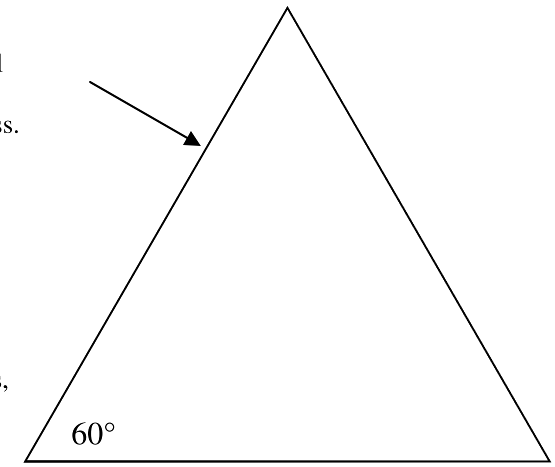
Due Wed., May 2

2011-12 PreAP Light and Optics 10



1. A beam of green light of wavelength 560 nm in air hits an equilateral **glass** prism (n = 1.52) perpendicularly. Because it is equilateral, the geometry is pretty easy and you know the index of refraction for glass. (I'll help you fight thru this.)
   A. * First, calculate the wavelength of the light in glass.

   B. * Since the light ray hits perpendicular to the surface of the glass, what angle will it have inside the glass?

   C. * Draw the light ray after it has passed straight into the glass.

   D. Determine the angle at the second boundary of glass/air.

   E. * Decide if it will pass thru the second boundary and refract or reflect off of the second boundary. Then draw the path of the light after the second boundary (if it refracts or reflects, give the approximate angles).

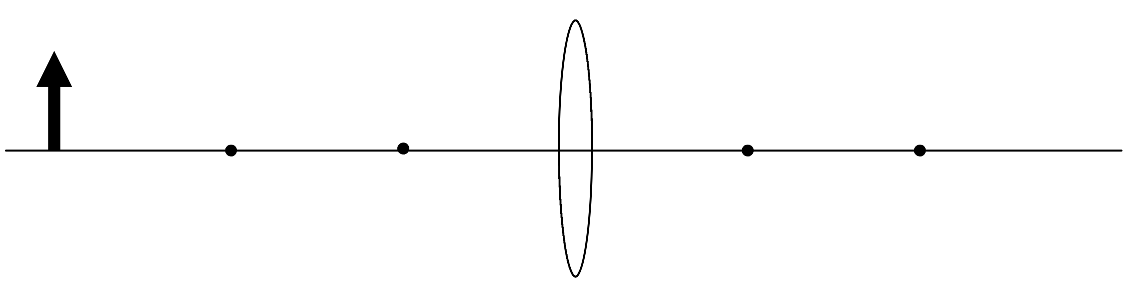
   F. What if the light was blue, how would its path change at each boundary?

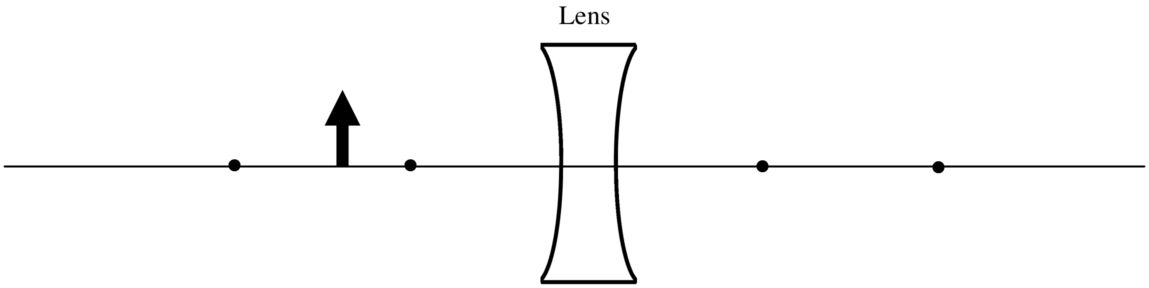
Simple Lens Equation and Optics Questions:

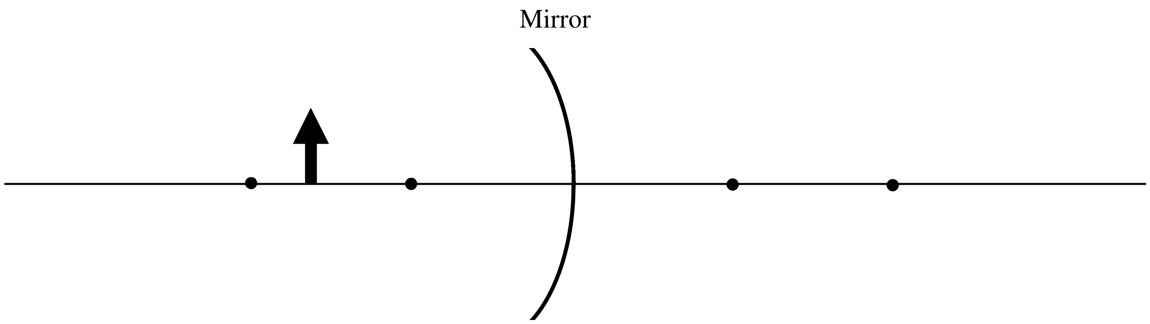
2. * An object is 8 cm from a convex lens that has a focal length of 4 cm. Where is the image and what is its magnification?

3. An object is 5 cm from a concave mirror that has a focal length of 4 cm.
   A. * Where is the image relative to f and C?
   B. Is the image magnified or reduced?
   C. Is the image real or virtual?
4. A real reduced image is produced by a convex lens.
   A. Where is the image relative to f and C?
   B. Where is the object relative to f and C?
5. A 5 cm object is 12 cm from a convex lens. The image is produced 8 cm on the right side of the lens. Calculate the focal length of the lens and the height of the image.

6. **<u>With a straight edge</u>**, complete the following three ray diagrams (two on next page). Study help is available.







7. A photovoltaic cell (solar cell) has a work function of 3.5eV. The electrons have 1.5eV of KE once they have escaped the atom.
   A. * Calculate the threshold frequency for this material.

   B. Calculate the frequency of the incoming photons.

1A) 368 nm 1B) since it hits perpendicular, both sides hit at the same time and it goes straight thru.
1C) This is simple geometry. Fight with it.
1E) Figure out the critical angle and decide if the light ray is inside or outside the critical angle.
2) p = 8cm; f = 4cm, so q must = 8 cm (= 2f) and M must = −1 (see previous HW)
3A) f = 4 cm so C = 8 cm. Since p = 5cm, p is between f and C, so q must be outside C.
7A) the threshold f is minimum and equals the work function. So convert the work function to frequency. (f = 8.5E14Hz)

