Ray Diagram Model for Plane Mirrors

Read from **Lesson 2** of the **Reflection chapter** at **The Physics Classroom:**

http://www.physicsclassroom.com/Class/refln/u13l2d.html

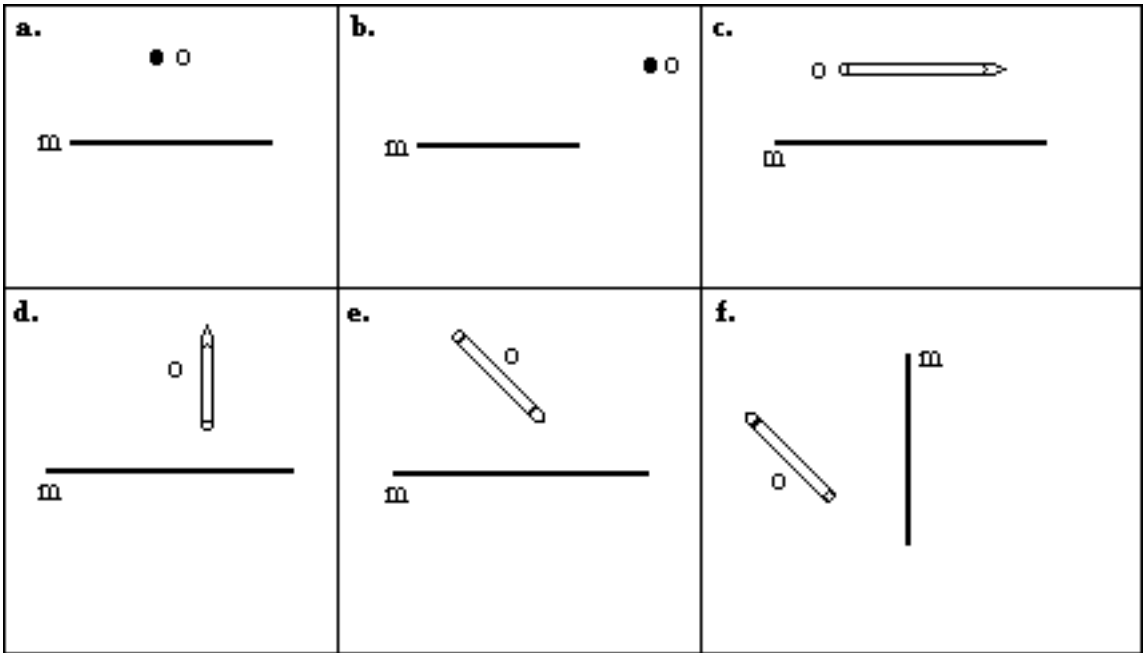
MOP Connection: Reflection and Mirrors: Mission 3

What is a Model?
Scientists develop models to explain the world that they observe. Models can be purely conceptual, purely mathematical, or a blend of both conceptual and mathematical elements. All scientific models are built upon understandings of how the physical (or chemical or biological) world functions. In this unit, we develop at least two types of models - a conceptual model that is built on our understanding of how light rays reflect and refract, and an algebraic/mathematical model that describes measurable quantities and their relationship to one another.

Ray Diagrams - a Conceptual Model
The ray diagram model is a conceptual model that is applied to explain the reflection and refraction of light by surfaces, by plane mirrors, by curved mirrors, by prisms, and by lenses. The ray diagram model may on occasion be blended with geometric rules; otherwise, it is a conceptual model with minimal mathematics that is used to explain what we observe of light and the images formed by light reflection and refraction.

Locating Images

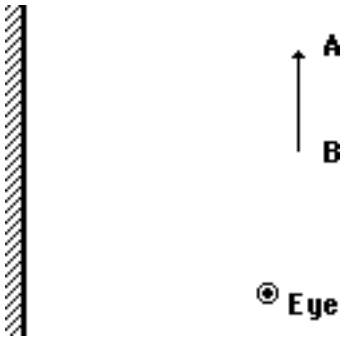
1. To use a ray diagram, one must first be able to locate the images of objects. Locate the images of the objects (labeled "o") shown below.



Drawing Ray Diagrams for Plane Mirrors

Questions #2 - #11 provide a detailed procedure for the completion of a ray diagram.

The diagram at the right shows an arrow (the object), a plane mirror, and an eye. Use this diagram and a ruler/straight edge to do the following steps.



2. Locate the image of points A and B. Label these points as A' and B'.
3. Draw in the complete image. Compare the size of the image to the size of the object.
4. If the eye is to see A by looking in the mirror, then the eye must sight along a line at the image of A (i.e., A'). Draw the reflected ray which reaches the eye as it sights at A'. Use a solid line and an arrowhead.
5. Extend this reflected ray beyond the mirror using a dashed line to show that the eye is sighting along a line directly at A'.
6. The light which follows the path shown by the reflected ray originated from point A. Show this by accurately drawing the incident ray that starts at point A and approaches the mirror. Be sure to use a solid line and put an arrow upon the ray.
7. Repeat steps #4-#6 in order to show how light travels from point B to the mirror and reflects towards the eye as the eye sights along a line at B'.
8. On the diagram, label the point on the mirror where the incident ray from A reflects from the mirror with the letter "x".
9. On the diagram, label the point on the mirror where the incident ray from B reflects from the mirror with the letter "y".
10. Points "x" and "y" represent the points on the mirror which would be needed to view point A and point B on the object. Where will any other ray from the object reflect from the mirror before traveling to the eye?

11. What parts of the mirror could be removed without interfering with the eye's ability to see the entire image of the arrow? Circle these sections of the mirror.

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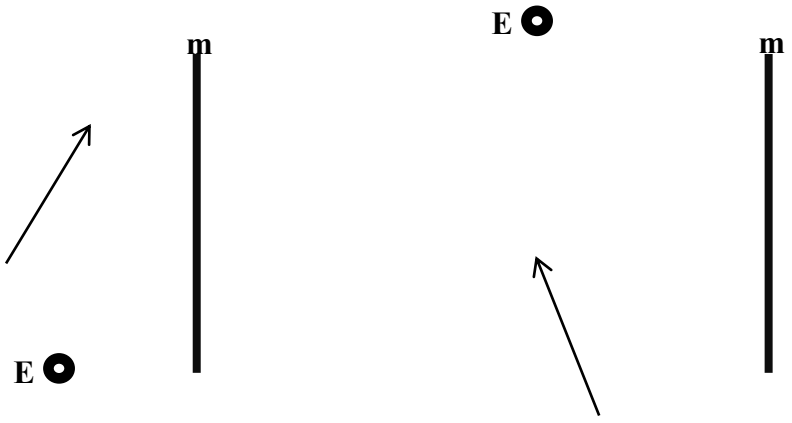
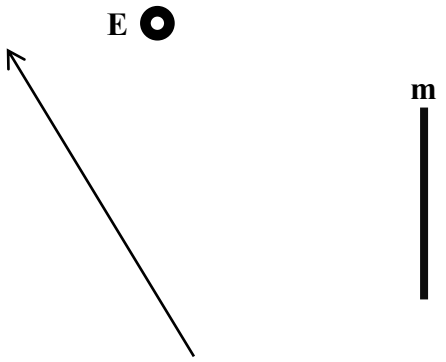
12. For the *arrow objects*, (a) draw the corresponding *images*, and (b) draw the incident and reflected rays that would allow the eye ("E") to view the object in the mirror ("m").



13. Use a ray diagram to determine what portion of the *arrow object* can be seen from the indicated eye location.



14. For the following two right-angle mirror situations, draw the middle image. Then, draw a ray diagram to show how light travels from the object to the mirror(s) to the eye. For the second situation, show the ray diagram for each extremity of the object.