Lenses and Telescopes

Materials

lenses, sticky tack (BlueStik), meter stick

1 Measuring focal lengths

We have an assortment of lenses. With your lab partner(s), find three lenses with different focal lengths. **Measure and record the focal length of each lens (to the nearest centimeter).**

1. Why does the light source need to be far away?
2. What direction would the image move if you moved the light source closer?
3. How is the image oriented when you use the lenses as magnifying glasses (held close to an object)?
4. Rank the lenses in terms of greatest magnification as a magnifying glass.
5. How is the image oriented if you use the lenses to look at distant objects?

2 Designing a telescope

Remember, the magnification of a telescope is given by $M = \frac{f_o}{f_e}$.

1. Should the lens with the longer focal length be the objective or the eyepiece, if you want your telescope to magnify distant objects?
2. Which combination of lenses will produce the highest magnification (and what is it)? Which will produce the smallest magnification greater than one?
3. If you wanted to make these two telescopes, how far apart would the lenses have to be in each case?
4. Does increasing the diameter of a lens (while keeping its focal length the same) change the magnification of the telescope?
5. Astronomers used to try to make the largest objective lenses they could, and now use mirrors instead of lenses because they can be made much bigger. Can you think of a reason why?

3 Making a telescope

Create both of the telescopes you designed in the last activity (one at a time), then answer the following questions.

1. Does it matter which way you look through your telescope?
2. How are the images oriented when you look through your telescopes?
3. Hold a piece of paper at the intermediate focus (between the two lenses). How is the image projected on the paper oriented?

4. Which telescope has the larger field of view?
5. Which way do you need to move the eyepiece to focus on something close to the telescope?