

Mathematics: The Language of STEM

Solar Panels

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CONTENT AND TASK DECISIONS

Grade Level(s): 5th Grade

Description of the Task: Students will use the solar panels at our school to calculate energy production by measuring solar panels and using formulas given by energy companies to determine the maximum watts created when the solar panel is at the optimal tilt. Students will use this information to adjust our current solar panel tilt to be sure the school is generating the maximum wattage possible.

Indiana Mathematics Content Standards:

5.AT.1: Solve real-world problems involving multiplication and division of whole numbers (e.g. by using equations to represent the problem). In division problems that involve a remainder, explain how the remainder affects the solution to the problem.

Indiana Mathematics Process Standards:

PS.3: Construct viable arguments and critique the reasoning of others.

PS.4: Model with mathematics.

PS.5: Use appropriate tools strategically.

PS.6: Attend to precision.

PS.8: Look for and express regularity in repeated reasoning.

Mathematics Content Goals:

Students will calculate the number of cells per solar panel and the energy produced by each cell.

Students will calculate the maximum watts per hour created by a solar panel set at the optimal tilt.

Language Objectives:

Students will write on lab reports the definitions of solar panel, watts, STC max power rating, and direct sunlight.

Students will create a data table comparing maximum hours of sunlight to watts of energy produced.

Materials:

Lab Sheets

Pencils

Clipboards

Rulers

Exit tickets

For teachers who do not have access to solar panels at their school, this website will be a good starting point to give information about solar panels and data you would need to complete this lesson.

<https://www.solarpowerauthority.com/how-to-calculate-your-peak-sun-hours/>

THE LESSON

Before:

- **Activate prior knowledge**
 - Ask students where they have observed solar panels before and what they believe solar panels are used for.
 - Compare watts and energy to inches and measurement to help students understand the watts are a unit of measurement
- **Be sure the problem is understood**
 - Front load vocab
 - Give students a practice multiplication problem using the formula (watts produced x number of direct sunlight hours) and discuss what this means
 - Transition to the problem: We have solar panels, but we need to find out how to produce the maximum amount of energy in order to better use our renewable resource.
- **Establish clear expectations**
 - Show all work so we can go back and look at each step.
 - Do not move on to the next section until you have justified your findings
 - Each group member should be involved in the conversation

During:

- **Let go**
 - Students will be split into groups of three. They will use both solar panels to examine the cells and record data.
- **Listen actively**
 - You should hear conversations explaining the number of cells in a panel and the number of panels. You should also hear conversations about how much energy is produced in each cell and how this relates to energy produced by the entire panel.
- **Provide appropriate support**
 - What are the dimensions of the solar panel?
 - How did you calculate the number of cells per panel? How many cells are in each row? How many rows are there per panel?
 - What formula can we use to find watts per hour?
- **Provide worthwhile extensions.**
 - Have students draw a new solar panel with half the number of cells and solve to find what the energy output would be.
 - Have students compare these findings to the original findings and justify.

After:

- **Promote a mathematical community of learners**
 - Give each group a section of the lab report to share their findings about.
- **Listen actively without evaluation**
 - After each group, ask if another group used a different method to solve the problem.
 - If there are disagreements, have students explain why.
- **Make connections**
 - How do the solar panels effect our school?
 - What is the purpose of the solar panels?
 - How does the weather affect solar panels?
 - Any ideas on other factors that may affect solar panel energy production?
 - How can we compare our energy usage to what the solar panel produced?
- **Summarize main ideas**
 - What you showed us today was that solar panels provide a renewable energy resource to

us. It's important that we know how much energy our solar panel produces per hour and per month so we can be conscious of how much energy we are using.

ASSESSMENT

Observe:

Students will be given an exit ticket with a set number of direct sunlight hours and a given Solar Panel STC rating. They will solve the problem.

Ask:

What does the solution to the problem you just solved mean?