Solar Energy: Photovoltaic Cells

Name: _____ Class:_____

Learning Goals:

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Your Role:
As an energy consultant, you and your team specialize in alternative energy. Many energy consumers are looking for different ways to meet their energy needs. Their reasons are often related to cost and wanting to help the environment. Your task will be to help the school board make an informed decision as to the value of solar energy for their school building.

Solar Energy Video Viewing Guide: Solar Power 101
How is solar energy converted to electricity? Illustrate and label the process below. Use these terms as labels: Sun, PV Cell, DC electricity, Inverter, AC electricity, Battery, Meter

The law of conservation of energy states that _____
_____
_____.

How does your above diagram show this? _____
_____

Research: Use a computer or ipad to research solar energy on the sites provided by your teacher. Fill in the table below with the information you find.

Cost of Solar Energy	How Photovoltaic Cells Work
http://energyinformative.org/cheapest-best-value-solar-panels/ www.solartechnologies.com http://solarenergy-usa.com/solar-info/solar-costs/	http://science.nasa.gov/science-news/science-at-nasa/2002/solarcells/ http://www.physics.org/article-questions.asp?id=51 http://www.solarenergy.org/answers-older-kids
Pros of Using Solar Energy	Cons of Using Solar Energy
Allow students to freely search for these. One possible site would be as follows. www.sciencekids.co.nz/sciencefacts/**energy**/**solar**power.html	

Photon Solar Racer Lab

Follow the directions on the Solar Racer Instruction Sheet to construct your car. Complete the lab below.

Problem: How do different amounts of sunlight affect the speed of a solar car?

Hypothesis: _____

_____

_____

Materials: Solar Car, Masking Tape, Timer, Meter Stick

Procedure:

1. In a very sunny spot, measure a 3-meter distance on the sidewalk and mark a starting line and a finish line with tape.
2. Repeat this in a spot with partial sun and a spot in the shade.
3. Conduct 5 trials in each condition with your car recording the TIME in SECONDS it takes your car to reach the finish line.
4. Calculate the average time it took the car for each condition.
5. Repeat steps 1-4 with a body-style design of your choice. Use the materials provided by your teacher to design a new body for your car.

Data:

Original Car	Time 1	Time 2	Time 3	Time 4	Time 5	Average
Full Sun						
Partial Sun						
Shade						

Your Car Design	Time 1	Time 2	Time 3	Time 4	Time 5	Average
Full Sun						
Partial Sun						
Shade						

Conclusions:

1. In which condition did the solar car travel fastest?

2. Explain why this occurred based on what you know about how solar cells convert light energy to electrical energy.

3. **Math Connection: Solar Savings**

Part A: The primary energy sources today are coal, renewables (such as solar, wind, hydropower), natural gas, petroleum (oil), and nuclear. Make an educated guess about what percentage world's energy comes from each type, and list them below in order of use, from least to greatest. Write the percent in the second column.

Type	Amount (%)
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____

Wattage usage for common appliances per hour

Description	Use
Refrigerator	490
TV (50" plasma)	480
DVD Player	50
Home Stereo System	75
Cell Phone Charger	15
Electric Clock	10
Iron	750
Clothes Washer	500
Clothes Dryer	400
Lap Top	250
Garage Door Opener	300
Coffee Pot	720
Microwave	600

Total hourly wattage use _____

Part B: Using the data from the previous page, calculate the monthly energy savings from having solar panels vs. using the original county electric power grid. Having just recently purchased solar panels for your home, you will now be saving on your monthly power usage! For every panel installed, you will save 6% of the monthly wattage usage. Please work with a partner or in groups and answer the following questions.

1. If you wanted to decrease your power usage by 24%, how many panels would you have to buy?

2. After finding the total power usage on page the previous page, fill out the following table using your findings.

	Monthly Savings	6-Month Savings	1-Year Savings
1 panel			
2 panel			
3 panel			

3. How many solar panels would it take to reduce your monthly wattage use to 2000 watts per month? Explain your reasoning in the space provided.

4. In Box A list any items that use more than 10% of the homes wattage usage in order from least to greatest. In box B, list all items that use more than 15% of the homes wattage usage in order from least to greatest.

Box A	Box B

5. Now, problem solve with your group about how you could use fewer panels, but save more energy. How does this apply to mathematics? Underline the mathematic vocabulary terms you used when explaining your reasoning. Provide proof of your mathematic savings in the box at the bottom of the page.

Mathematic Proof
Explanation

Pros and Cons of Solar Energy Debate

Using the research and investigations you conducted earlier, you will need to develop an argument related to one side of the solar energy debate. Your teacher will assign you to the "Pro Solar Energy" side or the "Anti Solar Energy" side. One side should persuade that solar energy is a positive investment for the environment and as an energy source. The other side should persuade that solar energy is not good for the environment and may bot be a valuable energy source in the future. Your questioning skills will be important as you attempt to build support for your beliefs on the issue of solar energy.

Pro/Anti Solar Energy (Circle one.) Write your main argument points below.

-
-
-
-
-
-

Letter to the Principal:
Write a persuasive letter to your principal outlining the importance of using solar energy and explaining the environmental and economic advantage of installing solar panels at your school. Your letter should have an introduction, body paragraph with your main points explained, and a conclusion paragraph.

Brochure
Your team will want to construct a brochure that can be distributed to the community on behalf of the school board. The brochure will need to educate the public in a manner that all community members can understand. Through your creativity, provide information through visual and written means that explains the energy conversion, design, and economic processes involved with this initiative. As the brochure will only support minimal use of words, the words selected for the brochure by your team, will need to be critical vocabulary and/or closely aligned to the purpose.

(Attach rubric. See Defined STEM.)