STEM in the lab

Inspiring Idaho's future STEM workforce

SOLAR POWERED CAR

GRADE LEVELS

This activity is appropriate for grades 5-12.

MISSION

Build a solar powered car using the engineering design process.

VOCABULARY

CONDUCTOR: A person who designs, builds or maintains engines, machines or public works.

ENGINEERING DESIGN PROCESS: A series of steps that guides engineering teams to solve problems. The design process is iterative, meaning that we repeat the steps as many times as needed, making improvements along the way as we learn from failure and uncover new design possibilities to arrive at solutions.

ENGINEERING DESIGN PROCESS STEPS: Ask, imagine, plan, create and improve.

PHOTOVOLTAIC CELL: A semiconductor device that converts the energy of sunlight into electric energy.

MATERIALS

- Solar panel powered source
- 1 electric motor
- 4 wheels
- 2 axles
- Rubber band
- 12 oz aluminum can
- Masking tape
- Measuring tape
- Stopwatch
- Any other supplies that are needed to think creatively: see how many items you can re-purpose.

ABOUT THIS ACTIVITY

Engineers at Idaho National Laboratory work every day to change the world's energy future and secure our nation's critical infrastructure. Nuclear, electrical, mechanical, chemical, and environmental engineering are just a few of the engineering careers found at INL. Even though these jobs have very different focuses, engineers all use the engineering design process. It's never too early to start thinking like an engineer. Building and testing a solar car combines aspects of electrical and mechanical engineering. In this activity, students will use the engineering design process to build a solar powered car that will be able to travel 25 feet on solid ground.

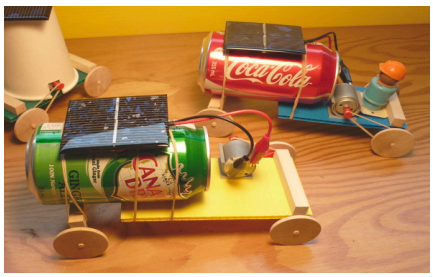


Photo Credit: sunwindsolar.com

INSTRUCTIONS

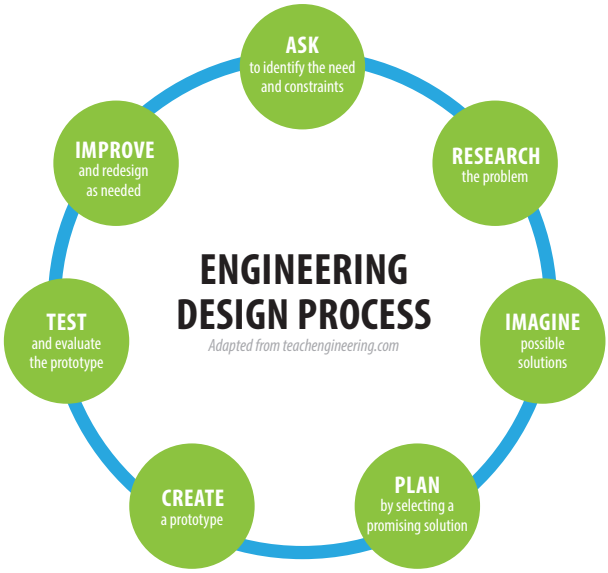
Divide students into small groups. Explain to students that they will be using the engineering design process to design a solar powered car that can travel a minimum of 25 feet on level ground.

1 ASK/IMAGINE:

How does a car's design affect the speed at which it can travel? What are the advantages/differences of a solar powered vs a battery powered car? Solar cells do not deliver as much power to a motor as a battery does. How would the weight of the car make a difference?

2 PLAN:

On a piece of paper, have every student sketch an idea about what their solar car will look like. The goal is to not only have the car complete the minimum 25 feet, but to also be the heaviest car. When every team member has a sketch or written plan, then each team member shows the drawing or plan to the others and talks about his or her idea. After looking at all the designs, the team decides what to do. This procedure ensures that every student has a voice in the design. A student may not have his or her idea used, but they have at least had a chance to be part of this process.



3 CREATE:

Each group will need a solar panel powered source, 1 electric motor (with leads), 4 wheels, 2 axles and an aluminum can. First, set up the car body, then add the axle and wheels. Next, add the motor and mount the solar panels. They will then need to attach both items to their aluminum can. Make sure that the solar panel is facing toward the sun and that it is steady. The design and size are up to the team. Any additional supplies can be added to increase the creative aspect of the vehicle but cannot add to the propulsion.

4 TRY IT:

Using masking tape, measure out 25 feet on level ground. Make a starting line. Once vehicles are completed, testing can begin. After each car has taken two test runs, students will then have 10 minutes to make any adjustments to improve their distance traveled. Using a stopwatch, record the time that each car takes on the track.

5 IMPROVE:

Once the 10-minute limit for adjustments has been met, one at a time, each team will place their car on the starting line. Using a stopwatch, record the time that each car takes on the 25-foot track. Each group will race their car once and then mark with tape where their car finished along the 25-foot track. Students measure from the front of the starting line tape to the front of their car. Groups then need to weigh their car. There will be three awards: the heaviest car that can still travel the full 25 feet, the car with the quickest time to travel 25 feet and car with the most creative design as voted on by all students.

THE SCIENCE BEHIND IT

Solar batteries, or photovoltaic batteries, don't have to ben "charged up". They do not hold a charge. When light photons hit the solar cell material, a flow of electrons is produced instantaneously, and that electricity can be used to power electrical devices such as motors and lights. When the light source stops, the electricity stops. Solar cell electricity is direct current (DC) electricity – it flows in one direction. When a solar panel is attached to a motor, the motor can be made to spin in the reverse direction by reversing the connections at the back of the motor.

EXTENSIONS

» Change the car to a propeller drive. Make the motor power a propeller instead of the wheels.

RESOURCES

» Racing with the Sun - Creating a Solar Car
https://www.teachengineering.org/activities/view/duk_solarcar_tech_act

» Solar Toy Cars
http://sunwindsolar.com/solar-models/sunnyside-up-pop-cars/#iLightbox[postimages]/0

» Beginners Notes
https://sunwindsolar.com/beginners-notes/

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For information on grants, training and student opportunities, curriculum ideas and other resources, please visit ***stem.inl.gov.***