

## Teacher Toolkit - Plane Mirrors

### Objectives:

1. To describe the law of reflection and to use the law to predict how light approaching a mirror at a given angle will reflect from the mirror surface.
2. To explain the distinction between diffuse and specular reflection and to identify and describe several applications of each.
3. To discuss what an image is and to explain how a plane mirror image is formed; and to describe the characteristics of a plane mirror image.
4. To use ray diagrams to demonstrate how light travels from an object to the mirror to an observer's eye and to use such ray diagrams as tools in answering a variety of plane mirror-related questions.
5. To analyze situations involving two mirrors in order to describe the observations that are unique to multiple-mirror arrangements (e.g., right angle mirrors, parallel mirrors, and adjustable angle mirrors).

### Readings:

[The Physics Classroom Tutorial, Reflection and the Ray Model of Light Chapter, Lesson 1](#)

[The Physics Classroom Tutorial, Reflection and the Ray Model of Light Chapter, Lesson 2](#)

### Interactive Simulations:

1. Who Can See Who? Interactive <http://www.physicsclassroom.com/Physics-Interactives/Reflection-and-Mirrors/Who-Can-See-Who>  
Have you ever wondered who can see who in a plane mirror and why? If Jill can view Jack's image in the mirror, can Jack view Jill's image? And if Casper can be seen by Mac in a plane mirror, can Casper also be seen by Tosh who sits in a different seat? And what fundamental principle can be used to explain the answers to all these questions. Use the Who Can See Who? Interactive and find out the answers to these questions and more.
2. Plane Mirror from eduMedia <https://www.edumedia-sciences.com/en/media/275-plane-mirror>  
This interactive simulation depicts a teapot, a plane mirror, and an eye. A ray diagram is shown that illustrates how light gets from the object to the mirror to the eye. The teapot's image is also shown. The teapot can be dragged about the space; the image location and ray diagram update in real time.
3. Multiple Reflections in Plane Mirrors <https://www.geogebra.org/m/Z5jhPkJB>  
The topic of mirrors and lenses is often termed "Geometric Optics." There may be no better tool for studying the world of geometry than GeoGebra. This free-for-use online website allows a user to design their own interactive simulation or to use the simulations built by other members. A physics teacher can obtain a free account and have a collection of interactive HTML5 content instantly available for use. Design your own activity or use one that has already been designed. You won't be sorry we suggested it. The one referenced here explores the multiple images formed by a set of three mirrors. The mirror angles can easily be adjusted and the image locations are updated in real time.
4. Kaleidoscope <https://www.geogebra.org/m/ETjVNjYX>  
This GeoGebra simulation allows a user to manipulate the angle between two mirrors and observe the multiple images formed by the mirrors. Easily adjust the angle or even the location of the object (marked in red). Primary, secondary, tertiary (and more) images are color-coded.
5. Mirror Reflection <https://www.geogebra.org/m/ujNvhnHB>  
This last GeoGebra simulation will take a learner a long distance towards understanding the formation of images. The interactive simulation features a plane mirror, an object, and three sets of incident and reflected rays. Extensions lines are drawn for all three reflected rays showing their intersection at the image location behind the plane mirror.

### Video and Animation:

1. Reflection in a Plane Mirror [https://www.youtube.com/watch?v=\\_v8RV7fKUKo](https://www.youtube.com/watch?v=_v8RV7fKUKo)  
This video from Cyberphysics describes the lateral inversion of an image in a plane mirror and explains the details as to how to determine the image location for a complex-shaped object using a ray diagram.
2. Ray Diagrams for Plane Mirrors <https://www.youtube.com/watch?v=aw5TMZwGtCw>  
This 10-minute YouTube video from the Swanson Does Science channel provides a thorough discussion of the construction of ray diagrams for plane mirrors and the properties of the images that are formed.
3. Image Formation for Plane Mirrors <http://www.physicsclassroom.com/mmedia/optics/ifpm.cfm>  
This simple GIF animation an accompanying text from The Physics Classroom clearly demonstrates why an image is formed by a plane mirror.

**Teaching Tips:**

1. How to Teach Reflection of Light in the Classroom <https://www.youtube.com/watch?v=tQ6eaV0x2AM>  
This 8-minute video describes a collection of labs, demonstrations, and tips for teaching students about the reflection of light and the formation of images.

**Photo Gallery:**

1. Specular Reflection Photo Gallery <https://www.flickr.com/photos/physicsclassroom/galleries/72157625381599100/> See Complete Toolkit on our Website for Details.

**Labs and Investigations:**

<http://www.physicsclassroom.com/lab#refln>

1. The Physics Classroom, The Laboratory, Reflection Lab
2. The Physics Classroom, The Laboratory, Plane Mirror Image Lab
3. The Physics Classroom, The Laboratory, Rough versus Smooth Lab
4. The Physics Classroom, The Laboratory, What Portion ... ? Lab
5. The Physics Classroom, The Laboratory, Right Angle Mirror Lab
6. The Physics Classroom, The Laboratory, Improving your Image Lab
7. The Physics Classroom, The Laboratory, Infinity Derivation

**Minds On Physics Internet Modules:**

<http://www.physicsclassroom.com/mop/module>

The Minds On Physics Internet Modules are a collection of interactive questioning modules that target a student's conceptual understanding. Each question is accompanied by detailed help that addresses the various components of the question.

1. Reflection and Mirrors, Ass't RM1 - The Law of Reflection
2. Reflection and Mirrors, Ass't RM2 - Plane Mirror Images
3. Reflection and Mirrors, Ass't RM3 - Plane Mirror Ray Tracing
4. Reflection and Mirrors, Ass't RM3 - Specular vs. Diffuse Reflection

**Concept Building Exercises:**

<http://www.physicsclassroom.com/curriculum/refln>

1. The Curriculum Corner, Reflection and Mirrors, Light Reflection
2. The Curriculum Corner, Reflection and Mirrors, Specular vs. Diffuse Reflection
3. The Curriculum Corner, Reflection and Mirrors, Image Formation and Characteristics
4. The Curriculum Corner, Reflection and Mirrors, Ray Diagrams

**Problem-Solving Exercises:**

<http://www.physicsclassroom.com/calcpad/refln/problems.html>

1. The Calculator Pad, Reflection and Mirrors, Problems #1 - #6

**Common Misconceptions**

See Complete Toolkit on our Website for Details.

1. The Image is on the Mirror Surface
2. Objects Located Beyond the End of the Mirror Cannot be Seen
3. Language! Language! Language!

**Standards:****A. Next Generation Science Standards (NGSS) – Grades 9-12**

**Crosscutting Concepts:** Scale, Proportion and Quantity; Patterns

**Science and Engineering Practices:**

**Analyzing Data; Constructing Explanations; Developing and Using Models; Planning and Carrying Out Investigations; Using Mathematics and Computational Thinking; Engaging in Argument from Evidence**