Main Topic	Light & Color
Subtopic	Reflection
Learning Level	Middle
Technology Level	Low
Activity Type	Student

Description: Predict and experiment with rays reflecting from two different concave mirrors. Find focal points.

Required Equipment	Light Box and Optical Set
Optional Equipment	

This lab is excerpted from *Light and Color Teacher's Guide* (Arbor Scientific P2-9560). The diagrams allow students to use the Light Box and Optical Set (Arbor Scientific P2-9561) directly on their lab pages.

Reflection—AB5—Concave Mirror

Teacher's Notes

Educational Objectives

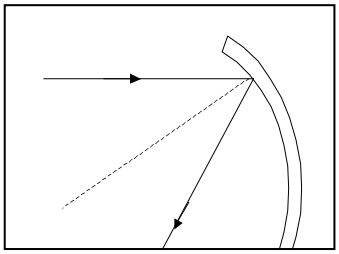
- Draw diagrams of rays reflecting from two different concave mirrors.
- Find the focal points of the mirrors.

Key Questions

- How will light striking a concave mirror be reflected?

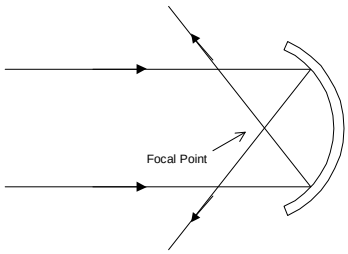
Concept Overview

Students should have already investigated plane mirrors and discovered the **law of reflection**. The concave mirror also demonstrates the law of reflection: the angle of incidence equals the angle of reflection. If a plane mirror was placed tangent to the surface of the concave mirror at the point where the incoming ray of light strikes the mirror the ray of light would be reflected such that the angle of incidence will equal the angle of reflection.



A **concave mirror** is one that opens toward the light (if you look into a concave mirror, it is like looking into a *cave*.) Each ray of light that hits the mirror reflects at an angle equal to its incident angle. Since the mirror is curved, however, each ray in a beam of light strikes the mirror at a different angle. Rays parallel to the axis that hit the top part of the mirror are reflected down, and rays parallel to the axis that hit the bottom part of the mirror are reflected up.

If the mirror is perfectly parabolic, all of these rays parallel to the axis will reflect so that they meet at a single point in front of the mirror. This point is called the **focal point**. If the mirror is spherical or circular, the rays parallel to the axis will not exactly meet at a focal point, but they will still



converge. A ray that is directed to the mirror through the focal point will be reflected along a path that is parallel to the axis of the mirror.

Techniques

Use a 4 slit mask on the light box. It is important that the 4 rays of light are parallel and that the mirror, convex side toward the light, be centered on the axis. Use the adjustment knob to produce rays of light that are as parallel as possible. Two of the rays should be above the axis and two rays should be below the axis.

Reflection: Concave Mirror Name: _____
Class: _____

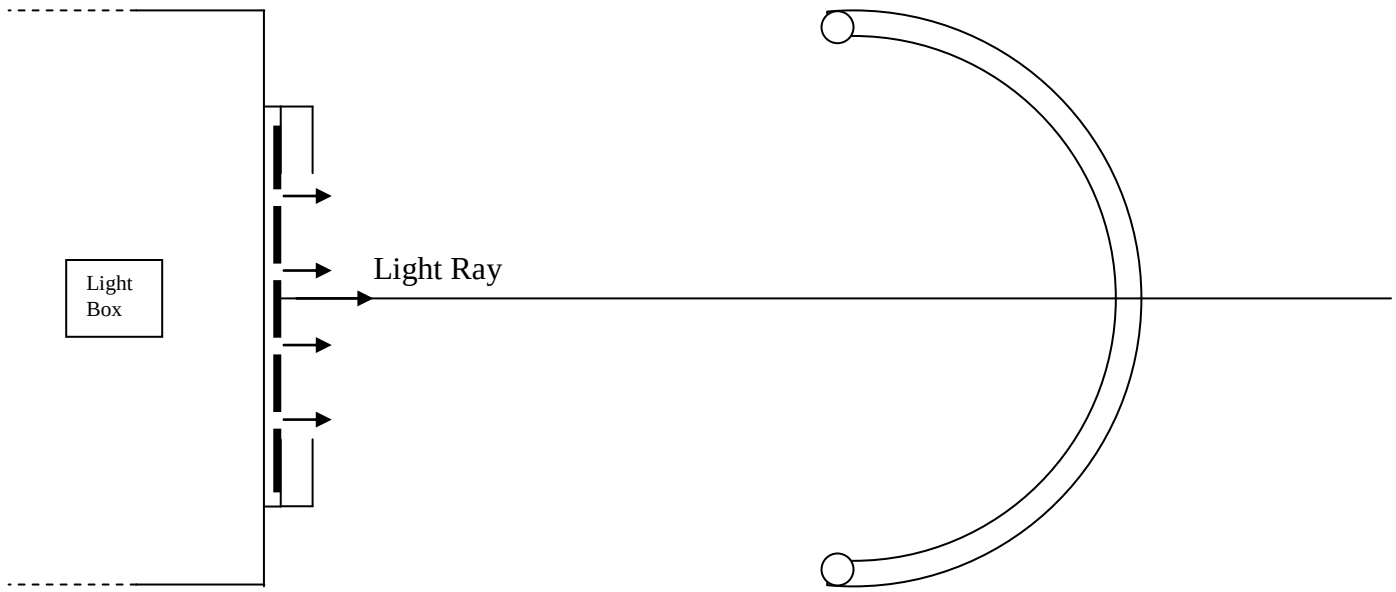
How Does Light Reflect from a Concave Mirror?

Goal

- To learn how light is reflected when it strikes a concave mirror.

Prediction

For the four light rays leaving the light box below, sketch how they travel to the concave mirror shown on the right. Please show how the light is reflected off the mirror. Use lines with arrows to show the direction of the light rays.



Briefly explain your reasons for sketching the reflected light rays as you did in the sketch above.

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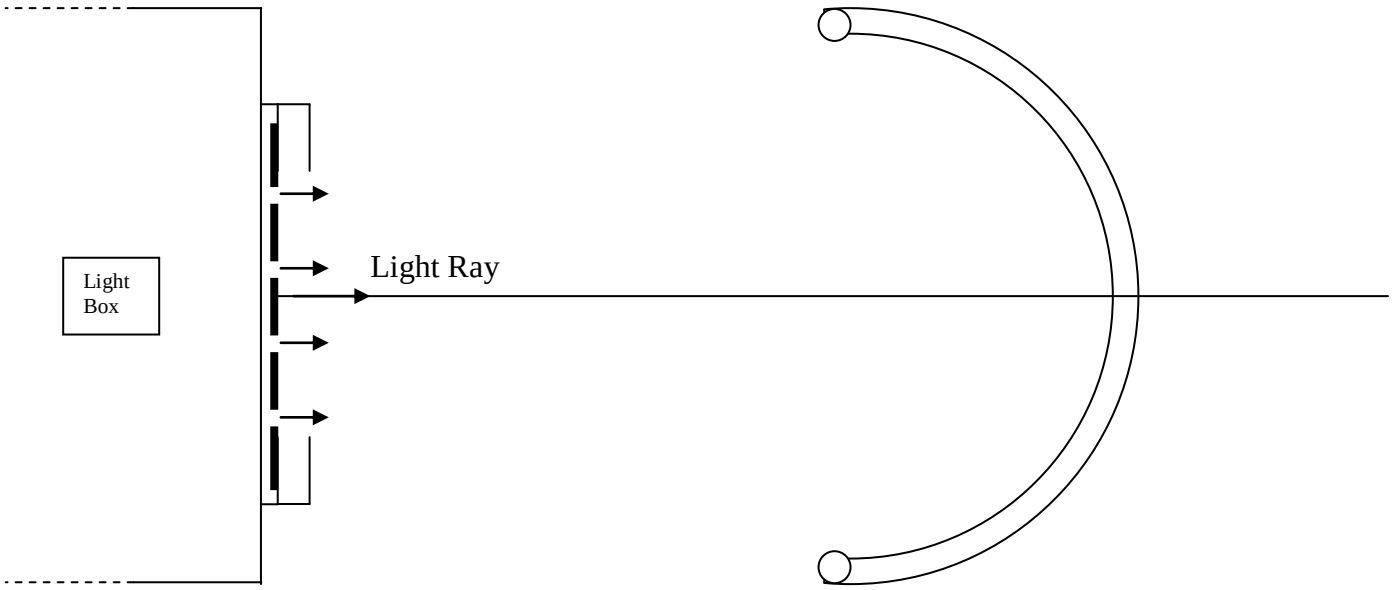
Reflection: Concave Mirror Name: _____
Class: _____

Materials

Light box
Concave Mirror
mask with four openings

Procedure

1. Place the concave mirror on the line below as indicated.
2. Use a four slit mask on your light box and shine the four rays parallel with the line below (two rays on each side).
3. Mark the reflected rays and indicate their direction with an arrowhead on the line.



4. What do you observe about the reflected rays that were different than the rays reflected from a plane mirror?

   _____

   _____

5. Compare the reflected light from a plane mirror and this concave mirror.

   _____

6. Explain how would you position 4 flat mirrors to produce the same pattern of light that comes from the concave mirror.

   _____

   _____

7. Replace the four-slit mask with a single-slit mask. Place the light box so that the ray leaving the light box is pointing toward the mirror on one of the reflected rays. What do you observe about the direction of the reflected ray?

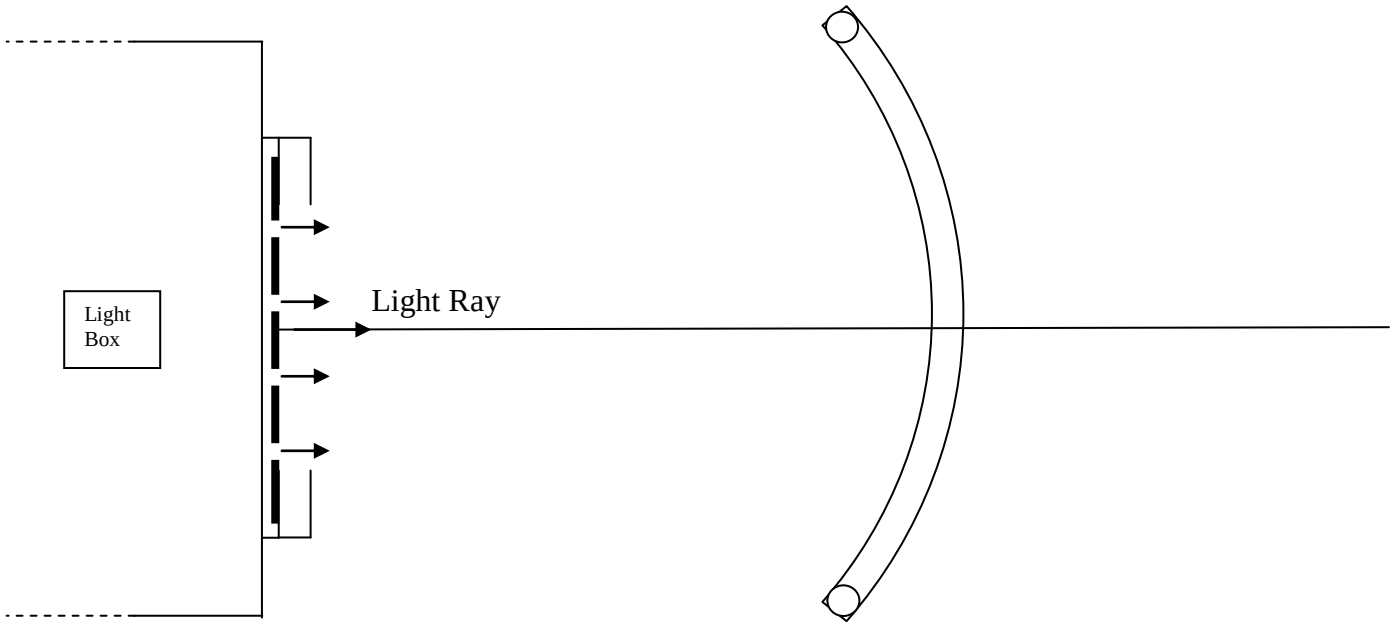
   _____

   _____

Reflection: Concave Mirror Name: _____
Class: _____

Prediction

For the four light rays leaving the light box below, sketch how they travel to the concave mirror shown on the right. Please show how the light is reflected off the mirror. Use lines with arrows to show the direction of the light rays.



Briefly explain your reasons for sketching the reflected light rays as you did in the sketch above.

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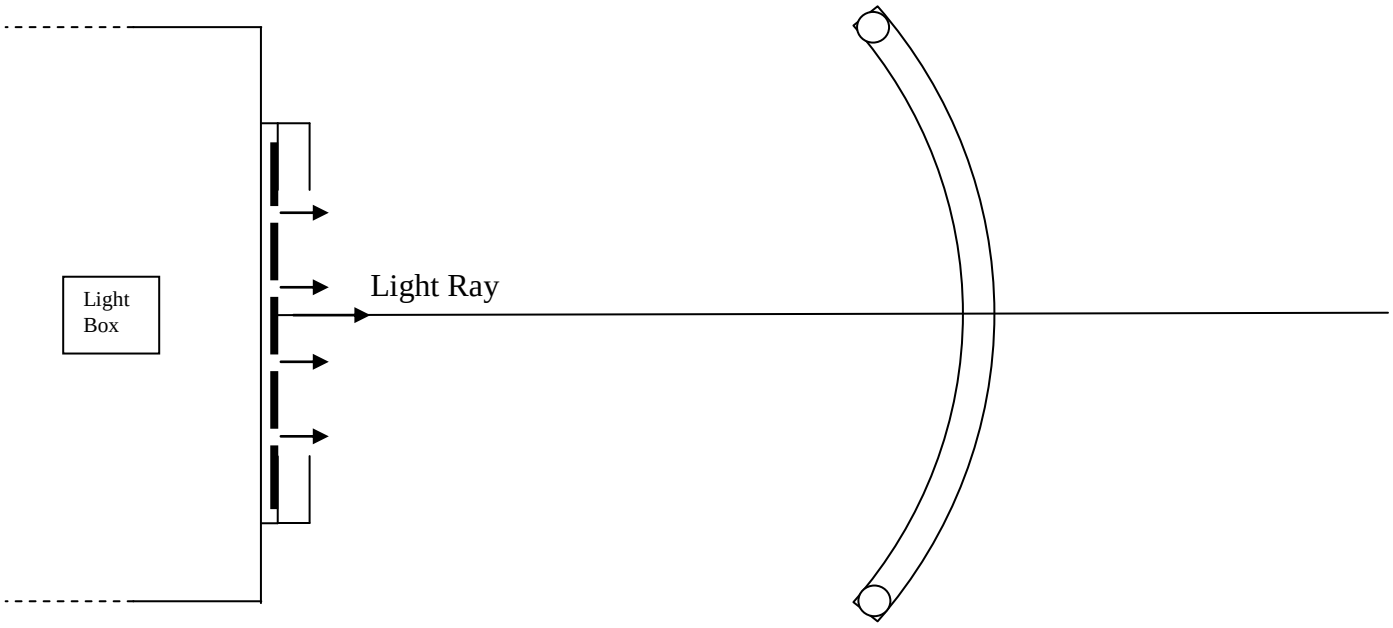
Reflection: Concave Mirror Name: _____
Class: _____

8. Place the concave mirror on the line below as indicated.
9. Use a four slit mask on your light box and shine the four rays parallel with the line below (two rays on each side).
10. Mark the reflected rays and indicate their direction with an arrowhead on the line.



11. What do you observe about the reflected rays that were different than the rays reflected from a plane mirror?

_____

12. Compare the reflected light from a plane mirror and this concave mirror.

_____

13. Explain how would you position 4 flat mirrors to produce the same pattern of light that comes from the concave mirror.

_____

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14. Replace the four slit mask with a single slit mask. Place the light box so that the ray leaving the light box is pointing toward the mirror on one of the reflected rays. What do you observe about the direction of the reflected *ray?*

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