**MYSTIC MIRRORS** (1 HR)

 Addresses NGSS  
 Level of Difficulty: 2  
 Grade Range: K-3

**OVERVIEW**  
In this activity, students will explore light travel and how it is redirected with the use of mirrors. Students will review how light is reflected by the objects it strikes. They will then create light illusions with mirrors and explain how they were designed.

**Topic:** Electromagnetic Radiation

**Real-World Science Topics**  
- An evaluation of the properties of light including its movement  
- The observation and experimentation of lights and mirrors and how they affect one another

**Objective**  
After completing this activity, students should be able to describe the path of light as reflected by a mirror. Students should be able to explain how mirrors can be utilized to redirect light from objects and how to create illusions with light.

**NGSS Three-Dimensions**

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<th>Science and Engineering Practices</th>
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| Planning and Carrying Out Investigations  
  - Plan and conduct investigations collaboratively to produce evidence to answer a question. | PS4.B: Electromagnetic Radiation  
  - Some materials allow light to pass through them, while others allow only some light through and others block all the light and create a dark surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. | Cause and Effect  
  - Simple tests can be designed to gather evidence to support or refute student ideas about causes. |

**Background Information**

**What is light and how does it travel?**  
In physics, light is actually electromagnetic radiation of a wavelength. The light is the visible spectrum that the human eye can see. The waves of the light either travel in a direct line or in a scattered pattern.
What are the characteristics which cause light to be able to pass through certain objects, but unable to pass through others?

When light goes through a translucent substance, it is able to maintain its same wavelength, thereby maintaining visibility. When it passes through an opaque substance, its wavelength stops and its visibility ends. According to the Law of Reflection, when a ray of light hits a surface, it bounces off like a tennis ball hitting a wall. When light encounters a change in medium other than the one it was traveling through, it changes direction at the point called the interface. This change comes from a change in velocity as well as wavelength.

What happens when a beam of light is shone on a mirror? What are the characteristics of the mirror which enable light to redirect itself?

When light is projected against the flat surface of a mirror, the light reflects without disturbing the image. The mirror itself contains light and is able to reflect light from it. Because the mirror is on a pane, the reflection itself is scattered.

Key Vocabulary

Wave – a traveling disturbance that carries energy from one place to another
Reflection – change in direction of a wave at the interface of two different mediums
Translucent – able to allow light to pass through
Luminous – able to generate its own light
Illuminous – capable of reflecting light into our eyes

Materials Needed for Activity

- Hand held mirrors for every student
- Larger mirror for teacher
- Sets of flashlights- one for each child or one for each group (groups of two or four)
- White paper
- Tracing paper or transparent paper
- Large metal serving spoons
- Books
- Old CDs (will be used to reflect light)
- Disco ball or decorative balls (such as those for a Christmas tree ornaments that have a mosaic mirror pattern or reflective surface)
- Pencils
- Crayons or colored pencils (optional)
- Mystic mirrors handouts (for second and third grade)

Teacher Preparation

Make copies of the Mystic Mirrors Handout per student.

Have all materials ready to use.
1. **Warm-up Activity:** Create a dark learning environment by turning out the lights and closing the blinds. Ask the students to describe the objects in the classroom overall and how they changed.
   - “Can you describe the difference in the classroom with light and without light?”
   - “What happened to your eyes when the light was changed?”
   - “How does light work?”

2. Explain to the students that our ability to see objects only comes because of light. “When the room was made completely dark, we still had the ability to see. Our brains still had the ability to process. The objects present in the room did not vanish. But, the ability to see them was hindered by the absence of light. Light makes it possible for us to see.”

3. Keeping the room dark, shine a flashlight on the ceiling. Ask the students to describe what they see.

4. Tell the students they are going to find out how light travels and how light travel can be altered by doing some tricks. Explain to them that each group will receive a mirror and a flashlight. Tell them you’d like them to shine the flashlight on the mirror and watch the path of the light. Give each student or group a flashlight. Give them time to observe what happens. Select student groups to share what happens.

5. Explain to the students that you are going to give them a sheet of paper. Tell them you want them to shine the flashlight onto the paper and see if the light on the paper can reflect into the mirror. Then, they should do the opposite. Discuss what happens.

6. Explain to the group that the light bounces off the mirror and is redirected. In this way, they can create a path of light with mirrors. Tell the students that you want them to create a long path of light using lights and mirrors. Give each person a mirror and two flashlights per group. Tell the students to try to shine the light to the mirror then back to itself and see how many times they can connect the line of the light from the flashlight to the mirror and back again. Give the students time to experiment with the lights and mirrors.

7. Next, tell the students you are going to pass out some other objects that reflect light. The students will use these lights to create “light tricks.” You want them to continue creating the paths of light using the mirror along with these new objects. Pass out the ornaments, spoons, and CDs, respectively. They can place objects in between to halt the line of the light. They can use tracing paper and regular paper to see how the light’s reflection is altered. Walk around the room as they are experimenting and help them in seeing how the light is reflecting in different ways. Direct students’ attention to see the rainbow that is created between the light and the CD.

8. Pass out the **Mystic Mirrors** Handout and explain. (Was it in a straight line? Was it scattered?) Finally, the teacher will call on each group one at a time to share their illusion with the class. Students will be given opportunities to ask each group a question.
Extension Activity

For this lesson, you will need larger mirrors and a camera. You will teach the students how to create trick images with the large mirror. When using the mirror, show the students how the simple reflection of the mirror can alter what appears to be happening. For example, have a student sit at the carpet. Have the student place the large mirror on the floor in front of the student's body so the mirror is showing the carpet in front of his/her body section. When looking at the student, you should see the student's head, followed by the large mirror just under his neck with his legs protruding onto the carpet. The reflection in the mirror should make it appear that his body is gone and only the carpet is there where his body was. Take a photo of this image. Have the students create several trick images with the large mirror and the camera. Print the pictures and have the student discuss how the images were made and summarize what they learned about creating illusions.

Sources

http://physics.bu.edu/~duffy/py106/Reflection.html
http://math.ucr.edu/home/baez/physics/General/BlueSky/blue_sky.html
http://sciencline.ucsb.edu/getkey.php?key=3903
http://www.physicsclassroom.com/class/refln/Lesson-1/The-Law-of-Reflection
Mystic Mirrors Photo Collection

Photo 1

Photo 2

Photo 3

Photo 4
Mystic Mirrors

Draw a diagram of the original light path. Include the mirror, paper and the light beam. Be sure to include directional arrows. Label your drawing.

Now, draw a diagram of the light “trick” you conducted. Label the picture. Explain below what you chose to do for your trick. Explain the outcome. Discuss how the mirror’s light/reflection affected the experiment.