

Solar Tilt Activity (grades K-5) - Educator Guide (no pyranometer)

(Simplified Version - great for clubs, summer programs, after school programs, etc.)

OBJECTIVES: Students will

- **Examine** shadows and how they change as the position of the sun changes
- **Demonstrate** how electrons move through a solar circuit to produce electricity
- **Understand** the job of a Solar Installer
- **Explore** the best direction to position solar panels to maximize electricity generated by the solar panel
- **Explore** whether or not the angle at which sunlight shines on a solar panel changes the amount of electricity generated by the solar panel.
- **Explain** the best location, direction and angle for solar panel installation on their school grounds

INSTRUCTIONS:

1. Use sidewalk chalk and have everyone get their shadow traced/trace someone else's shadow, marking where they stand.
2. Quick discussion:
 - What causes shadows?
 - Why might people want to know where shadows will fall during the day?
 - Do your shadows ever look different?
 - Can you do something right now that will make your shadow look different?
3. Take a trip around the school grounds to explore where we can find shadows.
4. Introduce solar panels (show them one). Quick discussion:
 - Do you know what this is?
 - What does it do?
 - Have you seen one before? Where?
5. Solar Relay to show how solar panels work.

SOLAR RELAY SET-UP

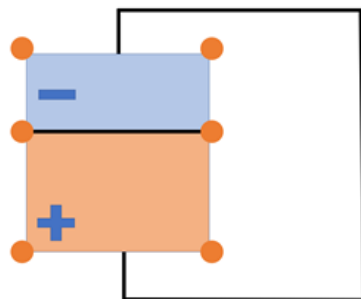
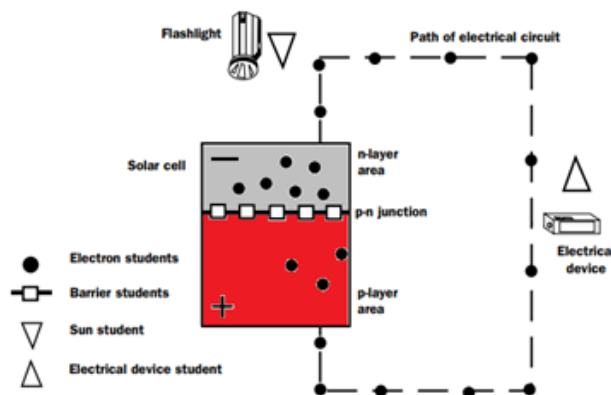
- Cones to mark panel (2-3 students on each side of p-n line = electrons in solar cell)
- Cones to mark p-n line (2-3 students stand on this line keep electrons from passing back through in the wrong direction)
- Cones to mark path of electrons (remainder of students = electrons moving in panel)
- Sun is out...electrons move
- Sun behind clouds/night time...electrons stop

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SOLAR RELAY INSTRUCTIONS:

- The **sun** shines flashlight on solar cell through the negative layer, p-n junction, into positive layer
- When light shines on the electrons in both - and + layer, the **electrons** start moving and wiggling around
- **Electrons** in the +/- layers move until they reach an edge of their layer then change direction. **Barrier students** allow **electrons** from + layer to pass to - layer but NOT **electrons** from - layer to pass to + layer.
- Eventually, **electrons in - layer** move out into the circuit. When this happens, **electrons in the circuit** start moving and **electrical device** turns on. **Electrons in the circuit** near the + layer enter it from the circuit.
- The process continues while the **sun** shines and stops when the **sun** (flashlight) is turned off.
- Ask kids where in the school grounds they think has the best sun for a solar panel.
- Learners pick a spot and we take the panels there.
 - Learners can check what the meters read at that location.



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6. Ask kids if they think it matters what direction the panel faces?
 - Kids move the panel around and see how the numbers change.
 - Kids use the compass to determine which direction the panel is facing when it has the highest number.
 - Tell students that it is the job of **Solar Installers** to determine the best direction and angle for installing a solar panel. (When you return to the classroom, watch a video on [Solar Installers](#).)
7. Ask kids if they think that angle (tilt) of the panel makes a difference?
 - Kids "guess" (make a hypothesis) what tilt will work best.
 - Kids move the panel to this position & check the numbers there
 - Kids move the panel in both directions afterwards to see if numbers go up / down.
 - Was their guess/hypothesis correct?
8. Ask kids what they think would happen if there was a cloud or if the panels were in a shadow?
 - Have kids find a place in the shadow to test the panel.
 - What happened?
9. Ask kids if there is any other place they'd like to check?
 - Test the panels there.
10. Quick discussion...
 - What things do you need to think about if you want to get the most electricity from a solar panel?
 - Direction
 - Angle
 - Shadows
11. Pack up panels and return to chalk shadow.
 - Stand in spot and retrace.
 - See how the shadow has moved/changed.
 - Discuss how this might impact someone who wants to install a solar panel somewhere.