Teacher Instruction Guide:

Harnessing the Sun's Energy with a Solar-Powered Car

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Context:

The solar-powered car project is designed to teach 4th and 5th grade students of all abilities about the importance of solar power and its necessity in the future as a primary energy source through hands-on activities. The main activity involves computing the speed of a small solar powered toy car by measuring out a distance and timing the car while it travels the distance. The light source which powers the car is mounted to a structure at three different heights which show a big difference in the energy output of the car. The inspiration behind the activity is one of the fourteen grand challenges for engineering: make solar energy economical. The usual take on this challenge is to improve the materials inside the solar panel or improving the connection between a solar panel and a battery which is the typical method of storing solar energy. Instead, this demonstration focuses on creating the optimal environment for a solar panel to collect the most solar energy and immediately turn it into kinetic energy, the energy of motion. Making solar energy more economical can also be accomplished by getting more energy out of the exact same solar panel. The solar-powered car activity highlights this focus by having the students compare the average speeds of the car when the light source is located at differing heights above the car. The students will be able to relate the proximity of the light source to the maximum speed of the car while gaining experience with the scientific process of running multiple trials, finding averages of the data, and dealing with error caused by variables in an experiment.

Instructions:

1. Divide the students into groups of two to three. Each group will need a solar-powered car, one light box, four cups, and one timer. See Appendix A for material identification.

2. Instruct each group of students to measure out a distance of 10 feet (or less) depending on the area of the classroom on the ground. The students should use the tape measurer. The students should mark the start and finish lines with masking tape.

3. Have each group place the frges place

5. Slide the light box along the path of the car. Always turn the light off between trials to prevent the box from overheating.

6. Instruct one student to time how long it takes for the front of the car to travel the distance between the start line and the finish line.

7. Instruct the group to record the measurements from each trial on their handout (see Appendix B).

8. Repeat steps 3-6 with each different height light box. Perform two trials at each height.

9. Have the students calculate the speed for each trial by using the equation speed = distance/time by using long division or a calculator.

10. Instruct each student to plot their speeds on a graph of speed vs height of light box to compare the speeds the car traveled to the height of the light box used.

11. Instruct the student to complete the handout then distribute the take home activities (Appendix C).

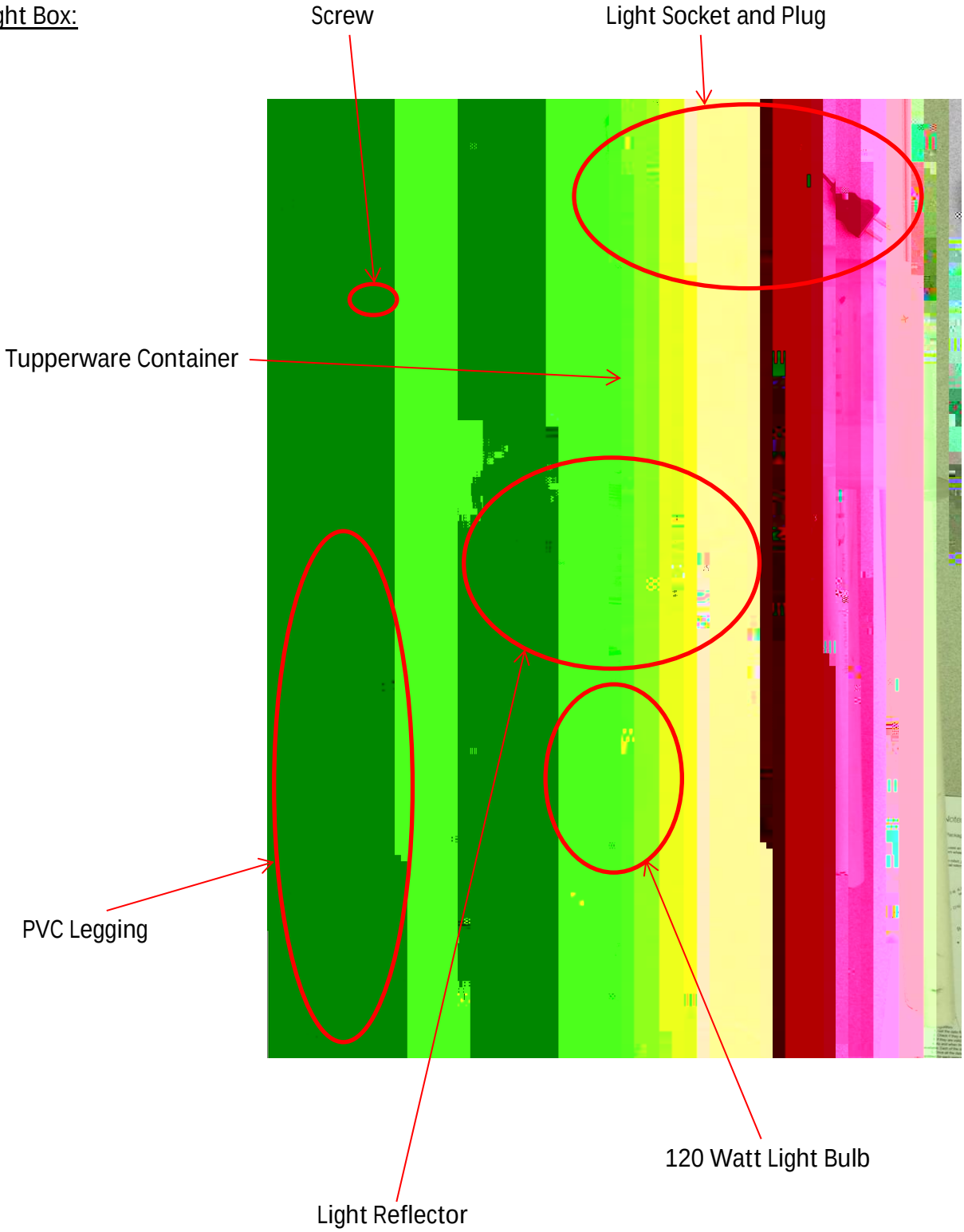
Additional Learning Resources:

What is the solar energy grand challenge?

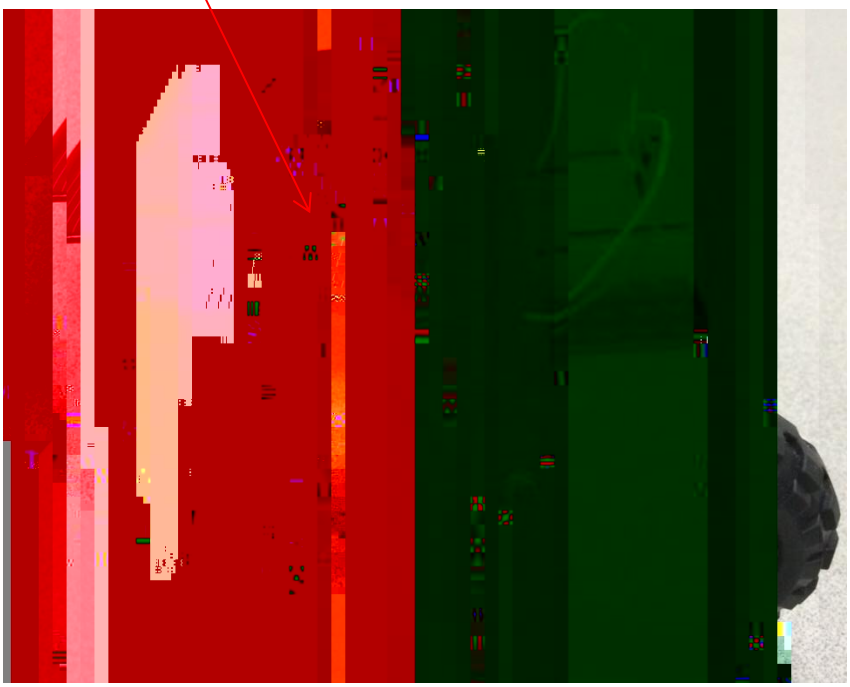
It is currently very expensive to extract energy from the sun through the use of solar panels. How can solar energy begin to be implemented worldwide? To start, it would be much easier if it was more efficient and more economical. The energy from the sun can provide 10,000 times the energy currently used on earth each day, and is renewable. Current solar panels are only 10 to 20% efficient in retrieving the energy from the sun, and are quite expensive to produce. Engineers are needed in order to help find ways to capture the energy from the sun more efficiently and in a more cost effective way.

Appendix A: Material Identification

Light Box:



Solar Car: Solar Panels Breadboard



Experiment Setup:

Light Box

Solar Car

Cups

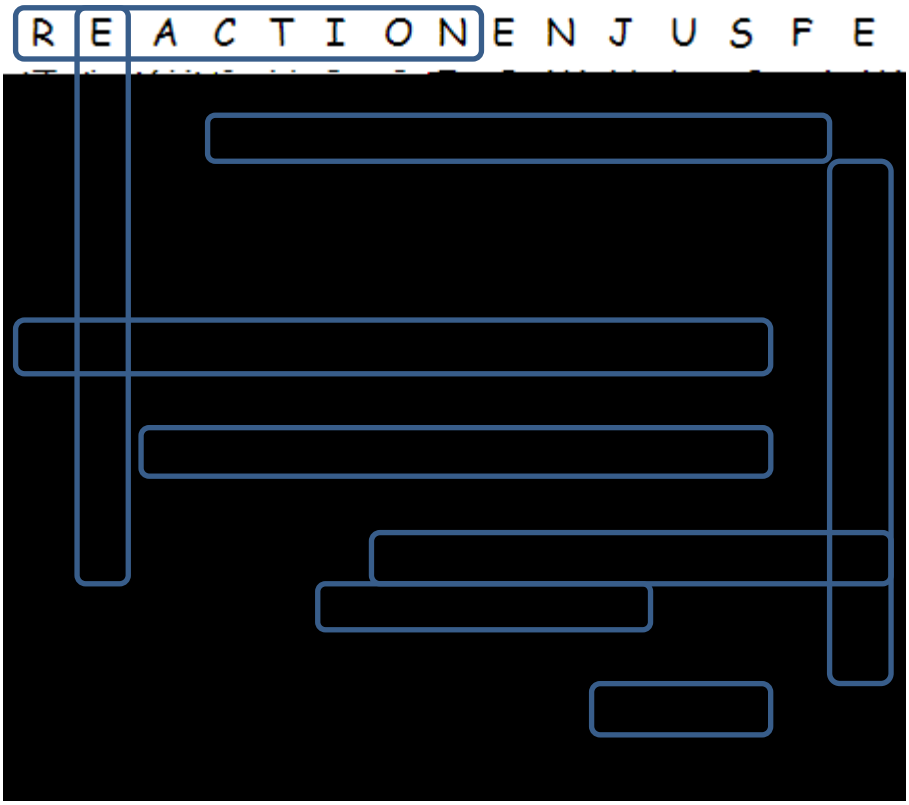
Appendix B: Handout

Name: Key Date:

How fast will the solar powered [redacted]?

Trial:	Height of light:	Distance:	Time:	Speed:
1		ft	s	ft/s
2		ft	s	ft/s
3		ft	s	ft/s
4		ft	s	ft/s

Solar Energy: Word Search Key



Electricity

Faster

Kinetic Energy

Scientists

Solar Energy

Solar Panels

Sun

Solar Energy Fill in the Blank

From the Sun, the [redacted] can be used in many ways. The type of [redacted] is called [redacted]. This type of energy can be [redacted] into electricity by [redacted]. The [redacted] in the solar [redacted] it. The flow of electrons is [redacted]. When a solar panel is connected to a car it [redacted] car move.

[redacted] is a type of energy that is present when something [redacted] is moving. The better a solar panel is at gathering the sun's energy [redacted] the [redacted] the car will go! [redacted] and [redacted] work hard to make solar panels affordable and even [redacted].

Word Bank:

Electricity	Kinetic Energy	[redacted]
Engineers	[redacted]	Solar panels
Faster	[redacted]	Sun

Solar Energy Word Search

R E A C T I O N E N J U S F E

Electricity

Faster

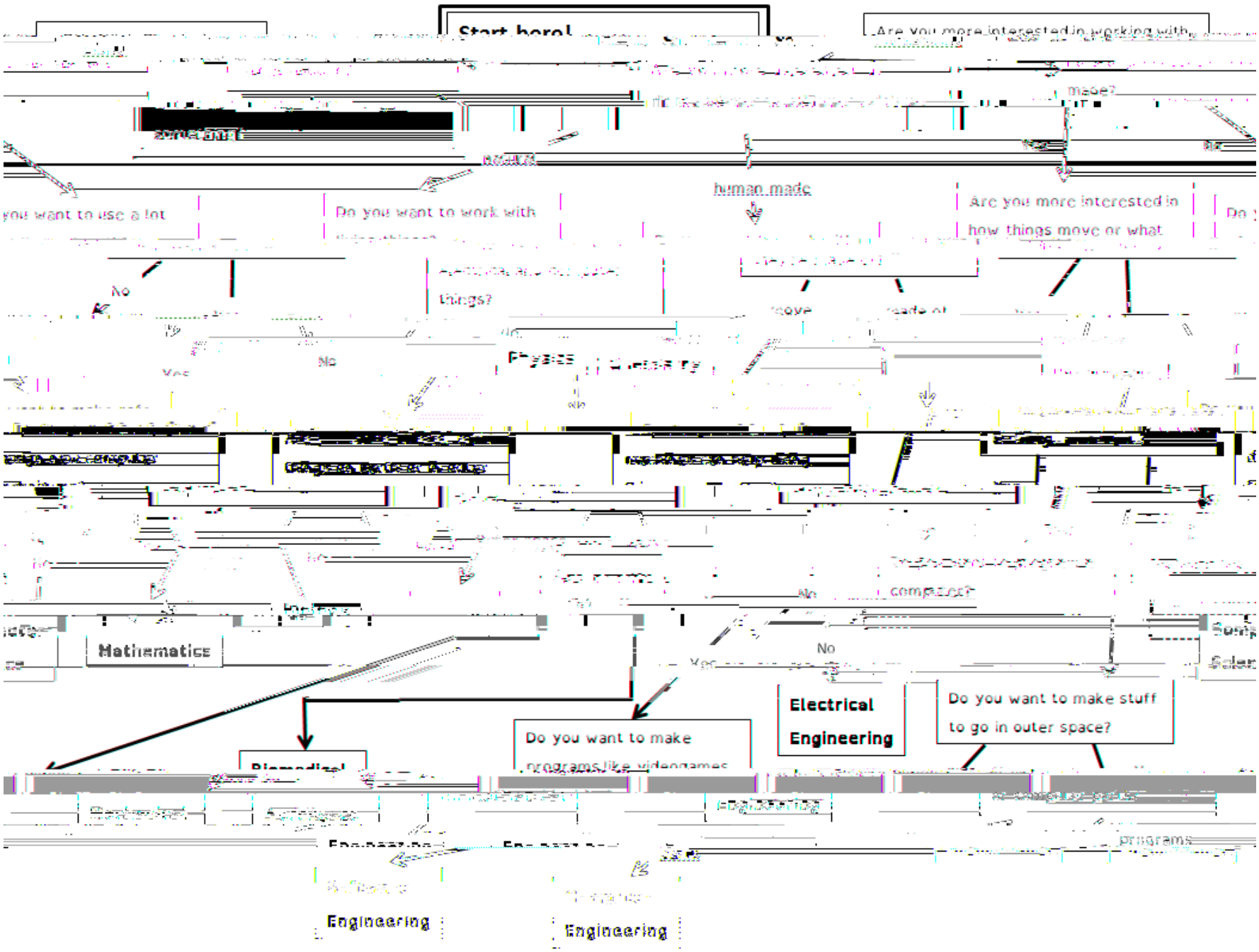
Kinetic Energy

Scientists

Solar Energy

Solar Panels

Sun


Start here!
Are you more interested in working with
made?
human made
you want to use a lot
Do you want to work with
things?
Are you more interested in
how things move or what
No
Yes
No
Physics
No
Mathematics
No
Yes
No
Electrical
Engineering
Do you want to make stuff
to go in outer space?
Do you want to make
programs like videogames
Engineering
Engineering
programs