Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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****Solar-Powered Cars Engineering Challenge

**Introduction**

Not only is the sun a source of heat and light, it’s a source of electricity too! Solar cells are used to convert sunlight to electricity. Solar energy is a clean source of renewable energy to replace fossil fuels.

A solar cell, also called a photovoltaic cell (PV cell), is a light-sensitive semiconductor device that uses the photoelectric effect to convert sunlight into electricity. The amount of current produced by a PV cell is proportional to the amount of light striking the cell. Wires attached to the PV cell allow the electricity to power calculators, watches, recharge batteries, electric motors, and many more electrical devices.

The purpose of this activity is to design a car that runs on solar power. The lab begins with an introductory activity to build and test a solar car prototype. Then different variables are tested to determine their effects on the car’s performance. Finally, the prototype is modified to increase the efficiency of the car, measured by its speed.

**Materials**

Cardboard base, 10.5cm x 14 cm (if your cardboard base is not this size, measure and cut it).

Scissors, DC motor, Straw, Ruler, Tape, Stopwatch, Solar mini panel, Paper, Solar Bag of wheels, axles, and gears

**Part 1- Assemble the Car**

**\*\*\*Follow the instructions on the “Building the Solar Car” sheet to build the solar car.\*\*\***

**Part 2- Testing the Car**

1. Take the car outside to an area designated by the teacher, keeping the solar panel covered with your hand or a piece of paper.

2. Set the car on the ground and uncover the solar panel.

3. The car should start moving across the ground. If it does not, check the following:

a. The motor does not turn. Check the wire connections.

b. The motor spins, but the car does not move. Check the gear alignment. Make any necessary adjustments.

4. Note which direction the car moves. If the motor is in front, the car has “front-wheel drive.” If the motor is in the back as the car moves, the car has “rear-wheel drive.” (Note: Switching the wire connecting will reverse the current, and the motor will spin in the opposite direction.)

5. If the car veers to the right or left, check the axle alignment and adjust as needed.

6. Once the car is functioning well, go to the start of the prepared race track.

7. Set the car down at the start, and time how long it takes to travel 3 meters. Record the time and any observations in Data Table A.

8. Repeat step 7 for a total of 5 trials.

9. Calculate the car’s speed for each trial and the average speed. Record the values in the data table.

**Data Table A.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trial** | **Distance (m)** | **Time (s)** | **Speed (m/s)** | **Observations** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |
| **5** |  |  |  |  |
| **Average** |  |  |  |  |

**Part 3- Engineering Challenge**

The challenge is to modify the solar car in order to achieve a faster average speed than in Part A on the same 3-m track. **The motor, motor gear, wheels and axles must remain the same**. **The solar panel may be altered but must remain intact**. **The cardboard base must be used for the chassis, but it may be modified.**

**Consider the following**: Make a list of variables that might affect the car’s performance. Which of the variables listed may be tested by modifying the solar car? Which of the variables listed cannot be controlled? Why is it important to change one variable at a time?

**Additional Materials to purchase: Budget: \_\_\_\_\_\_\_\_\_**

|  |  |  |  |
| --- | --- | --- | --- |
| **Material** | **Cost ($)** | **Quantity** | **Cost X Quantity** |
| **Washer** | **$5 each** |  |  |
| **Aluminum Foil** | **$10/square** |  |  |
| **Card Stock** | **$10** |  |  |
| **Masking Tape** | **$5/meter** |  |  |
| **Total Cost= \_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

Once the final design of solar car is ready, conduct five trials on the track and record the time for each trial in Data Table B on the worksheet. Calculate and record the speed of the car in Data Table B for each of the five trials and determine the average speed.

**Data Table B.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trial** | **Distance (m)** | **Time (s)** | **Speed (m/s)** | **Observations** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |
| **5** |  |  |  |  |
| **Average** |  |  |  |  |

**Post-Lab Questions and Calculations**

1. Describe the final design of your group’s solar car and give a reason for each modification.

2. Was your final design from Part B faster than the prototype built in Part A? If so, by how much?

3. If allowed to make other changes, and more materials were available, what else might be done to improve the car’s performance?

**Clean-up**

**The wheels, axle, motor, motor gear, and solar panel must be taken apart to be used by the next class.**

**If you altered the cardboard base, you may throw it away. Throw away any tape, foil, cardstock or paper that you used. Return washers to the front table.**