Colors Here and Colors There

Overview:

Students experiment with filters to see the effects on the spectrum visible to them. They also make measurements of the light spectrum displayed in the classroom to learn if all color bands in the light spectrum are the same thickness.

Objectives:

The student will:

- discover filters do not color the light;
- determine filters block light; and
- conclude not all color bands in the visible spectrum are the same thickness.

Materials:

- Diffraction grating
- Black construction paper or manila folder
- Meter stick
- Colored pencils
- Red, green and blue colored filters (gels used for theater lights work well, or colored pieces of cellophane) cut into about 4" X 4" squares for each student group
- STUDENT WORKSHEET: "Colors Here and Colors There"

Activity Preparation:

1. Set up the overhead projector as shown in the Teacher Instructions of the *Aurora Misconceptions* activity so that an image of the light spectrum is visible.
2. Tape a meter stick on the wall (two if necessary) so the spectrum is spread across its length. Turn off the projector until all students have had the opportunity to fill out their hypotheses on the STUDENT WORKSHEET: "Colors Here and Colors There."

Colors Here and Colors There

Activity Procedure:

1. Review with students what they learned about the light spectrum during the *Aurora Misconceptions* activity. Students may need their copy of the STUDENT WORKSHEET: "Spectrums of Light" for reference. Explain during this activity students will use the light spectrum to perform two experiments to learn more about light.
2. Distribute the STUDENT WORKSHEET: "Colors Here and Colors There" and colored pencils.
3. Read and discuss the "Testable Questions" as a class. Ask students to review the background information and then complete their hypotheses. After they have finished, turn on the projector and dim the classroom lights so students can perform the experiments.
4. Depending upon the layout of the classroom and the space available where the light spectrum is projected, it may be necessary to have one portion of the class perform Problem #1 while the other portion performs Problem #2, then have them switch.

Answers to Student Worksheet:

Data:

Problem #1: Answers will vary based upon the spectrum projected onto the wall. Perform measurements in preparation for checking student work.

Problem #2: Answers will vary based upon the quality of filters provided. Perform experiment in preparation for checking student work.

Analysis of Data:

1. C. Yellow 2. E. Blue 3, 4, & 5. Data will vary slightly, see above.

Conclusion:

Problem #1: All color bands in the visible light spectrum are of different thicknesses.

Problem #2: The filter(s) will cause other colors in the light spectrum to disappear or be blocked.

Other answers will vary.

Further Questions:

1. *Answers will vary dependent upon the materials provided.*
2. *Answers will vary dependent upon the materials provided.*
3. *Answers will vary.*

Name:_____ **Student Worksheet (1 of 4)**

Colors Here and Colors There

Testable Questions:

Are all color bands in the light spectrum the same thickness? How do red, green and blue filters affect the light spectrum you can see?

Background Information:

The colors we experience in our everyday world are the result of light from the sun or other sources, such as light bulbs, reflecting off the objects we see. As you learned in the activity *Spectrums of Light*, white light is actually composed of colors all blended together. When you look at an object you see it as having a color because it absorbs all colors except the one you see. For example, when you look at a red apple, the skin of the apple absorbs all of the extra colors, and reflects only the red part of the light spectrum. Your eyes then receive the red light and send information to your brain telling you the apple is red.

Hypotheses:

Problem #1: Are all color bands in the light spectrum the same thickness?

Use the background information provided by your teacher or on this worksheet to make a hypothesis (Check one):

_____ All color bands in the visible light spectrum are the same thickness.

_____ All color bands in the visible light spectrum are of different thicknesses.

Problem #2: How do red, green and blue filters affect the light spectrum you can see?

Use the background information provided by your teacher or on this worksheet to make a hypothesis (Check one):

_____ The spectrum will not change when I look through the filters.

_____ The filters will cause other colors in the light spectrum to turn into the same color as the filter.

_____ The filters will cause the other colors in the light spectrum to disappear or be blocked.

Name:_____ **Student Worksheet (2 of 4)**

Colors Here and Colors There

Experiment:

Materials:

- Colored pencils
- Red, green and blue colored filters
- STUDENT WORKSHEET: "Colors Here and Colors There"

Procedure:

Problem #1: Are all color bands in the light spectrum the same thickness?

1. Observe the light spectrum projected onto the wall.
2. Look closely, without blocking the light source, and observe the width of each band of color.
3. Use your observations to complete the data below.

Data for Problem #1:

In the table below, record the data you collect while making your observations.

Colors	Red	Orange	Yellow	Green	Blue	Indigo	Violet
Width of Band (centimeters)							

Problem #2: How do red, green and blue filters affect the light spectrum you can see?

1. Stand back from the light spectrum your teacher has projected onto the wall.
2. Look through one of the filters at the light spectrum.
3. After observing the spectrum, use colored pencils to draw the spectrum you see through the filter in the spaces provided below. Be sure to note which filter you were looking through above each sketch.
4. Repeat steps 2 and 3 with the other two filters.

Data for Problem #2:

The spectrum I observed while looking through the _____ filter.

The spectrum I observed while looking through the _____ filter.

The spectrum I observed while looking through the _____ filter.

Name:_____ **Student Worksheet (3 of 4)**

Colors Here and Colors There

Analysis of Data:

1. Which color in the visible light spectrum has the smallest band?

   A. Red B. Orange C. Yellow D. Green E. Blue F. Indigo G. Violet

2. Which color in the visible light spectrum has the widest band?

   A. Red B. Orange C. Yellow D. Green E. Blue F. Indigo G. Violet

3. When you looked through the blue filter at the light spectrum, which colors were no longer visible?

   A. Red B. Orange C. Yellow D. Green E. Blue F. Indigo G. Violet

4. When you looked through the red filter at the light spectrum, which colors were no longer visible?

   A. Red B. Orange C. Yellow D. Green E. Blue F. Indigo G. Violet

5. When you looked through the green filter at the light spectrum, which colors were no longer visible?

   A. Red B. Orange C. Yellow D. Green E. Blue F. Indigo G. Violet

Conclusion:

Place a check next to your conclusions:

Problem #1: Are all color bands in the light spectrum the same thickness?

_____ All color bands in the visible light spectrum are the same thickness.

_____ All color bands in the visible light spectrum are of different thicknesses.

Problem #2: How do red, green and blue filters affect the light spectrum you can see?

_____ The spectrum will not change when I look through the filters.

_____ The filters cause other colors in the light spectrum to turn into the same color as the filter.

_____ The filters cause other colors in the light spectrum to disappear or be blocked.

Name:_____ **Student Worksheet (4 of 4)**

Colors Here and Colors There

Conclusion (continued):

1. Was your original hypothesis for Problem #1 proved or disproved? Use a complete sentence.

_____

_____

2. Briefly explain how you came to your conclusion.

_____

_____

_____

3. Was your original hypothesis for Problem #2 proved or disproved? Use a complete sentence.

_____

_____

4. Briefly explain how you came to your conclusion.

_____

_____

_____

Further Questions:

1. Which of the filters you used in Problem #2 let through the fewest colors?

_____

2. Which of the filters you used in Problem #2 let through the most colors?

_____

3. What is one way a scientist might use color filters when performing an experiment?

_____

_____

