

Solar Panels and Efficiency With Colored Films

ACTIVITY SUMMARY: Students will construct the [Deluxe Solar Educational Kit Model SK-40](#) using the directions available. They will then proceed to hold different colored films in front of a flashlight, shining towards the solar panel. After three trials the students should be able to decipher which color allows the solar panel to produce the most volts of power. This can be decided by using a decibel meter app that can be downloaded for free on an iPad or iPhone.

AUTHORS: Weinan Su, Bryce Kelly, and Gabriella McVicker
(Students at Wilsonville High School and West Linn High School)

PROJECT DESCRIPTION: Students learn how to construct and use a solar panel. In addition, students place several different colors of plastic film over a flashlight to determine which color produces the highest amount of energy for the solar panel. In this lesson, the solar panel is connected to a bell. When energy input solar energy input is higher the bell rings louder and when solar energy input is less the bell is quieter. To determine the highest amount of energy generated a Decibel Meter App is used that measures decibel levels.

GRADE LEVEL(S): 6, 7, 8

SUBJECT AREA(S): Physics and Engineering **ACTIVITY LENGTH:** 45-60 minutes

LEARNING GOALS: Allow for students to construct a solar panel and find the color that produces the most power.

N.G.S.S. STANDARDS MET:

Standard	Standard Description
MS-ETS1-3	<i>“Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.”</i>
MS-ETS1-4	<i>“Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.”</i>

MATERIALS LIST (PER STUDENT OR GROUP):

- 1 Deluxe Solar Educational Kit Model SK-40
 - Colored films (Red, Orange, Yellow, and Blue)
 - 1 Flashlight
 - 1 Ruler
 - Decibel meter Smart Phone or Tablet app (Decibel X)
-

ACTIVITY VOCABULARY:

Decibel - a unit used to measure the intensity of a sound or the power level of an electrical signal by comparing it with a given level on a logarithmic scale.

STUDENT BACKGROUND: Solar panels can absorb light. However, solar panels may absorb certain colored lights better than others.

EDUCATOR BACKGROUND: The results of this activity should turn out as yellow having the highest decibel, followed by orange, blue, and red with the lowest. Blue and red may end up similar. An explanation for these results can be explained using Physics, more specifically, the different wavelengths of the colors. The shorter the wavelength, the more energy it carries; this can also make it pass through more objects. If a wavelength is too short, instead of being absorbed by a solar panel, it passes through. Red, having the longest wavelength, lacks the energy to pass all the way through the filter; which is why it has the weakest decibel number. Blue, having the shortest wavelength, has too much energy so it cannot all be absorbed by the panel. The reason why yellow has the highest decibel reading is because it has a mid-length wavelength, which is the shortest wavelength that won't have most of its energy pass through the solar panel. This causes yellow to produce the highest decibel as it has the best balance between the amount of energy and the amount of available energy collected. There is an example of the set up on the following pages.

LESSON DETAILS:

1. Gather materials required for the lesson as stated above.
2. Take out the parts within the Deluxe Solar Educational Kit

3. On the back of the solar panel are six pins that are numbered 1 - 6 going from left to right.
4. Connect the yellow speaker to the solar panel by using the connected wires and attaching them to pins 1 and 6.
5. Using one of the extra yellow wires, connect the wire to pins 2 and 3.
6. Using another yellow wire connect pins 4 and 5
7. Download a Decibel meter app. The app that was used to test was Decibel X.
8. Put the solar panel and speaker in an area that is quiet and dark, each group should be a comfortable distance apart.
9. Shine a flashlight onto the panel with the decibel meter app open while covering the solar panel with a colored film.
10. For each test, start the decibel meter with the colored film over the solar panel and have the speaker ring three times, then stop the meter and make sure for each test that the flashlight stays in the same place. Note: the plastic colored film should be the same distance from the solar panel when testing the different colors. For example, the colored plastic should be approximately 1 inch from the solar panel. (See pictures on page 2)
11. Record the max decibel recorded by the decibel meter app. Reset the meter and repeat until data table is completed for all colors.

Resource about how different Colors Impact Voltage:

<https://sites.suffolk.edu/bobbyg3142/2015/11/11/solar-power-how-different-colors-and-distances-affect-voltage/>



Figure 1: Shows the approximate distance the flashlight and solar panel should be.

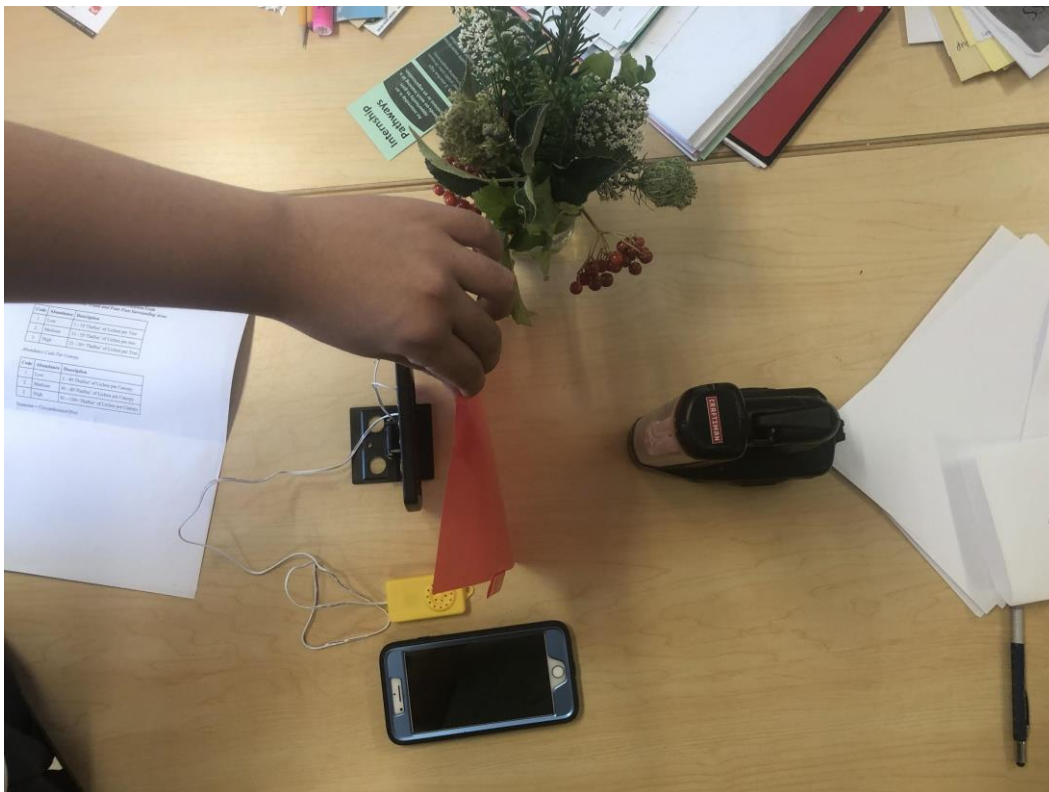


Figure 2: Shows how the color plastic sheet is held near the solar panel.



Figure 3: Shows how the door bell is positioned with the phone that has the decibel app

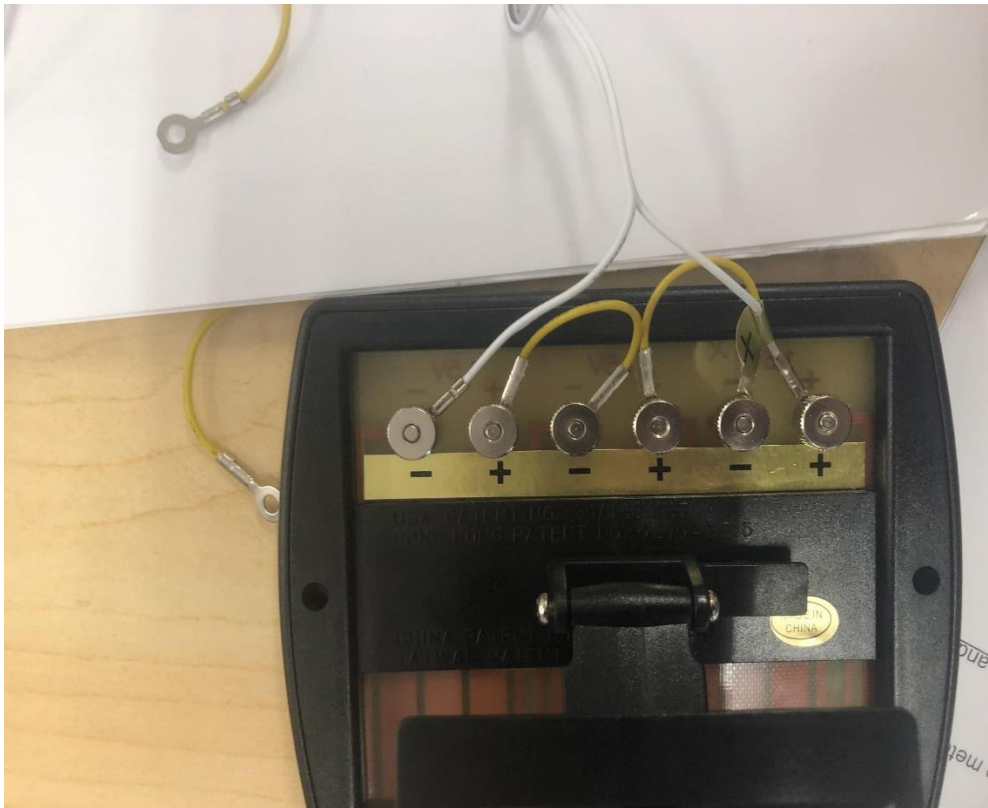


Figure 4: Shows how to setup the solar panel

NAME _____ DATE _____ GRADE _____

Solar Panels and Efficiency With Colored Films

Directions

1. Gather materials required for the lesson as stated above.
2. Take out the parts within the Deluxe Solar Educational Kit
3. On the back of the solar panel are six pins that are numbered 1 - 6 going from left to right.
4. Connect the yellow speaker to the solar panel by using the connected wires and attaching them to pins 1 and 6.
5. Using one of the extra yellow wires, connect the wire to pins 2 and 3.
6. Using another yellow wire connect pins 4 and 5
7. Download a Decibel meter app. The app that was used to test was Decibel X.
8. Put the solar panel and speaker in an area that is quiet and dark, each group should be a comfortable distance apart.
9. Shine a flashlight onto the panel with the decibel meter app open while covering the solar panel with a colored film.
10. For each test, start the decibel meter with the colored film over the solar panel and have the speaker ring three times, then stop the meter.
11. Record the max decibel recorded by the decibel meter app. Reset the meter and repeat until data table is completed for all colors.

Data Table

Colors	Trial 1	Trial 2	Trial 3
Red			
Orange			
Yellow			
Blue			