Gabriel Alsina

Solar Power

This lesson is meant to be part of an energy unit for 7-8th grade students

Rationale: Solar power is an interesting and relevant way to engage students in lessons involving energy. Renewable energy is a hot topic in science and engineering which students are usually interested in learning more about. This lesson will give students an opportunity to connect what they learn in the classroom with real hands-on exercises while also satisfying the following Wyoming State Science Standards:

- SC8.1.7: The Earth in the Solar System – understand that the sun is a major source of energy
- SC8.1.12: Forms and Uses of Energy
- SC8.1.13: The Conservation of Matter and Energy

Objectives:

Students will construct and operate small, solar-powered cars, discuss the advantages and disadvantages of solar power, interpret and implement a simple circuit that utilizes solar energy to power a small fan, and understand how solar panels convert light energy into electrical energy.

Statement of Engagement:

As students arrive to the classroom they will see solar car kit boxes piled on the front table and be naturally curious about today's lesson. The teacher will then follow this up by: reviewing the different types of energy the class has been learning about and introducing solar power. The teacher should have a pre-built car with a strong light bulb shining on it to demonstrate how the technology works. After a short introduction, students will build small solar cars and then race them outside. This will be a fun and engaging way for students to observe how the sun's energy can be used to power devices.

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Minute by Minute Breakdown:

Time (min)	What the Teacher is Doing	What the Student is Doing
DAY ONE		
2 - 3	Overview of today's lesson: solar car building and racing, solar power discussion	Listening, engaged, and excited to build their own solar cars.
8 - 10	Ask students to pair up and follow instructions in kits to build a solar car per group	Find a partner and retrieve a solar car kit. Construct the solar car by using the instructions provided. Test the car near a window if possible.
12 – 15	Lead students outside to a sunlit, flat area to race solar cars. Make sure students observe what happens in the shade. Students may keep their solar cars.	Test cars and troubleshoot any problems. Race against other teams. Experiment with shade.
18 – 20	Start a student-led discussion on solar power. Ensure all students participate and all topics are discussed by asking about advantages, disadvantages, how the panels might work, possible applications, and multiple uses of solar power (light and heat).	Participate in the discussion. You must be able to write a half-page journal entry on solar power by the end of the lesson.
5	Ask students to write a half-page journal entry that addresses at least 3 of the topics listed above (and on the board).	Write journal entries. Clean up area and pack up.
DAY TWO		
2 - 3	Give an overview of the day: multi-meter demonstration, circuit building, discussion, and how a solar panel works	Quietly listening. Getting super excited about building their own circuits.
10 – 15	Explain how to measure current and voltage on a circuit drawn on board. Explain how flow and pressure are analogous to current and voltage.	Taking notes on how to measure voltage and current using the multi-meter.
20 - 25	Provide a circuit board, solar panel, wires, and tools. Assist students as they complete motor madness lab.	Complete Motor Madness lab attached. Must finish Task 1. Additional time can be spent on completing additional tasks.
5 – 10	Lead a discussion of results obtained from the lab.	Discuss observations and results obtained from lab.
10	Explain how a solar panel is constructed and how it produces electricity.	Listen and take notes. Be able to write a journal entry on how solar panels work.
5	Instruct students to complete journal entries.	Complete journal entries, clean up lab area, and pack up for the day.

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Lab #2: Motor Madness

NOTE 1: Be careful of the spinning fan blades.

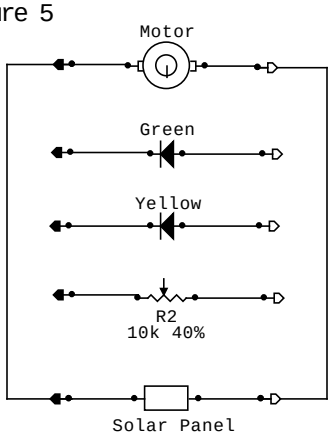
NOTE 2: To measure voltage you must measure it with one probe on each side of the component. To measure current you must connect the meter within the circuit.

Procedure

Task 1: Connecting the motor

1) Connect the circuit as shown in figure 5.

Figure 5



2) Take the following measurements:
   V_{motor} = _____

   I_{motor} = _____

3) Block some of the light to the solar cell. With the light blocked retake the same measurements. What happens to the voltage and current?
   V_{motor} = _____

   I_{motor} = _____

   _____

4) Reverse the wires to the motor. What happens?

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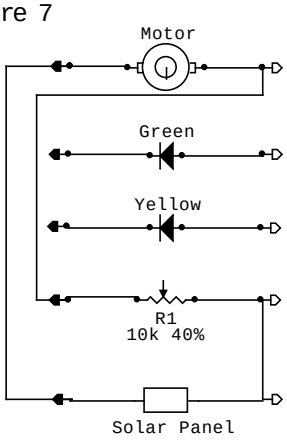
Task 2: Adding the Potentiometer

1) Connect the circuit like figure 7.

Figure 7



2) Turn the potentiometer. What happens?

3) When the speed of the motor is reduced, take the following measurements:

$V_{solar\ panel}$	
V_{motor}	
$V_{potentiometer}$	
$I_{into\ motor}$	
$R_{potentiometer}$	

Task 3: Creating Power

1) Connect the motor to the green LED as shown in figure 8.

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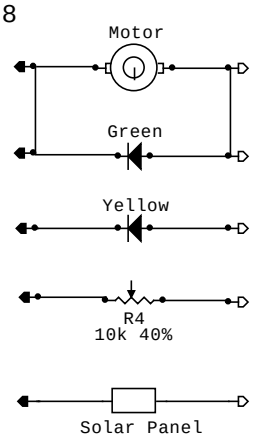
Figure 8



2) Spin the fan as fast as you can. What happens?

The motor is converting mechanical power (you spinning it) into electrical power that lights up the LED. A device made specifically to do this is called a generator. Generators and motors are physically very much the same they just have opposite functions. A wind generator is a generator that is turned by the wind and creates electricity; this like solar power is another form of “clean” energy.

In this lab the mechanical power was created by you, what other things could cause a fan (or a turbine) to spin to generate electricity?