Solar Energy Science Fair Ideas

How to set up an experiment

The Engineering Process

Brainstorming/Questions:

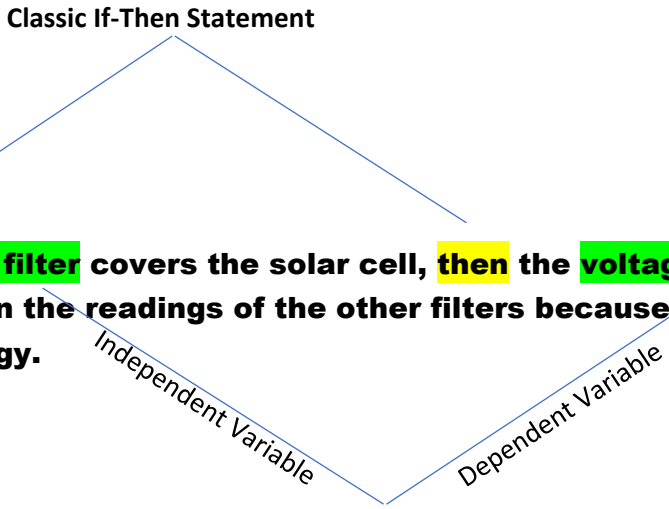
What conditions affect how much energy a solar cell generates?

1. Does the color of the light affect the amount of solar energy generated from a solar cell?
    a. Which color transmission filter will have the greatest effect on the electricity produced by a solar cell?
    b. Are solar cells more sensitive to specific colors of light?
2. Does the tilt/angle of the solar cell relative to the sun affect the amount of solar energy generated from a solar cell?
    a. What time of year is the best for solar energy production?
    b. What angle should your house be at to get the best use out of solar panels?

Variables:

- Angle of the solar cell
- Time of day
- Direction of the sun/light source
- Distance of solar cell from light source (This is when using a lamp to simulate the sun because we can't change our distance from the sun).
- Color (using the orange, yellow, blue filters)
- Size of the solar cell
- Type of solar cell

	Question 1- Specific	Question 2- Very Specific; Probes Further Questions and Experiments
Dependent Variable	**Amount of Solar Energy (in volts)**	**Amount of Solar Energy (in volts)**
Independent Variable	**Color of filter (Orange Yellow, Blue)**	**Angle from the sun/light source (30^o, 45^o,60^o, 90^o)**
Controlled Variable(s)	• **Angle of solar cell** • **Distance from Light Source** • **Time of day** • **Type of cell** • **Direction of light source** • **Size of cell**	• **Distance from light source** • **Direction of light source** • **Color** • **Type of cell** • **Time of day** • **Size of cell**



Hypothesis:

1. **If the blue filter covers the solar cell, then the voltage reading will be higher than the readings of the other filters because blue light has more energy.**

2. **If the solar cell is held at a 30° angle, then the voltage reading will be lower than the voltage readings of the solar cells at the other angles.**

Materials:

Question 1	Question 2
• 1 Solar Cell with wiring • 1 Multimeter* • 2 Alligator clips • 1 75 Watt lightbulb in a lamp • 1 Orange light filter • 1 Yellow light filter • 1 Blue light filter • 1 Ruler • Chart (Handwritten or Typed)	• 1 Solar Cell with wiring • 1 Multimeter* • 2 Alligator clips • 1 75 Watt lightbulb • 1 Protractor • Chart (Handwritten or Typed)

At this point, I have decided that question 1 will be my science fair project. Now I will focus and develop the rest of the engineering process on question 1.

Procedure:

1. Gather all materials.
2. Create a chart using either an electronic device or paper and pen, like the one shown below:

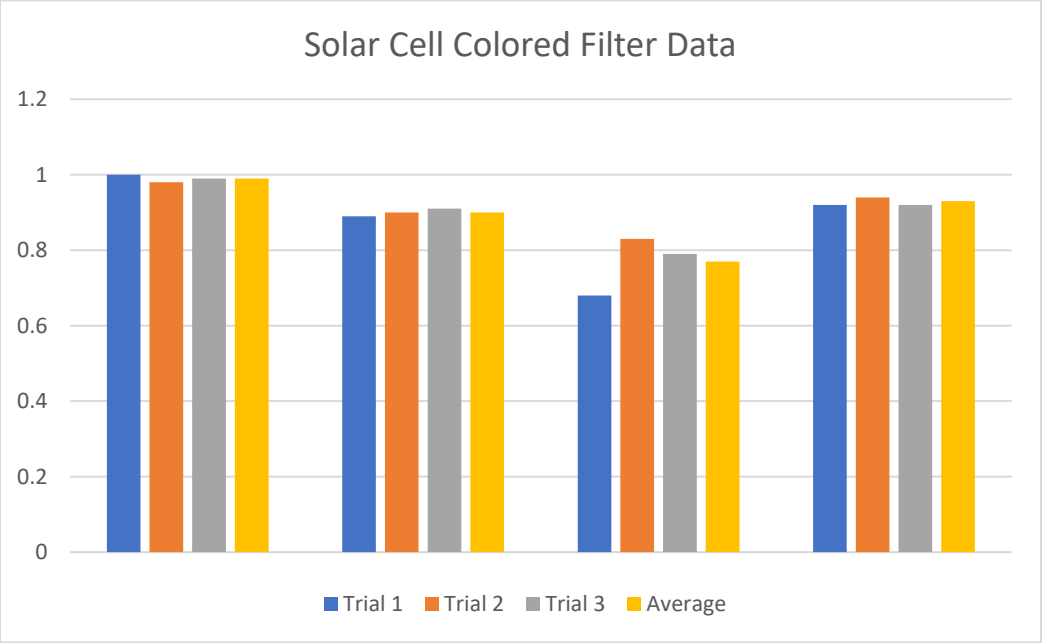
Color of Filter – Independent Variable

Voltage Reading (V)- Dependent Variable

	Control (No Filter)	Yellow	Orange	Blue
Trial 1				
Trial 2				
Trial 3				

3. **Attach one side of the alligator clips to the multimeter.**
4. **Attach the other side of the alligator clips to the solar cell.**
5. **Turn on the lamp.**
6. **Using the ruler, position the solar cell 12 inches in front of lamp.**
7. **In the chart, record the value of the solar cell without a filter in the cell on row 'Trial 1', under column 'Control (No Filter)'.**
8. **Add a yellow colored filter on top of the solar panel and record the value in the appropriate cell. Make sure that you maintain the 12 inch distancing while adding the filters.**
9. **Repeat the same process with the blue and orange filters.**
10. **At the end of Trial 1, repeat steps 7-9 for Trial 2 and Trial 3.**

Data Analysis:



NO FILTER **Yellow** **Orange** **Blue**

	Control (No Filter)	Yellow	Orange	Blue
Trial 1	1.0 V	.89 V	.68 V	.92 V
Trial 2	.98 V	.90 V	.83 V	.94 V
Trial 3	.99 V	.91 V	.80 V	.92 V
Average	.99 V	.90 V	.77 V	.93 V

There are some conclusions I can gather from this data. First, there is a possible outlier found in the data of the orange filter column. The value '.68 'is much different than the other values, it is

more on the extreme side. Although this number was factored into the average, it would be interesting to form a conclusion on why that outlier may be present. However, because there is an outlier in the orange filter category, it skews the results of the orange. Another observation is that the data in the columns of the Yellow and Blue filters are very similar— the results in both categories are all related and are with in .01-.03 V of each other.

Conclusion:

In conclusion, my hypothesis was correct. When the blue transmission filter covered the solar cell, the voltage reading was higher than the readings of the yellow and orange cells. While the Blue and Yellow filters had similar results throughout all three trials, the results of the Orange filters were unique. Due to the outlier, the results were significantly lower than those of the other filters. The outlier most likely occurred due to human error. The solar cell was accidentally farther away from the lamp than it was for the other filters. Even though it may seem like the distance isn't that significant and that it can be manipulated without error, that is false because the solar cells are sensitive to the light and any variation in the distance can affect the voltage readings.

Further Applications:

For further experimentation, I can look into using this data to help fuel my interest of solar cooking. I would like to see if I can use the knowledge of filters and solar cells to model solar cooking in other climates and conditions.

This report was written by Joelliane Langeview.