

Name: KEY

PHYSICS 2220 - QUIZ #9 - SPRING 2009

1. A lens is made of glass having an index of refraction of 1.50. One side of the lens is concave with a radius of curvature of 20 cm, and the other side is convex with a radius of curvature of 15 cm.

- a. Find the focal length of the lens.

$$\frac{1}{f} = (n-1) \left( \frac{1}{R_1} + \frac{1}{R_2} \right) \text{ where } R_1 = -20 \text{ cm (concave)}$$

$$R_2 = 15 \text{ cm (convex)}$$

$$\text{So } \frac{1}{f} = (1.5-1) \left( -\frac{1}{20 \text{ cm}} + \frac{1}{15 \text{ cm}} \right)$$
$$= (0.5) \left( \frac{-15 \text{ cm} + 20 \text{ cm}}{(20 \text{ cm})(15 \text{ cm})} \right) = 8.333 \times 10^{-3} \frac{1}{\text{cm}}$$

$$\Rightarrow \boxed{f = 120 \text{ cm}}$$

- b. If an object is placed 45 cm in front of the lens, where will the image be located? Is the image real or virtual?

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{i} \text{ or } \frac{1}{i} = \frac{1}{f} - \frac{1}{p} = \frac{p-f}{pf}$$
$$\Rightarrow i = \frac{pf}{p-f} = \frac{(45 \text{ cm})(120 \text{ cm})}{45 \text{ cm} - 120 \text{ cm}}$$

$$\boxed{i = -72 \text{ cm}}$$

the (-) sign  
means the image  
is virtual