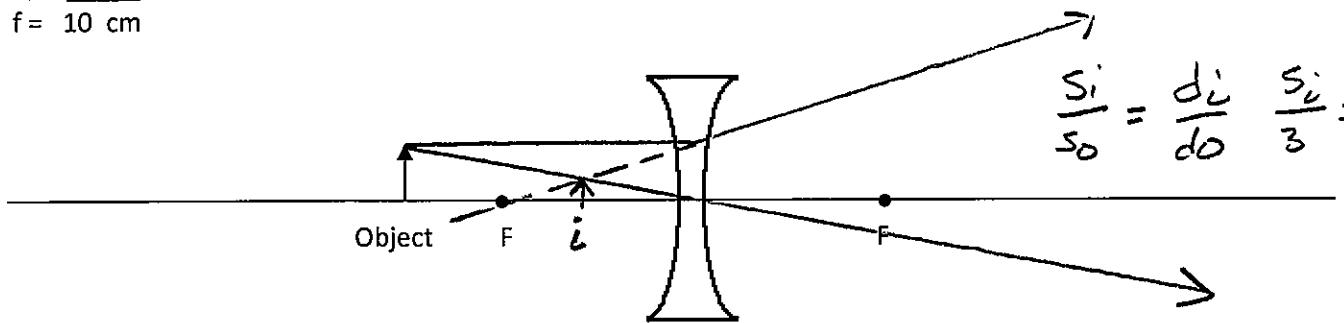
$d_o = 15$ cm

$-\dfrac{1}{10} = \dfrac{1}{15} + \dfrac{1}{d_i}$

$d_i = \underline{-6}$ cm

$f = 10$ cm

$s_o = 3$ cm

$s_i = \underline{1.2}$ cm

$\dfrac{S_i}{S_o} = \dfrac{d_i}{d_o} \quad \dfrac{S_i}{3} = \dfrac{-6}{15}$

Object   F i F

Image = <u>Virtual</u> (Real, Virtual)

Name of this type of Lens is <u>Concave</u> , <u>Diverging</u> , or <u>Reducing</u> .

4. Draw the Ray Diagram for the Object and/or Image in each of the following diagrams. Use a straight edge and pencil for each of the drawings. Label <u>Image</u> & Solve the blanks. Show Work.
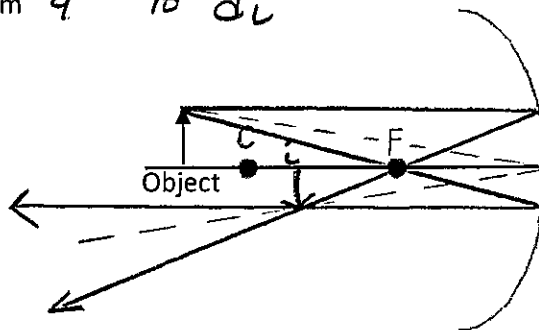
$d_o = 10$ cm

$\dfrac{1}{4} = \dfrac{1}{10} + \dfrac{1}{d_i}$

$d_i = \underline{6.7}$ cm

$f = 4$ cm

$s_o = 1.5$ cm

$s_i = \underline{-1}$ cm

C   Object   F

$\dfrac{S_i}{1.5} = -\dfrac{6.7}{10}$

Image = <u>REAL</u> (Real, Virtual)

Name of this type of Mirror is <u>CONCAVE</u> , <u>CONVERGING</u> , or <u>MAGNIFYING</u> .

5. Draw the Ray Diagram for the Object and/or Image in each of the following diagrams. Use a straight edge and pencil for each of the drawings. Label <u>Image</u> & Solve the blanks. Show Work.
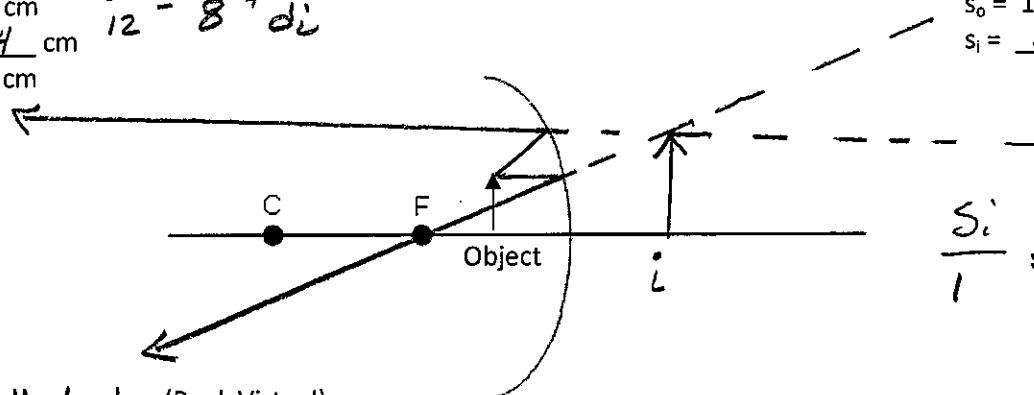
$d_o = 8$ cm

$\dfrac{1}{12} = \dfrac{1}{8} + \dfrac{1}{d_i}$

$d_i = \underline{-24}$ cm

$f = 12$ cm

$s_o = 1.0$ cm

$s_i = \underline{3}$ cm

C   F   Object i
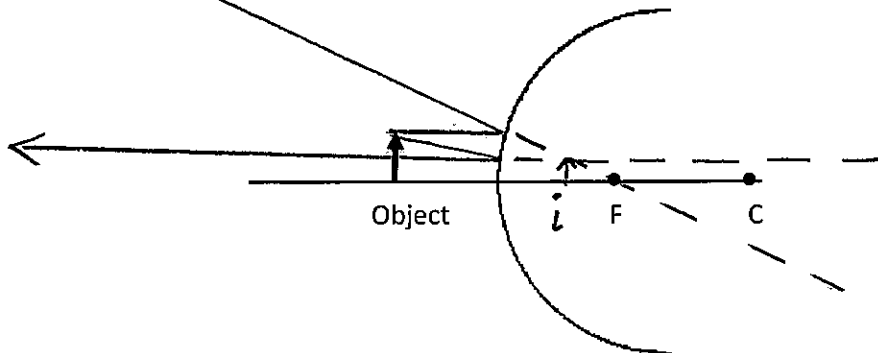
$\dfrac{S_i}{1} = -\dfrac{-24}{8}$

Image = <u>Virtual</u> (Real, Virtual)

6. Draw the Ray Diagram for the Object and/or Image in each of the following diagrams. Use a straight edge and pencil for each of the drawings. Label Image & Solve the blanks. Show Work.

$d_o = 10$ cm
$d_i = -6$ cm
$f = 15$ cm

$$-\frac{1}{15} = \frac{1}{10} + \frac{1}{d_i}$$

$s_o = 4.0$ cm
$s_i = 2.4$ cm

$$\frac{S_i}{4} = -\frac{-6}{10}$$

Object   i   F   C

Image = Virtual (Real, Virtual)

Name of this type of Mirror is Convex , Diverging , or Reducing .

7. Given the situation below, calculate the angle of refraction of all three angles. Angle of Incident between air and water is 40 degrees. Show Work!! 2 points per degree

$$N_1 \sin\Theta_1 = N_2 \sin\Theta_2$$

$40°$
Θ_1

Air
$n_i = 1.0$

Water
$n_2 = 1.33$

Θ_2 $N_1 \sin\Theta_1 = N_2 \sin\Theta_2$ Angle of refraction = 28.9°

$1 \sin 40° = 1.33 \sin\Theta_2$ $\Theta_2 = 28.9°$

Ethanol
$n_3 = 1.37$

Θ_3 $n_2 \sin\Theta_2 = n_3 \sin\Theta_3$ Angle of refraction = 27.9

$1.33 \sin 28.9° = 1.37 \sin\Theta_3$
$\Theta_3 = 27.9°$

Glycerin
$n_4 = 1.47$

$n_3 \sin\Theta_3 = n_4 \sin\Theta_4$ Angle of refraction = 25.86°

$1.37 \sin 27.9° = 1.47 \sin\Theta_4$
$\Theta_4 = 25.86°$