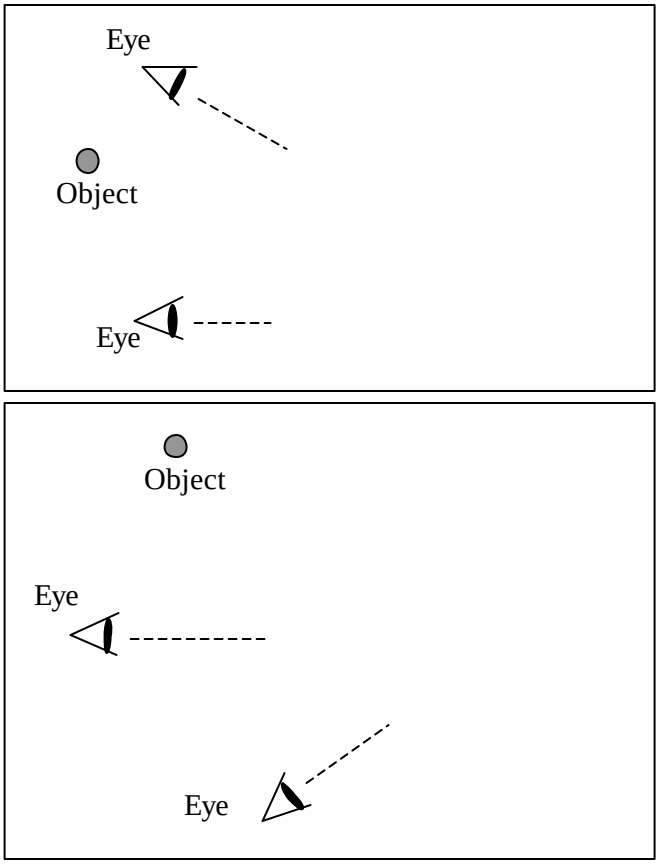
Physics 122, sections 502-4 and 8101 **Assignment 9**
Laura Lising **Due April 17, start of class**

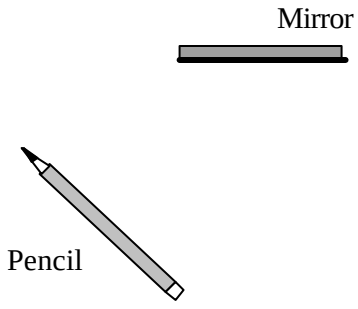
Reference: Cutnell & Johnson, Chapter 25.1-3 and 26.1-2

1) The top view diagrams at right were drawn by a student who is studying image formation by a mirror. Each diagram shows the location of an object and two lines of sight to the image of that object in the mirror.

For each diagram, determine whether or not the situation illustrated is possible. If a situation is possible, draw the location and orientation of the mirror. Explain how you reached your conclusions.



2) A pencil is placed in front of a plane mirror as shown in the top view diagram below.

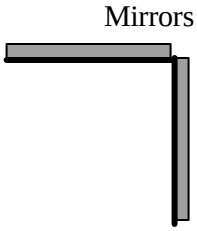


a) Duplicate this drawing on your paper and use ray tracing to detemine the location of the image of the pencil. Use a protractor and a straightedge to make an accurate drawing. Clearly indicate the entire image on your drawing.

b) Draw a separate diagram and determine the region in which an observer must be located to see (i) the image of the tip of the pencil, (ii) the image of the eraser, and (iii) the image of the entire pencil, if possible. Clearly label each region on your diagram and explain your reasoning.

c) We made a definition of image in class and for a plane mirror, we found that the image is behind the mirror always, as it is in this problem. What does this mean "the image is behind the mirror"?

3) Consider two mirrors arranged at right angles.



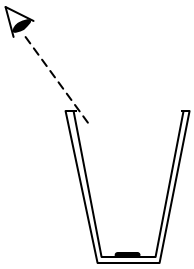
a) Imagine shining a flashlight or laser with a fairly narrow beam at one of the mirrors. What happens to the light? To figure this out, choose a location and draw a flashlight there and draw where the light goes. Now choose another location and draw a flashlight there and do the same thing. What happens to the light? What can you say about this arrangement of mirrors and what it does to light?

b) If you were looking at the mirrors, where would you need to stand in order to see your reflection?

c) Thinking what this arrangement of mirrors does to light, think of two possible applications in real life. (These are actually used for lots of things. More common is the 3-D version, with three mirrors, often quite small, arranged all at right angles to each other like at the corner of a room. This is called a "corner cube.")

6) We did the front of a spoon, now do the back. Or imagine looking at your image in a shiny sphere. Make a sketch that shows how light leaves your face, hits the sphere, and bounces back to your eyes and elsewhere. Use the sketch to show why the image is small and right-side up. Is it a real image or a virtual one (meaning, does the light pass through the location where the image is or not)?

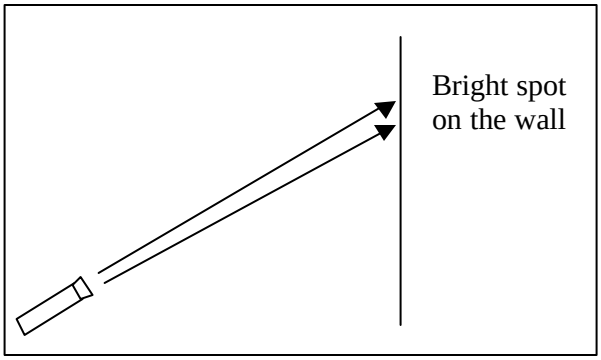
5) Get an opaque cup of some sort - a styrofoam cup or a paper cup. Draw a dot on the bottom of the cup in the center. Get a second cup and fill it with water. Hold your head so that you can see the dot on the bottom of the cup, and then move your head back a little so that you can no longer see the dot on the bottom. (Your eyes should now be in a position like the one shown.) Now, holding your head still, pour the water from the other cup into the one with the dot.

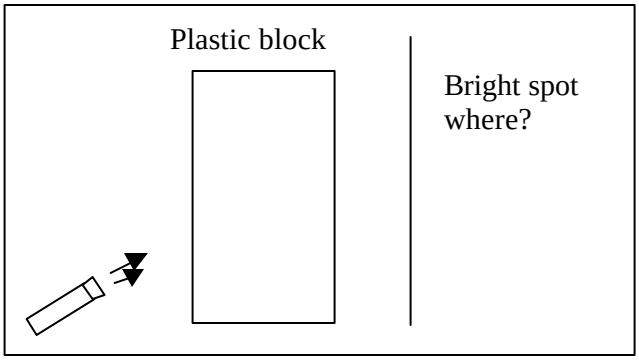


a) Explain what you see and why. Draw a picture of the cup, the water, your eye and the dot, drawing what the light is doing.

b) Try this again, but this time draw the dot on the side of the cup instead of the bottom. Before you pour the water in, predict what will happen and make a drawing to support your prediction.

6) Suppose you have a flashlight or a laser and you hold it at some angle and shine it on the wall, observing a bright spot at some height.





a) Suppose you know put a clear plastic block between the flashlight and the wall. Where would the bright spot be? At the same height or different? If different, how? Draw ray diagrams and explain your reasoning.

b) Suppose now you have a triangular shaped plastic block in between the flashlight and the wall. Will the spot be higher, lower, or at the same height as the spot with no plastic? Explain ….