

Scitech Activities: Solar panel cars

Time: 4 hours (broken down into 4-1 hour classes)

Standards:

4th grade science content standards:

PS1g. Students know electrical energy can be converted to heat, light and motion.

I&E6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

5th Grade Science Content Standards:

I&E6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

6th grade science content standards

3a. Students know energy can be carried from one place to another by heat flow or by waves, including water, light and sound waves, or by moving objects.

3d. Students know heat energy is also transferred between objects by radiation (radiation can travel through space).

4a. Students know the sun is the major source of energy for phenomena on Earth's surface; it powers winds, ocean currents, and the water cycle.

4b. Students know solar energy reaches Earth through radiation, mostly in the form of visible light.

6a. Students know the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.

6b. Students know different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable

Topical Objectives:

- Students will experiment with solar power by using motors powered by solar panels.
- Students will design, construct and test a solar powered vehicle to demonstrate their understanding of solar energy and how it is converted into mechanical energy.

Safety Precautions:

Students should be reminded that the lamps used to test their solar panels will get HOT. Students should also be aware that the spinning component on their motor will tangle hair or loose threads and can pinch skin if not used properly. Caution should be used with hot glue guns, box cutters and large scissors are to be used by teachers only.

Materials:

(For each student)

1 solar panel with wire and motor

Materials to be used for wheels:

Lids, film canister tops, small containers, bottle caps

Materials to use as car bodies:

Cardboard, foam core bottles, plastic containers, milk cartons

Straws

Skewers

Pipe cleaners

Duct tape

Masking tape

Scissors

Hot glue guns and lots of hot glue sticks

Rubber bands of various sizes

Black plastic pulleys of various sizes

Clamp lamps for testing vehicles

Optional: electric drill with bits or hammer and nails.

Day One

Solar Energy and panel introduction

Preparation:

1. Set up clamp lamps in the room for testing panels
2. Have solar panels and masking tape on hand.

Procedure:

1. Discuss the term Solar. What does it mean? Energy comes to earth from the sun, but how do we convert it into electricity that we can use? Briefly review electricity
2. Hand out solar panels and observe the structure of the panel, how it's shaped to catch light and radiation. Discuss how it functions. Silicon in crystalline form reacts with the heat from the sun and displaces electrons within the silicon atoms. Conductors placed within the silicon help collect the displaced atoms, creating a circuit.
3. Pass out wires and motors and describe how to properly attach the motor to the panel. Make sure the students test their panel on the clamp lamps making sure it is connected properly.

4. Once the students have identified the one moving part on their motor, they will begin to design a vehicle to capture the mechanical energy created by their solar panel. If more help is needed discuss how a bicycle works and axles. If pre-made solar vehicles are available have students manipulate these to get ideas or look at photos of other solar panel vehicles.
5. Any ideas should be documented in their journals, along with a brainstormed list of materials they could use.
6. Have each student put their name on their solar panels and leave them in the class.

Day two:

Begin construction of solar powered vehicles

Preparation:

1. Set up clamp lamps in as designated testing station
2. Divide up all building materials into designated boxes. For example, all glue, tape and scissors in one bucket, all cardboard, foam core and possible parts to be used for the body of the car in another, anything to be used for wheels and axles in another.
3. Set up a hot glue station/ box cutter station to be overseen by an adult.

Procedure:

1. Introduce Axles. An axle is what will hold our wheels together and also attach them onto our cars. Demonstrate the straw and skewer method of creating an axle, remind them that their wheels need to spin freely and smoothly in order to be successful.
2. Introduce the building supplies, tools, stations and buckets.
3. Have the students draw or revisit their brainstormed ideas while you call up each group to choose their building supplies.
4. Building time! Any problems? Wheels spinning smoothly? Body not too big or heavy? Are wheels securely attached to their axle?
5. Clean up time!

Day three:

Continue with construction of solar cars

Preparation:

1. Set up clamp lamps in a testing station.
2. Set up building materials and supplies
3. Set up gluing, cutting stations, hole hammering station.

Procedure:

1. Students should be building as they need. Remind them about their wheels needing to spin. Help with any problem solving, test, re-test, re-test.
2. If all wheels and axles are attached students should be testing their motor, and thinking about how to attach their motor to their wheels, placement of the motor and solar panel, etc.

3. Have the students bundle all supplies together and label everything to continue building the following day.
4. Clean up time! All re-usable supplies back in the buckets.

Day Four:

Wrap up solar car construction (an extra day may be added depending on schedule)
Test them out in the sunshine.

Preparation:

1. Set up clamp lamps with extension chords. (to test for motion)
2. Set out building materials and supplies.
3. Set up a gluing, cutting and hole punching station.

Procedure:

1. Students should be testing with the sunlight this time, retesting, problem solving, and fixing their last details. * remind them to be aware of friction, weight, angle of their panel, and the tension on their rubber band. Double check all moving parts.
2. Minor alterations and possibly remaking of certain parts.
3. When solar car is complete and successful (rolls on it's own) have each student draw a detailed picture of their completed solar car , labeling all moving parts including their solar panel and motor. If time allows have students describe how it moves or stops in the sunlight and the connection between solar energy and the motion of their car.