***PocketLab Voyager: A Study of Color Reflectivity***

By Richard Born
Associate Professor Emeritus
Northern Illinois University

There are three basic classifications of reflectivity—diffuse, mirror, and retroreflection. Diffuse reflection is probably the most common type and occurs when light strikes rough surfaces such as pavement, vehicles, clothing, and foliage. Diffuse reflectivity depends on a number of factors including surface characteristics and color. One way to quantify reflectivity is to define what might be called *percent reflectivity*. This is the ratio, expressed as a percent, of the light intensity from the surface to the light intensity from aluminum foil. Aluminum foil can be used as the basis for comparison since aluminum has high reflectance over a wide range of wavelengths and is readily available for classroom use.

A common experiment for studying the reflectivity of different colored surfaces makes use of colored construction paper, aluminum foil, a light source, and a light sensor. Voyager's light sensor and the little flashlight included with the *Explorer Kit* are perfect tools for performing this experiment. Figure 1 shows the setup used by the author. Ring stands were used to keep Voyager and the light source stable during data collection. The light intensity reflected from 3½" square pieces of construction paper was measured for black, white, and ROYGBV. A piece of cardboard was used on which the aluminum foil was tightly wrapped. The aluminum foil's reflectivity changed if the foil was rotated 90°. The orientation of the foil with the higher of these two values was used as the standard for comparison.

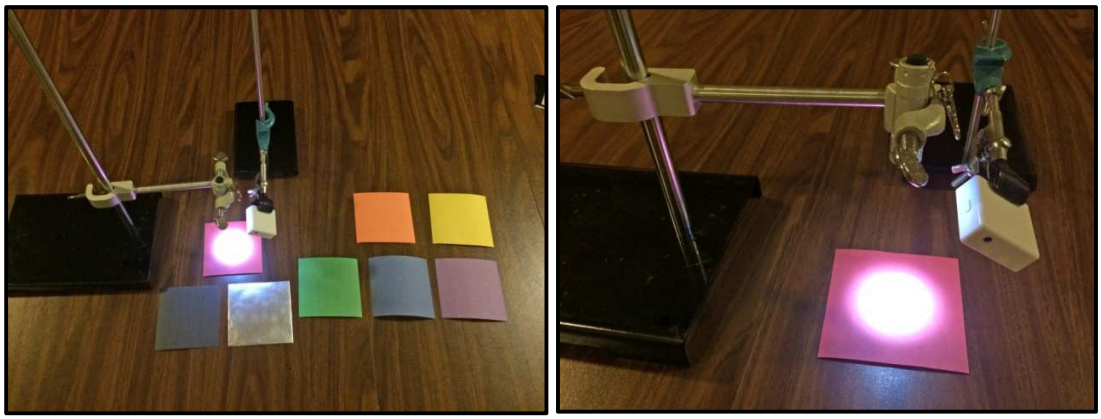


*Figure 1*

Voyager's light sensor was set to five data points per second. In a single data collection run, each of the colored papers was centered on the light beam for several seconds. Figure 2 shows the Excel chart that was constructed from the csv file created by the PocketLab app. The percent reflectivity was lowest for black and highest for aluminum. Orange and yellow were the highest for the ROYGBV colors. White, reflecting the entire spectrum, was higher than any ROYGBV color. Note that the white square was

taped to the table top so that each of the colored squares could be placed on top of it, keeping the location of the squares the same for each color square.

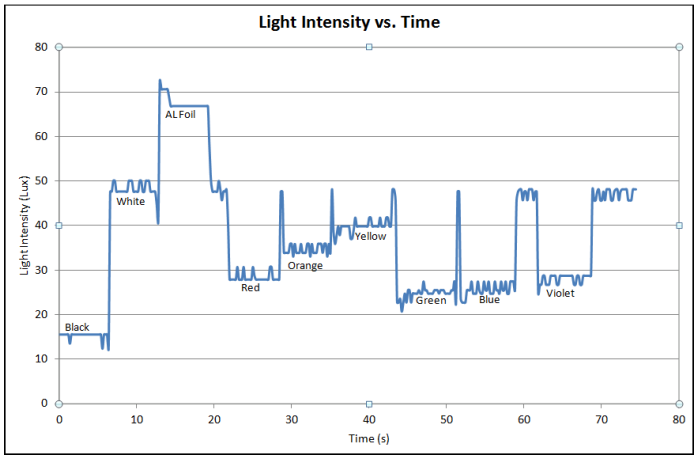



*Figure 2*

A much fancier chart of the results is shown in Figure 3. Copies of this chart, minus the data points and graph lines, can be found on the final pages of this document. These can be duplicated for students or lab groups to record their experiment results. You can choose from full color or black and white.

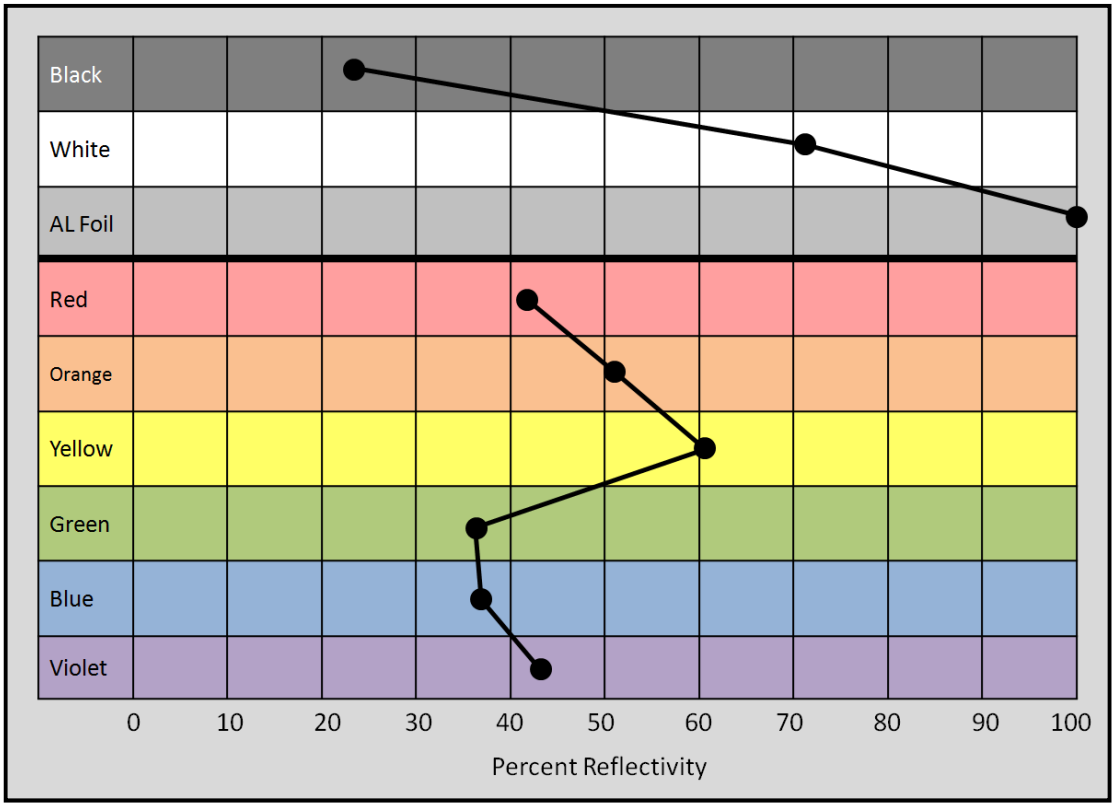
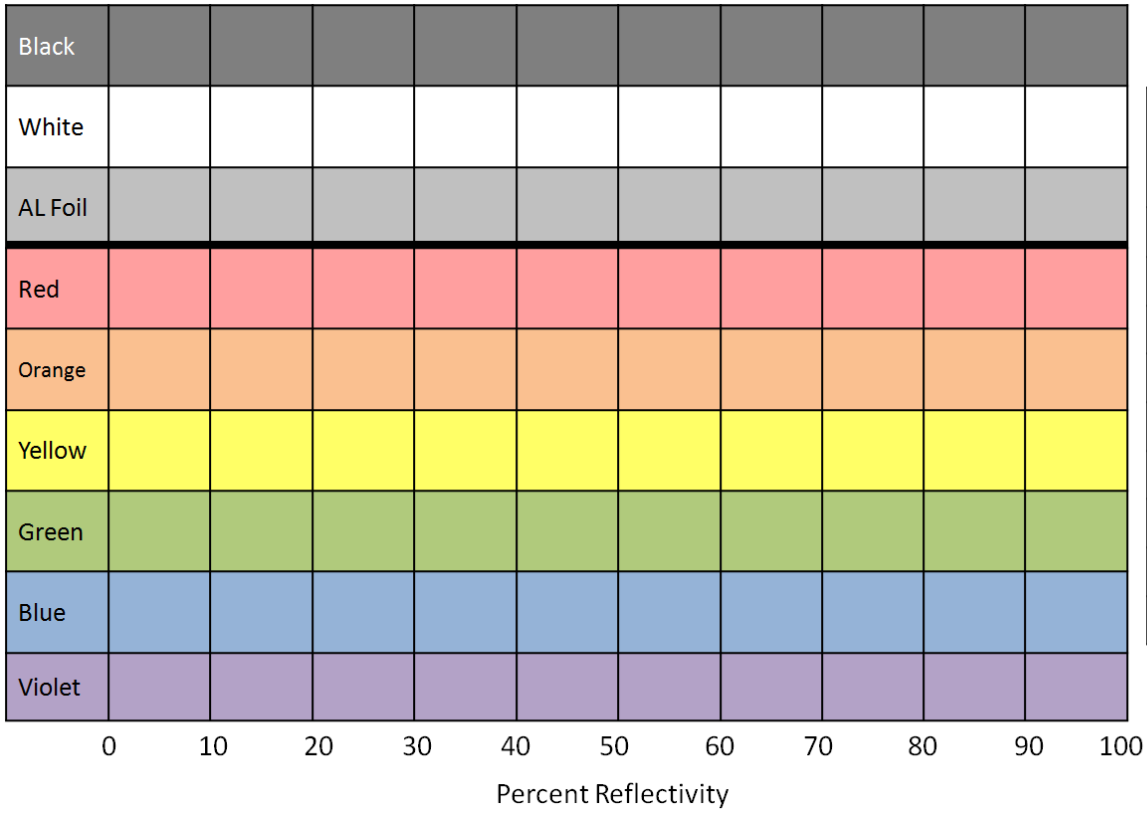
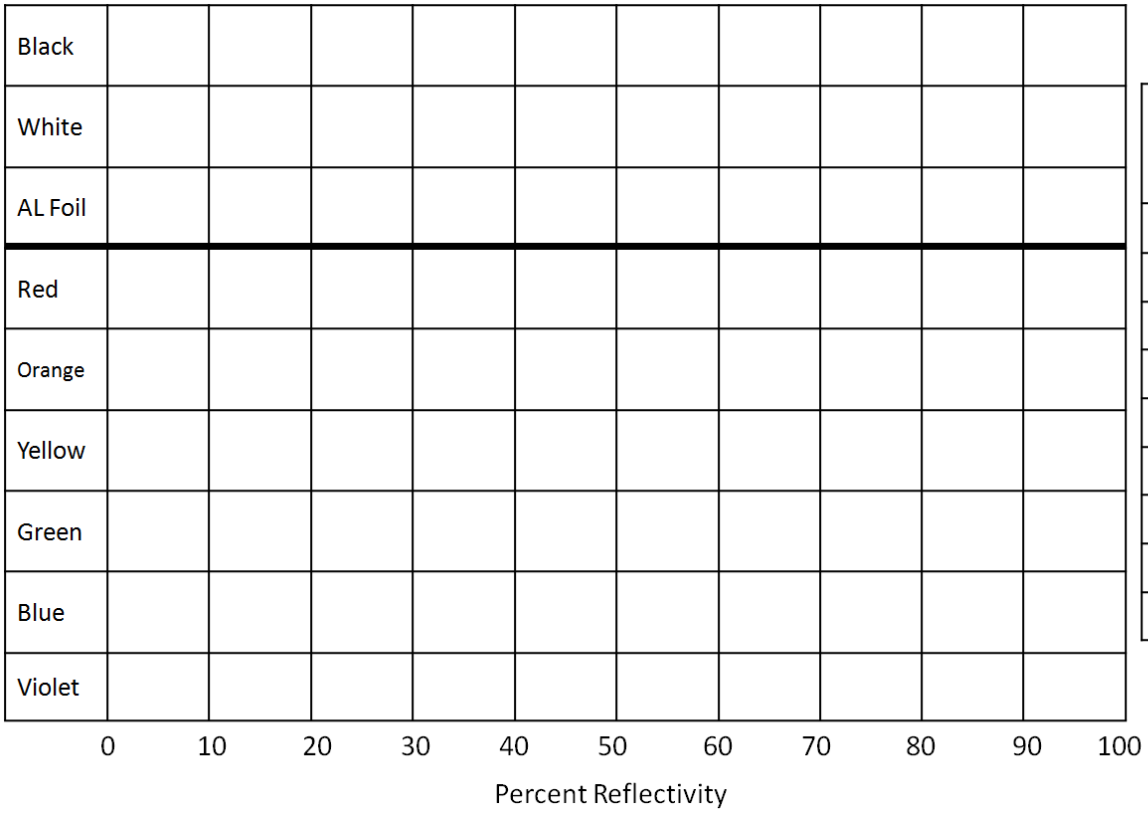



*Figure 3*




| *Color* | *Light Intensity (lux)* | *Percent Reflectivity* |
|---|---|---|
| *Black* | | |
| *White* | | |
| *Aluminum Foil* | | |
| *Red* | | |
| *Orange* | | |
| *Yellow* | | |
| *Green* | | |
| *Blue* | | |
| *Violet* | | |




| *Color* | *Light Intensity (lux)* | *Percent Reflectivity* |
|---|---|---|
| *Black* | | |
| *White* | | |
| *Aluminum Foil* | | |
| *Red* | | |
| *Orange* | | |
| *Yellow* | | |
| *Green* | | |
| *Blue* | | |
| *Violet* | | |