MAINE MUSEUM OF INNOVATION LEARNING + LABOR

Energy Innovation Kit

Teacher's Guide:
Lesson 5

Made possible in part by:

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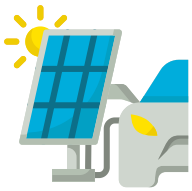
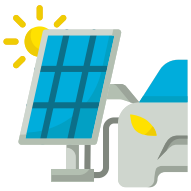


Driving on Sunshine Building a Solar Car STEAM Challenge



Innovation Kit Lesson 5

Time: 1 - 50-60 min. Class period

Lesson Notes: It is highly recommended that teachers build a solar car prior to class to familiarize themselves with the process and to identify any possible challenges for students based on their grade, age and ability level. Keep this assembled car as a model to show the class before beginning car construction. For a video on how to assemble the car visit the Sun Wind Solar website.

Learning Objectives:

- Students will construct solar cars using engineering design principles.
- Students will explain how the angle of the solar panel is placed in relation to the sun affects the energy output.
- Students will understand that the amount of current produced by a photovoltaic cell is proportional to the amount of the light hitting the cell; therefore, increasing light intensity or increasing the size of the cell itself will increase the power output of the cell.

Previous knowledge: It is recommended that students complete "From Sun to Circuits - Innovation Kit Lesson 4" prior to the construction of solar cars to establish an understanding of basic electrical circuits.

Materials Needed*

- ReVision Energy Solar car kits including directions for assembly.
- "Driving on Sunshine" Lab Reflection sheet for each student.

*If it is a cloudy or rainy day, solar cars can be charged using a flashlight or by holding under a bright lamp.

Set up

1. Have car kits ready to distribute at the beginning of class.
2. This project works best with students working in groups of 2-3. It is left to the teachers discretion whether students choose their own partners or if groups are assigned.
3. Set up a "race track." Cars run best on a flat, hard surface with open access to the sun. A playground or parking lot surface works well. Mark a start line with tape or chalk. Measure approximately 15 feet and mark a finish line.
4. Have the NBC news report "Could Solar Powered Cars Be the Future of Electric Vehicles?" ready to play with a computer and projector.

Introduction

1. Explain that students will be building a car powered by the sun. Ask students how the sun currently powers an electric vehicle. Answers should include using solar panels to create the power for your home where you then plug in your electric vehicle. Ask students if they have ever seen a completely solar powered car. Show the video "Could Solar Powered Cars Be the Future of Electric Vehicles?"
2. Ask students to summarize in their own words some of the challenges and advantages they heard in the video about producing and using a solar powered car.

Instructions, Teacher Modeling, Guided Practice

1. Show students the completed model car assembled by the teacher. Demonstrate how to charge the vehicle and how to make it go. Make sure to demonstrate how the car's speed is affected by how much sunlight is shining on the solar panel.
2. Explain that the students will be building their own solar cars, testing them and then at the end of the class period they will race their car against their classmates in a "Solar Car Derby."
3. Distribute solar car kits and review directions for assembly together as a class and answer any questions.

Independent Work Time

1. Students should use this time to construct and test their cars. Make sure to circulate around the room to answer questions or to help as the need arises but do allow students to work out the construction and troubleshooting process on their own as much as possible.
2. Students should be reminded to test their vehicles often, ensuring their solar panel is charged, wheels are turning smoothly, gears and rubber bands are attached correctly, etc. Have students troubleshoot and correct as needed.

Solar Car Derby

1. Bring the class to the designated racetrack area.
2. Have all groups line their cars up on the starting line.
3. Do one "test race." Students should now be given a few minutes to correct any problems with their cars or to make adjustments to make them move faster.
4. Let the races begin!

Closing and Homework

1. Have students disassemble the race car kits and return all materials to the designated area.
2. The "Driving on Sunshine" lab reflection sheet should be completed for homework and turned in at the next class meeting.

Standards

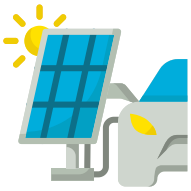
Maine Learning Results

3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

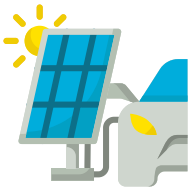
Next Gen Science Standards

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Name:_____



Driving on Sunshine
Building a Solar Car Reflection



Answer the following questions following the "Driving on Sunshine" solar car building activity.

What did you find to be the most challenging part of assembling your car? Explain.

Identify two adjustments that you needed to make while testing your car to make it run faster/straighter/etc. Describe how you fixed the problems.

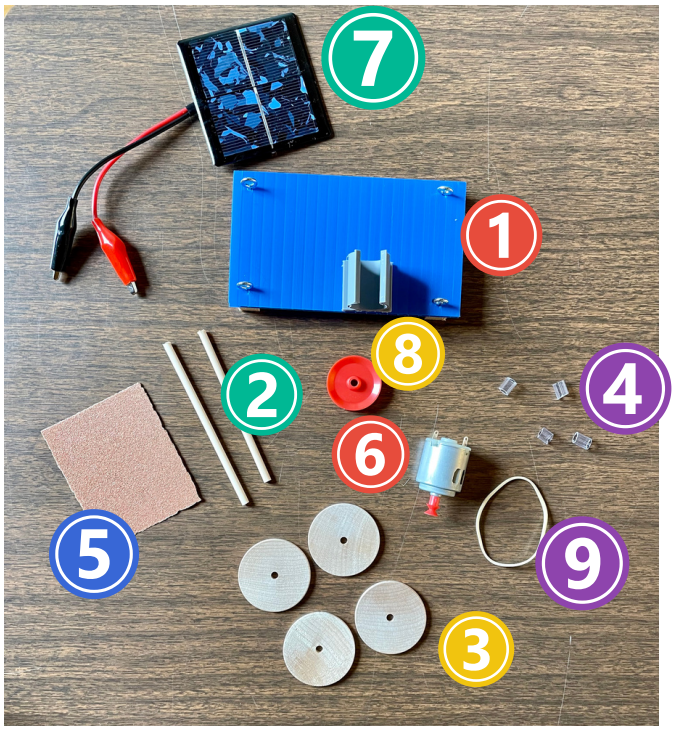
How did changing the angle of the solar panel in relation to the sun affect the speed of your car?

Based on the news report that you viewed in class and your experience building your solar car, would you want to drive a solar car? Explain.

Driving on Sunshine
Instructions for Building Solar Car

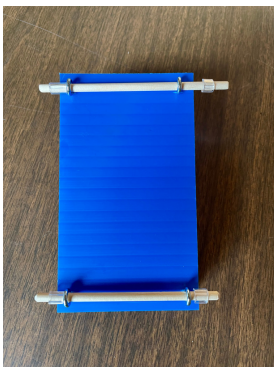
Each Solar Car Kit should contain:

1. Car base with eye screws, wooden blocks and motor clip attached
2. 2 wooden axels - one short and one long
3. 4 wooden wheels
4. 4 small pieces of clear plastic tubing
5. Sandpaper
6. Motor
7. Solar Panel with alligator clips attached
8. Pulley
9. Ruberband

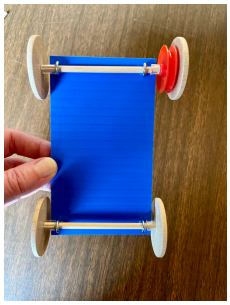


To Assemble your solar car:

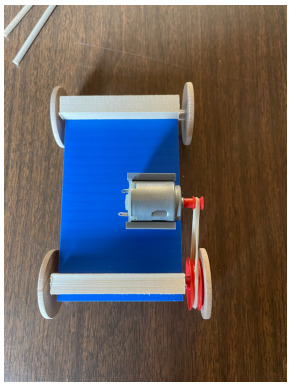
1. Use the sandpaper to GENTLY sand the ends of the axels to make them rounder. This will make it easier to attach the tubing and wheels. Careful not to sand too much. Just round the edges.
2. Put each axel through the eye screws. The longer axel goes on the back of your car.
3. Push a small piece of clear plastic tubing onto the end of each axel. This will keep the wheels away from your car base.



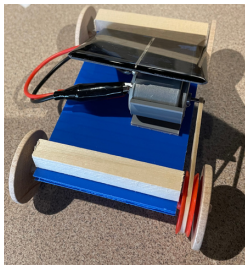
4. Push two wheels onto the front axle.
5. For the rear axle - attach one wheel to the side opposite the motor clip on the base of your car. On the side with the motor clip attach the red pulley to the axle and then place the wheel on the outside.

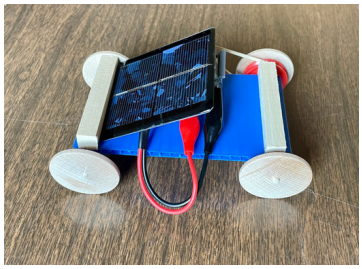


6. Flip the car over so that the wooden blocks are facing up and the car base is now standing on its wheels. Test that your car rolls smoothly and that the wheels and pulley are tight on the axle and turning with it.
7. Put the motor in the motor clip with the red piece facing out.
8. Loop the rubber band around the red pulley attached to the rear axle and the red piece of the motor. Make sure that there is easy tension. The rubber band should not be too loose or too tight.



9. Attach the alligator clips of the solar panel to the two metal terminals at the back of the motor. Solar panels produce direct current electricity. Note that reversing the connections at the back of the motor will reverse the direction of the motor's spin.





10. Time to race! Point your solar panel toward the sun or change with a flashlight and see how fast it can go!