Investigation Three – Solar Oven

Standard 06:
Students will understand properties and behavior of heat, light, and sound.

Objective 1:
Investigate the movement of heat between objects by conduction, convection, and radiation

Intended Learning Outcome
1 – Use Science process and thinking skills
2 – Manifest scientific attitudes and interests
4 – Communicate effectively using science language and reasoning

Standard VI

Objective 1

Background Information

It's possible to fry an egg on a sidewalk, but you need a very hot, sunny day and the cooking process takes a while. Using a solar oven is more efficient. You've probably taken a magnifying glass and focused sunlight through it to burn paper. The curved reflector in a solar oven does about the same thing, concentrating all the sunlight that strikes it into a very hot spot near the center of the oven. The efficiency of an oven made from a bowl is affected by the size and shape of the bowl; a continuous curve shape will focus the parallel rays of sunlight better. Both homemade solar ovens will be affected by how smoothly you are able to apply the aluminum foil. Be aware of things you can't control, like the movement of the sun. (You can tell the sun is moving by watching the oven's shadow.) As the sun moves, so does the oven's "hot spot", so adjust the oven accordingly. Ideally, the reflector should point directly at the Sun at all times.

Pre-Assessment/Invitation to Learn

We have had electricity for cooking for about a century. Before the inventions of the use of electricity how did people prepare their food? (Most will say fire, preserves, smoking meat.) Ask them if they think the sun can cook our food. How can this be done? Show them a solar oven you have made. Tell them today you are making solar ovens.

Materials
- ☐ Mixing bowl or salad bowl (wooden bowls are good because they are often rounded without the flat bottom usually found in plastic or glass bowls)
- ☐ Aluminum foil
- ☐ Doubled-sided tape
- ☐ 20 cm x 35 cm sheet of flexible cardboard
- ☐ 1 m of string
- ☐ Scissors
- ☐ Marshmallows
- ☐ Long forks or skewers

Instructional Procedures

1. Never look directly at the sun or at reflected, focused sunlight. It can damage your eyes permanently.
2. Design One: Line the inside of a large bowl with aluminum foil, shiny side up. Use several small pieces of double-sided tape to secure the foil. Press the foil close to the bowl and make it as smooth as possible.

3. Design Two: Cover one side of a sheet of cardboard with aluminum foil, shiny side up, securing the foil with double-sided tape. Bend the cardboard into a semicircle, with the foil on the inside of the curve. Wrap a length of string twice around the cardboard semicircle and knot the string at the back.

4. Face both ovens into the sun. You may want to prop up and angle the cookers by making a base with Plasticine. Find each oven's "hot spot", the spot where the sun's reflected rays crisscross. Different ovens have different hot spots. To find the bowl oven's hot spot, slowly put your open hand into the bowl until you feel the "hot spot"; **don't hold your hand in the hot spot!** You'll probably find the cardboard oven's "hot spot" near the middle of the string, closer to the foil.

5. Put marshmallows on the end of long skewers and hold a marshmallow in each oven's "hot spot". Which oven cooks a marshmallow the fastest? Can you alter an oven to make it work better (e.g., change curve of cardboard)?