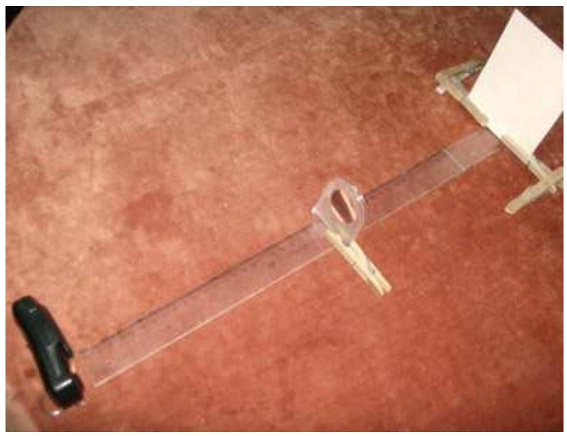
The Thin Lens Equation

<u>Materials</u>: small flashlight, the larger converging lenses from the OSA kit (labeled A), a small piece of aluminum foil, clothespins, card for screen, three rulers
<u>Procedure I</u>:

The object was a small narrow triangle of aluminum foil taped to the center of the front of the flashlight, small enough so that light can shine around it on all sides. I used three rulers, one of 40cm long and two of 30cm long. The lens and screen were supported by clip-type clothespins. I centered all components by hand (I know that is not “scientifically”…). My set up for this lab is shown below:



I noticed that as the object moves closer to the lens, the image moves away from the focal point. If the object is exactly at the focal point, there is no image formed at all. (The image distance is sometimes said to be "infinite.") In fact, if a point of light is placed at the lens focus, the rays are made parallel by the lens.

With object 30cm from the lens, I moved the screen back and forth until a clear image was formed. The image was 12.5cm to the right of the lens, inverted and smaller than the object. Using the thin lens equation

$$\frac{1}{-30cm}+\frac{1}{f}=\frac{1}{21.5cm}$$

$$f=12.52cm$$

I calculated also the magnification M=-21.5/30=-0.71.
I tried a few different object distances and calculate an average focal length from all my measurements:

object distance	image distance	focal length	average focal length
-30cm	21.5cm	12.52cm	12.5cm
-25cm	25.4cm	12.6cm	
-20cm	32.5cm	12.38cm	

Procedure II:

If the object distance is 50cm to the left of the lens, using the thin lens equation I found that

$$\frac{1}{-50cm} + \frac{1}{12.5cm} = \frac{1}{d_i}$$

d_i = 16.67cm

After I performed the experiment with the object set at 50cm to the left of the lens, I measured an image distance of 16.5 cm, close enough to my prediction.