**5E Template- Science**

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| **Content Area: Science** | **Grade Level(s): 6** | **Topic: Solar Energy** |

**Standards (SOL)**

 **Science 6.1b -** precise and approximate measurements are recorded

 **6.1e** – a method is devised to test the validity of predictions and inferences

**6.1i** - models and simulations are designed and used to illustrate and explain phenomena and systems

 **6.2b** - role of the sun in the formation of most energy sources on Earth

 **6.2d** - renewable energy sources

 **6.3b** - the role of radiation and convection in the distribution of energy

**Objectives (UKD’s) – The students will work in groups and build three different solar cookers and find the most efficient one.**

**Materials & Resources -** The general principle of a solar cooker is to heat food using the sun, which shines directly and can also be reflected. Dark cooking utensils absorb heat energy. A glass top traps the heat inside. In this activity, students will be measuring the temperature of cooking sur-faces for three different types of solar cookers, a reflective box cooker, a

cone shaped cooker, and a black box cooker. This activity concentrates on measuring and comparing the temperatures produced by these cookers.

In commercially available solar ovens, cooking times are comparable to a conventional oven as the temperature can reach 450°F. In these student made cookers, cooking times will be much longer, as they will typically reach a maximum 95°C in direct sunlight. Some quick-cooking foods include hot dogs, sliced frozen cookie dough, s’mores, and nachos.

Thermometers for all three cookers

• Materials for Solar Cooker #1 (box panel cooker)

- 1 pizza box

- appropriate cutting tool (scissors, Xacto knife)

- aluminum foil

- plastic wrap

- black construction paper

• Materials for Solar Cooker #2 (simple cone cooker)

- 1 90 x 90 cm poster board

- aluminum foil

- rubber cement

- 3 brass brads

- appropriate tool for punching holes for brads

- 1 box 30 cm x 30 cm x 30 cm (i.e. copier paper box without lid)

- oven cooking bag

• Materials for Solar Cooker #3 (modified box panel cooker)

- 1 cardboard box approximately 30 cm per side

- cutting tool

- black paint

- paint brush

- duct tape

- oven cooking bag

**Safety Considerations –** Students will wear safety goggles. When the food is done cooking, pot holders will be used. The teacher or assistant will take the food out of the solar cooker. Teacher or assistant will make all cuts with the Xacto knife. The teacher will make holes in the posterboard for solar cooker #2, and the box cuts for solar cookers #1 and #3.

**Engage – Time Estimate 5 minutes**

“It’s hot enough to fry and egg on the sidewalk” is a phrase heard in the summer. It certainly felt like that around here back in July. But can you really use the sun to cook? Today we’re going to find out. Have any of you ever used the sun to cook anything? I have left things in the sun to melt or to allow bread dough to rise, but never used the sun to cook anything. Do you think there’s anywhere in the world where they do use the sun to cook? Where do you think that might be (near the Equator or in third world countries where they have no choice but to use the sun to cook)?

**Explore – Time Estimate 45 minutes**

How to assemble solar cooker #1

1. Put a few sheets of newspaper in the bottom of a pizza box. Cover the newspaper with black construction paper to absorb heat.
2. Cut a flap out of the top of the pizza box two inches from the sides and front but attached in the back. Bend it back and cover the inside of the flap with aluminum foil.
3. Tape plastic wrap across the hole left by the flap.
4. Close the box.
5. Use a book or tape to prop open the flap so that the aluminum foil can catch the sunlight and reflect it onto the marshmallow.

How to assemble solar cooker #2

1. Cover the poster board with aluminum foil (shiny side up).
2. Bend the posterboard, foil side in, into a cone shape and glue it together with rubber cement.. The cone should still be open on both ends.

3. Have your teacher poke holes in the poster board and put brads through the holes to reinforce the cone seam.
4. Prop the cone in the box with narrow end pointing down.

5. Allow this solar cooker to “warm up” out in the sun for as long as you can
(at least 15-20 minutes)
6. Now put food in an oven bag

7. Put the oven bag on the bottom of box in the centre of the cone.

8. Allow to cook for 30 minutes.

How to assemble solar cooker #3

1. Cut the corners of the box from top to bottom.
2. Paint the inside of the box black and allow to dry.
3. Once the paint has dried raise the corners part of the way and tape with duct tape. Allow for the box to have a wide open feel.
4. Place the food to be cooked in the middle of the box.

Put thermometers in all three cookers and monitor the temperature every 10 minutes during the cooking process.

The sun is very hot and in solar cookers can get to over 95°C. This radiant energy from the sun is useful.

**Explain -- Time Estimate 5-10 minutes**

Black absorbs sunlight. The sun can get very hot and heat is needed to cook food. Materials that are shiny reflect and concentrate heat. All these things are parts of the designs you used for your solar cookers.

**Extend -- Time Estimate 15 minutes**

The solar cooker that works the best will be compared to commercial solar cookers that we can find advertisements for. What characteristics that worked for our class are incorporated into products already on the market? Are all solar cookers black?

**Evaluate -- Time Estimate 5 – 10 minutes**

 The students will cook for the same amount of time and see which one is the closest to being done. Those that are not done cooking will continue cooking until the items are done.

**Plans for Diversity**

*Student(s): Category/Characteristics: Accommodations:*

Special needs students will work with their classmates on the project and they will have jobs within the group that contribute to the project without being overwhelming to them.

I may allow a group of motivated students to design their own solar cooker based on the three designs they see and have four different ones to compare.

**Connections –** The sixth grade science curriculum includes objectives on solar energy and renewable energy and this lesson will combine those two objectives and may give a student an idea on how to become more self-sustaining in energy development. This could lead to a student finding another use for solar energy and may be something they do their science fair project on. Depending on the success of the solar cooker, the concession stand at the high school may consider something like this.