Fab Lab Design Brief

Fabricated Solar Car

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Intermediate Unit 1
6th - 8th Grade

Summary

This lesson enables students to design and fabricate their own solar-powered car! Students will laser cut cardboard/wood to uniquely design the body/wheels of their car assembly. It's all up to the individual to then create a casing for a small DC motor to attach onto an axle (dowel rod), using plastic gears while calculating the best gear ratio. After assembly, a small solar panel is connected to the DC motor to bring their car to life! **Estimated Time: Five (1 hour) Days**

Standards

National Standards for Technological Literacy:

1. STL1.6-8.G - The design of structures includes a number of requirements.
2. STL3.6-8.D - Technological systems often interact with one another.
3. STL8.6-8.E - Design is a creative planning process that leads to useful products and systems.
4. STL18.6-8.G – Transportation systems are made up of subsystems that must function together for a system to work effectively.

State Academic Standards for Science, Technology and Engineering Education:

1. PA 3.3.12.A1 - Explain how parts are related to other parts in weather systems, solar systems, and earth systems.
2. PA.3.4.8.C1 - Evaluate the criteria and constraints of a design.
3. PA.3.4.8.C2 - Explore the design process as a collaborative endeavor in which each person in the group presents his or her ideas in an open forum.

Objectives

1) Students will fabricate a small motorized car using power from a solar cell.
2) Students will apply basic knowledge on solar power and how it powers a small DC motor.
3) Students will compare and contrast different gear ratios to effectively move a vehicle.

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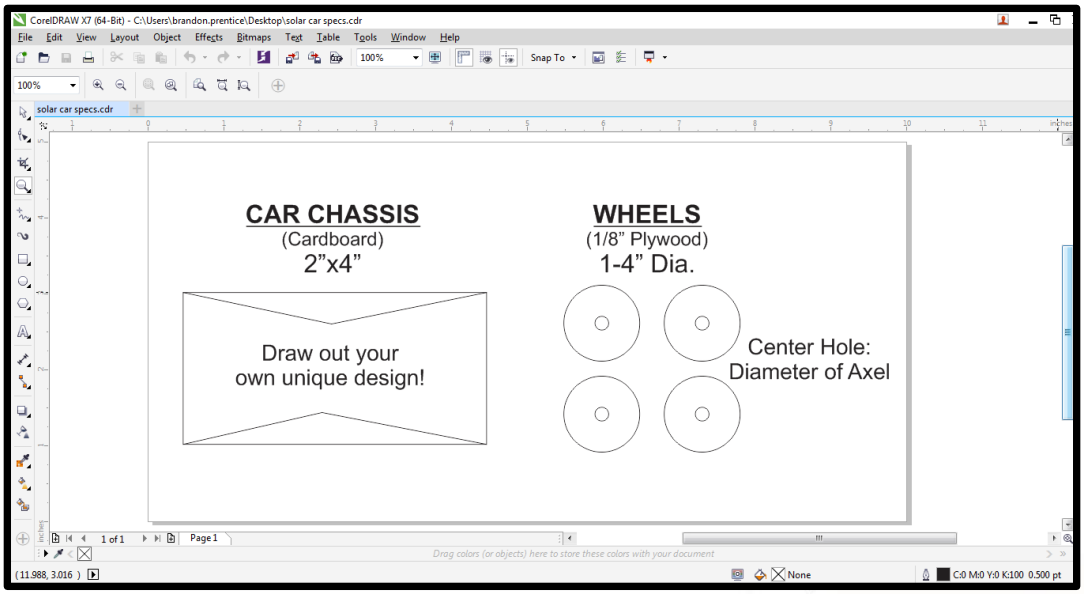
Name: _____ **Date:** _____

Fabricated Solar Car

Design and create your very own electric car! There are multiple ways to create this easy functioning vehicle by designing different body types, gear ratios, wheel sizes, and more. Fabricate your own parts to figure out which features give your car the most power and speed!

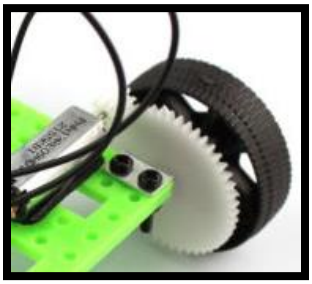
Days 1&2: Design and Laser Cut Chassis/Wheels

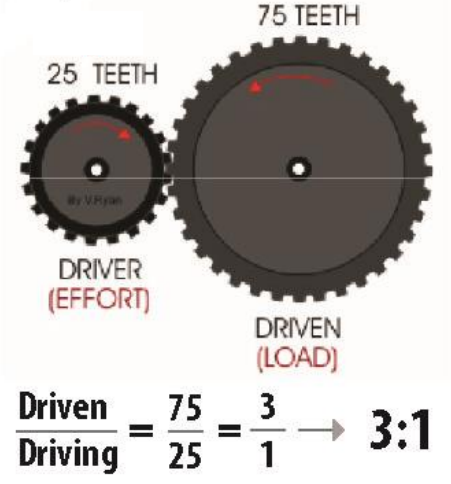
Using CorelDraw, design your own vector cutout for both the chassis and wheels of your car using the constraints below:



Days 3&4: Attaching Gears and Solar Panel

Driver/Driven Gears: Attach a small driver gear to the DC motor and a larger driven gear on the front or back axle. Create a unique gear ratio that you find effective.





Axles: Depending on the structure of the chassis, axels can be attached in multiple ways such as using straws to house them, or laser cutting cardboard edges underneath with tiny holes to align axles in place.

DC Motor: Create a casing for the motor itself that you can make from laser cut cardboard, wood, etc. to align/ attach the motor onto chassis/larger driven gear. Tape, rubber bands, and/or glue can be recommended.

Solar Panel: Either solder or crimp together the positive wire (+) of the DC motor and the positive wire (+) of the solar panel. Do the same with both of the negative wires (-) as well.

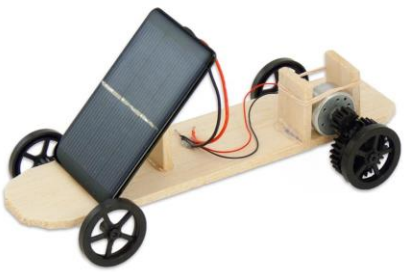
NOTE: Solar panels can be replaced with battery packs that output anywhere between .5-6v

Day 5: Modifying & Testing It Out!

This is the time to evaluate and try out all car designs. Reflect on the pros and cons of your design and ask yourself questions. *Is your gear ratio limiting the speed? Is the DC motor installed properly? Are the wheels too big/small?* Reference the pictures on the right to see past examples:

Resources:

3v 160ma Solar Battery Panel
Small DC Motor .5-6v
Pack of Assorted Plastic Gears
Cardboard for Chassis/body
1/8” Plywood for Laser Cut Size Wheels
3/16” dia. or Smaller Dowel Rods (Axels)



Solar Car Rubric

Name: _____ Date: _____

Students are to use the following rubric to target expectations and achievement to complete the fabricated solar car project.

Points	10 - 12	7 - 9	4 - 6	1 - 3	Score
Required Elements	The solar car has all the features that were required.	Most of the required features are included for the car assembly.	Speakers are missing a few features.	More than half of the required features are missing.	
Creativity	The student's car is designed very well.	The student's car is designed typical.	The student's car are designed below average.	The student's car are designed very poorly.	
Appearance	The appearance of the car is exceptionally attractive	The designs are mostly attractive and neat.	The designs are not well thought out or organized.	The appearance of the designs are messy and unpractical.	
Construction	Construction is very symmetrical and sturdy. Everything lines up.	Construction is solid and mostly sturdy. Most components line up.	Not very solid. Not sturdy in places. Parts don't line up. Symmetry is off.	Construction is poor. Nothing lines up or is sturdy. Joints are not solid.	
Power /Gearing	The DC motor is properly installed and connected well with the gears.	Most of the connections are good and the DC motor is functional.	A lot of the connections are not done well and DC motor wasn't installed properly.	The gear connections are made poorly and DC motor will not move car.	

Total Score: /60