

Light/Color/Vision

Target Grade: 4th grade

Teacher Prep Time: 60 minutes (the first time to create the diffraction and color analyzing cards)
After that, prep will be 10 minutes or less.

Lesson Time: 60 minutes or 1 class period; 2nd class period to include the extension of creating own secret message.

Learning Goals:

- Students will observe how white light is reflected and absorbed.
- Students will investigate the relationship between the color of an object and how it is viewed through different colored filters.

NGSS:

- 4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- Disciplinary Core Ideas
 - PS4.B: Electromagnetic Radiation
 - An object can be seen when light reflected from its surface enters the eye.
- Cross Cutting Concepts
 - Cause and Effect
- Science and Engineering Practice
 - Developing and Using Models to describe phenomena.

Where this lesson fits in:

- This lesson fits in after learning that light and sound are made of waves.

Materials Needed:

Per Group (groups of 4)

1 flashlight

1 mirror

1 Black, 2 white construction paper rectangles (3 x 5)

Diffraction grading card(s) – depending upon how many you have

Color Analyzer card(s) – depending upon how many you have

Individual

Colored pencils

Lab sheet

Secret Message page

1 sheet of white paper (8 ½ x 11)

Teacher Prep:

- Cut black and white construction paper 3 x 5 (or can use blank 3x5 card for white)
- Obtain diffraction grating and cut into smaller pieces. (Carolina.com Diffraction Grating Film #755227, 6 x 12" sheet \$19.50 plus shipping)
- Obtain colored "Gel Cells" and cut into smaller pieces. (can be obtained from local theater companies usually free- these are the film cells used on lights to produce colored lighting **OR** Amazon.com, 6 Color - Transparent Correction Lighting Gel Filter Film Plastic Sheets, 8 x 10" sheets, \$12.79 plus shipping)
- Make the color analyzer cards by punching holes (1 for diffraction grating and enough for the number of colors you have) and tape your pieces to the backside.
- Color 1 sheet of paper with red stripes
- Copy the lab worksheet and numerous copies of Secret Message page (each student in a group should have a different secret message)
- Gather remaining materials.

10 minutes	Beginning Thoughts Engage: <ul style="list-style-type: none">• Have students think/pair/share what they know about how the outside black top feels in the morning and afternoon. Have they noticed a temperature difference? Has anyone ever set down on the blacktop where there are painted white lines? What did you notice? (if students have no experience, take them outside and touch the blacktop and the painted areas)• Ask students to share with their table groups, then discuss as a whole class.
40 minutes	Explore: <ul style="list-style-type: none">• As a class, read aloud the introduction to the Light Reflection Lab and give examples of things that reflect light and things that absorb light.• Review together the materials needed for the lab.• Review the lab set up.• The teacher models how to set up the materials. Place a mirror and white card at angles and shine the flashlight into the mirror so the light reflects on the white card.• Pass out the materials to the students and set up in each configuration. Discuss and record observations in groups.• Share with whole class and discuss the light reflection for the mirror and white card and absorption of light for the black card.• Colored Objects section:<ul style="list-style-type: none">• As a class, read aloud the introduction to Colored Objects. Discuss example and have students give other examples and what color is absorbed and reflected.• Pass out both gel color cards. (red/green/diffraction & multiple colors)• Look through the diffraction grating at the lights and share with partners what is seen.• As a class, read aloud #4 information.• As a class, to confirm understanding about wavelengths and color, label the light bulb

	<p>wavelengths with the appropriate color. (clockwise from top: red, yellow, violet, orange, blue, green)</p> <ul style="list-style-type: none"> • Using colored pencils, draw in the wavelengths in the arrow using the light bulb diagram for assistance. • Have the students select 4 different colored objects around the room. • List these objects and their color in the first column of the chart in #5. • Make a prediction for each object what color it will appear when viewed through the different color gels. • Using the color gels, view each object and record the color it appears. • If time, select 2 more objects and complete the graph using evidence from previous experience to modify their predictions. <p>Explain:</p> <ul style="list-style-type: none"> • Have students look through the red gel and close their eyes. Hold up the paper that has been colored with red stripes. Ask students to open their eyes and observe. Put the paper down so they can't see it with just their eyes. <ol style="list-style-type: none"> 1. Discuss with their partners what they see. 2. Now look at the paper again with just eyes. Discuss with partners. 3. Why do you think these differences occurred? Write a reflection explaining the differences and why it occurred. #6
	<p>If time:</p> <p>Extend:</p> <ul style="list-style-type: none"> • Decode the Secret Message (GEMs Color Analyzer) <ol style="list-style-type: none"> 1. Explain to students they will now make secret messages. 2. Hand out one secret message sheet for each student. 3. Using the key provided, color in the sections evenly. Tell the students not to outline the areas. 4. After the students have finished coloring, have them look at their messages through the green and red filters. Allow them to exchange messages with their neighbors. 5. Ask, which is the best message decoder, the red or green filter? (red) 6. Discuss why they see the messages through the red filter but not the green filter. (Accept all answers without being concerned about the correct explanation. The students may notice that the message components are green ,violet or blue which contrast with the camouflage colors with are red, yellow and orange.) 7. Using their knowledge of color reflection and absorption, have students make their own hidden messages.

Red/Green/Diffraction Grating

Multiple Color Cards

