

## Color Addition Lab

### Teacher's Guide

**Topic:**

Light and Color

**The following information is provided to the student:**

**Question:**

What is the result of adding combinations of the three primary colors of light in equal and unequal intensities?

**Purpose:**

To determine the result of adding primary colors of light in equal and unequal intensities and to develop four general rules of color addition for adding light colors in equal intensity.

A complete lab write-up includes a Title, a Purpose, a Data section, and a Conclusion/Discussion of Results. The Data section should include the provided table with all rows completed. The Conclusion/Discussion should respond to the question raised in the Purpose of the lab.

URL: <http://www.colorado.edu/physics/2000/tv/colortv.html>

**Materials Required:**

Online interactive color mixing box at <http://www.colorado.edu/physics/2000/tv/colortv.html>.

**Description of Procedure:**

Students go to the web page listed above and scroll down until they see the interactive color mixing animation. The three squares can be completely or partially overlapped. The sliders can be adjusted to alter the intensity of the three primary light colors. The relative intensity of each color is listed as a number between 0 and 255. Students adjust the intensities to create the colors indicated in the provided data table.

**Alternative Materials and Procedure:**

Numerous Java applets and online animations are available for setting the R-G-B characteristics of a color and observing the result.

**Safety Concern:**

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Student *horseplay* and off-task behaviors should not be tolerated.

**Suggestions, Precautions, Notes:**

1. Very little introduction to the principles of color addition are required for this activity. The activity itself will *do the teaching*. It would be helpful for students to know that computers and televisions create color by adjusting the intensities of three light colors -red, green and blue.

## The Laboratory

- The fact that the intensity of each color can range from 0 to 255 illustrates a *color depth* of 8-bits; that is, there are  $2^8$  possible intensities to which each of the three colors of light can be adjusted to.
- Students will often insist that red, blue and yellow are the primary colors. Inform them that the red, blue and yellow of art class was referring to the primary colors of paint. Physics is referring red, green and blue as the primary colors of light.
- Follow this activity up with a discussion of primary and secondary colors of light and the simple rules of color addition.

### Auxiliary Materials:

The following page is provided to the student for completion and inclusion in the Data section of their lab notebook.

Go to: <http://www.colorado.edu/physics/2000/tv/colortv.html>

What relative color intensities are needed in order to produce the color typical of the following objects?

- |                            |           |             |            |
|----------------------------|-----------|-------------|------------|
| a. yellow school bus       | Red _____ | Green _____ | Blue _____ |
| b. cyan sky                | Red _____ | Green _____ | Blue _____ |
| c. magenta ink             | Red _____ | Green _____ | Blue _____ |
| d. orange.....orange       | Red _____ | Green _____ | Blue _____ |
| e. milk chocolate brown    | Red _____ | Green _____ | Blue _____ |
| f. lavender flower         | Red _____ | Green _____ | Blue _____ |
| g. light pink rose         | Red _____ | Green _____ | Blue _____ |
| h. purple grape            | Red _____ | Green _____ | Blue _____ |
| i. navy blue Bear's jersey | Red _____ | Green _____ | Blue _____ |
| j. forest green car        | Red _____ | Green _____ | Blue _____ |

Come up with four of your own:

- |          |           |             |            |
|----------|-----------|-------------|------------|
| k. _____ | Red _____ | Green _____ | Blue _____ |
| l. _____ | Red _____ | Green _____ | Blue _____ |
| m. _____ | Red _____ | Green _____ | Blue _____ |
| n. _____ | Red _____ | Green _____ | Blue _____ |

### Scoring Rubric:

L6. Color Addition Lab	Score
____ Included, labeled and organized all parts of the lab report.	____/____
____ Data section includes the provided table.	
____ Conclusion/Discussion clearly and accurately states four rules of adding two or more of the primary colors of light in equal intensity and discusses the result of adding primary colors of light in unequal intensity.	

## **The Laboratory**

### **Connections to The Physics Classroom Tutorial:**

The following readings are a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/light/u12l2b.cfm>

<http://www.physicsclassroom.com/Class/light/u12l2c.cfm>

<http://www.physicsclassroom.com/Class/light/u12l2d.cfm>

### **Connections to Minds on Physics Internet Modules:**

Sublevel 3 of the Light and Color module is a suitable accompaniment to this lab:

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