Light

Goals

- Use a solar panel to generate electricity from light
- Run a motor with the electricity generated
- Use the speed of the motor to measure light energy

Background

Light is a strange phenomenon. You've probably been using two highly sensitive light detectors since the day you were born, and they're helping you to read these words right now. But what we see as light is just part of a diverse type of energy that exists all over the universe and has many uses here on our own planet as well.

Light is just a small part of something known as the electromagnetic spectrum, a form of energy that travels through space as waves. You can see only part of that spectrum with your eyes, which your brain interprets as colors. Difference in wavelength (the distance between the peaks of the waves) result in different colors. The colors you can see range from red at the long end of the spectrum to violet at the short end.

But there are many more "colors" beyond those that you can't see, although you may have heard of their names. We call the colors with wavelengths too short to see "ultraviolet" and those with wavelengths too long to see "infrared." Other types of electromagnetic waves, like X-rays and gamma rays, have even shorter wavelengths than ultraviolet. Radio waves and microwaves have even longer wavelengths than infrared.

Solar power is a way of generating electricity that uses the energy contained in these waves to create an electric current. During this activity, you'll use a solar panel to generate an electric current and describe how it works.

Procedure

1. Look at the top of the car frame to see where you should attach the solar panel support. Make sure the solar panel support fits securely onto the top of the frame.
2. Place the solar panel on top of the support.
3. Connect the wires from the motor to the red and black plugs nearest to them on the front of the frame.
4. Use the other red and black wires to connect the solar panel to the other plugs on the front of the frame.
5. Make sure the car is in direct sunlight, and it should start to run.
6. Use the stopwatch to time how long it takes your car to complete the track.

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Observations

Experimentation

1. You can use colored plastic gels, or different lightbulbs, to change the color of light hitting the solar panel. Do certain colors work better than others? Try using the solar panel to run the car while the panel is hit with different wavelengths of light and record your observations below:

Light Color:	Time to fill H2:	Observations:

2. The solar panel is dark in color. Does the color of its surroundings affect how well it collects light for generating electricity? Try using the panel to run the car while the panel is in front of different colored backgrounds and record your observations below:

Light Color:	Time to fill H2:	Observations:

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3. Raise the front wheels off the ground and use a piece of paper or other method to shade parts of the panel and observe the effects. How much of the solar panel can you cover before the motor stops running? Does it matter which side of the solar panel is shaded?

Measurement

For this section, you will need a multimeter or the Horizon Renewable Energy Monitor. For an introduction to using a multimeter, click here.

1. Raise the front wheels off the ground. Measure the current in Amps and the voltage in Volts while shading the solar panel to find the minimum values for each that will still run the motor. Record your answers below:

Current: _____ A

Voltage: _____ V

2. Voltage is equal to the current multiplied by the resistance (V = IR), so according to your data what is the resistance of the motor?

Resistance: _____ Ω

3. Use different colors of light with your solar panel as before. Measure the current in Amps and the voltage in Volts while running the motor. What color gave the highest values? Record your answers below:

Color: _____

Current: _____ A

Voltage: _____ V

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Analysis

1. Make a scientific claim about what you observed while running the solar car.

2. What evidence do you have to back up your scientific claim?

3. What reasoning did you use to support your claim?

4. Design an experiment that could test the relationship between the energy of light and its wavelength.

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Conclusions

1. Based on your observations, do you think a solar panel would be useful for generating electric energy from any type of light? Explain your reasoning.

2. What would you say is the most important factor in determining how much electric energy a solar panel produces?

3. Based on your observations, what color of light emits the most energy?

4. Based on your observations, what color of background absorbs the most energy?