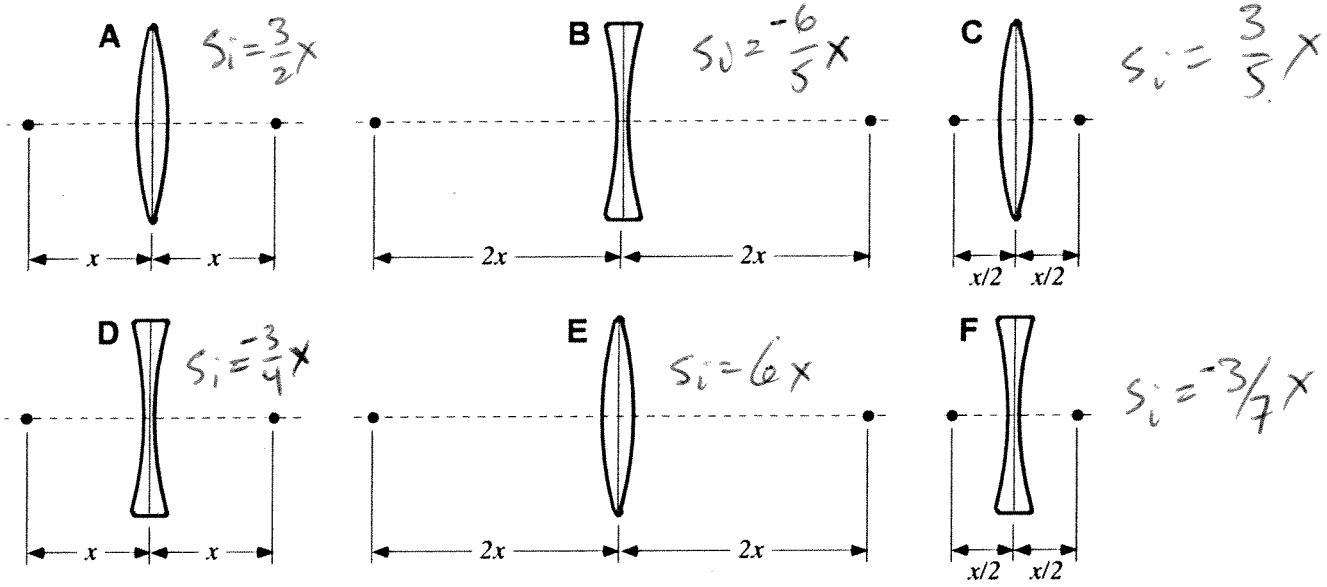
Lenses—Object to Image Distance[212]

The figures below show converging or diverging thin lenses. Their focal lengths (magnitude) in air are x, $2x$, or $x/2$ with focal points indicated in the diagrams. An object (not shown) is placed in front of each optical system at the same distance, $3x$, from the center of the lens.

Rank these setups, from greatest to least, on the basis of the (magnitude) distance from the object to the image.



Greatest 1 E 2 A 3 C 4 F 5 D 6 B Least

Or, the distance is the same (but not zero) for all six setups. _____

Or, it is not possible to compare these distances without knowing more. _____

Please carefully explain your reasoning. Let $x = 1$, $y = 1, 2, 3, \frac{1}{2}$

Converging

$$\frac{1}{S_i} + \frac{1}{3x} = \frac{1}{y}$$

$$\frac{1}{S_i} = \frac{1}{y} - \frac{1}{3}$$

$$S_i = \frac{3y}{3-y}$$

Diverging

$$\frac{1}{S} + \frac{1}{3} = \frac{-1}{y}$$

$$\frac{1}{S} = -\frac{1}{y} - \frac{1}{3}$$

$$S_i = \frac{-3y}{y+3}$$

Distance between object and image

$S_o + S_i$

How sure were you of your ranking? (circle one)

Basically Guessed					Sure				Very Sure
1	2	3	4	5	6	7	8	9	10

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