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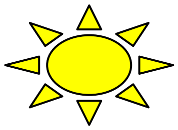


Earth and Space Systems: Grade 1 – Daily and Seasonal Cycles

**Specific Expectations Addressed**:

***Understanding Basic Concepts*** – identify the sun as a source of heat and light

***Developing Skills of Inquiry, Design, and Communication*** – record relevant observations, findings, and measurements, using written language, drawings, concrete materials, and charts (e.g. measure and record changes in temperature)

***Relating Science and Technology to the World Outside the School*** – identify features of houses that help keep us sheltered and comfortable throughout daily and seasonal cycles (e.g. lights, furnaces, [oven/stove])

**Background**:

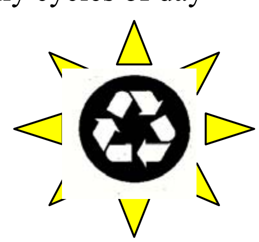
**Finding the *"Sun"* Total of all Parts**

Our universe and all the stars began with fire a long, long time ago. The fire – or heat and light – of our closest star, the sun, is the source of all our energy on earth. Although it is 150 million kilometers away, this gigantic fireball of over 18 thousand degrees centigrade, made of 72% hydrogen and 28% helium gases, has awesome and dramatic effects on our planet.

Solar energy reaches the earth in approximately eight minutes. This energy takes many forms: ultraviolet light, visible light, infrared radiation, and other forms of radiant, or electromagnetic, energy. Fortunately, not all of the radiant and solar radiant energy reaches the earth's surface where it would be too powerful and destructive for life. Some of the energy is reflected back into space and some (especially ultraviolet radiation) is absorbed by the ozone layer. The remaining solar energies are life-giving energies which warm and light the earth (and moon!); photosynthesize the green plants; power the recycling of critical chemicals and elements (carbon, phosphorus, nitrogen, water, oxygen); and drive the seasons, climates, and weather systems that distribute heat and fresh water over the earth's surface.

Since the earth is on a tilt / slant of 23.5%, and constantly moving in a counterclockwise rotation, the sun's solar energy strikes the earth's regions differently, either directly or indirectly. Solar energy strikes the earth directly along the Equator and indirectly at the Poles, therefore producing the hot central climates and cold polar climates. The atmosphere surrounding the earth is also constantly cycling or moving around and it tends to even out these temperature differences by transporting warm air from the Equator to the Poles and moving cold polar air towards the Equator. Finally, because the earth itself is constantly rotating, these air movements are deflected and even complicated by the daily cycles of day and night (heating and cooling).

Thus, due to the sun and the circular and cyclical movements of the earth around the sun – and the atmosphere around the earth – the earth enjoys not only heat and light, day and night, but also seasons, climates, and weather systems. The sun *is* our sum total for energy.



**Procedure:**
**Part 1**

***Relating Science and Technology to the World Outside the School*** – identify features of houses that help keep us sheltered and comfortable throughout daily and seasonal cycles (e.g. lights, furnaces, [ovens])

***Developing Skills of Inquiry, Design, and Communication*** – record relevant observations, findings, and measurements, using written language, drawings, concrete materials, and charts (e.g. measure and record changes in temperature)

1) Provide each student with large sheet of manila paper or chart paper and coloured catalogues or newspaper flyers with home appliances, furniture (Sears, Canadian Tire, Home Depot, etc.)

2) Have each student sketch an outline of their own home: in an apartment, town home, condo, detached home, mobile home, etc. (Basic cross-section sketches to show shape, height, different rooms)

3) Instruct students to cut out examples of items in their homes which help keep them sheltered and comfortable all year long:

- Lights
- Furnace
- Air conditioner
- Water heater
- Roof
- Windows
- Stove / Oven
- Refrigerator
- Plumbing

4) Paste these examples onto students' home sketches

5) Class Discussion: Why or How do these household items keep people safely sheltered or comfortable? (Hint: Part 2 will emphasize the use of ovens)

6) Create an Observation Chart: see Handout 1
Distribute Handout #1 for class to answer together on overhead or chalkboard.
Students to complete Observation Chart for their individual Science workbooks / folders.

**HANDOUT #1: Observations Chart** **Name: ___________________**

# My Home

| HOUSEHOLD ITEM OR MATERIAL: | PURPOSE: | DAILY TIME OF USE: | SEASONAL TIME OF USE: |
|---|---|---|---|
| Lights | • To make rooms bright enough to see in or read in | • Early morning<br>• Night time | • Cloudy, overcast, rainy days<br>• Dark winter days |
| Furnace | | | |
| Air conditioner | | | |
| Water heater | | | |
| Roof | | | |
| Windows | | | |
| Stove / Oven | | | |
| Refrigerator | | | |
| Plumbing | | | |

**Procedure:**
**Part 2**

***Understanding Basic Concepts*** – identify the sun as a source of heat and light

***Developing Skills of Inquiry, Design, and Communication*** – record relevant observations, findings, and measurements, using written language, drawings, concrete materials, and charts (e.g. measure and record changes in temperature)

***Relating Science and Technology to the World Outside the School*** – identify features of houses that help keep us sheltered and comfortable throughout daily and seasonal cycles (e.g. lights, furnaces, [oven/stove])

**Solar Sweets** *Note: This experiment depends on 1) a sunny day 2) no food allergies

This science experiment not only provides young students with a greater understanding of the sun and solar energy, but it will provide a greater appreciation of the "sweet" rewards the sun can produce, beyond warm summer days.
Inform students that for this experiment to work well, summer is the best *season* (especially in Canada) to derive the most solar power. Therefore, this works well in late May / June. It is also interesting to note that even in the (almost) summer season before school ends, the *weather patterns* will also affect the experiment. Even a slightly overcast summer day will lessen the solar energy needed for our purposes. A clear, sunny day of direct sunlight is best for the production of solar power.
First grade students may work in partners or small groups, whatever the teacher deems best for his/her particular classroom. They will be constructing "Pizza Box Solar Ovens" and learning the fundamentals of a science experiment: design and construction, procedures, measurements, observations, recordings, questions, and suggestions to improve upon for next time.

**Materials Needed For Activity:**

- one average-sized, empty, clean, corrugated pizza box per student grouping
- black construction paper
- extra-wide aluminum foil
- plastic window film (sold in hardware stores to prevent window drafts)
- markers
- Exacto knife
- meter stick
- thumbtacks
- string
- tape
- glue
- thermometers
- stop watch / time keeping device

**Plus Ingredients for Solar S'mores:**

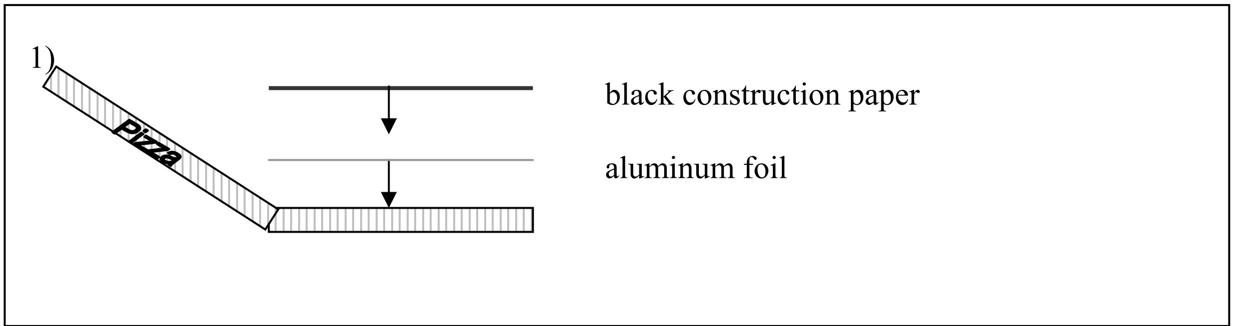
- Graham crackers
- Chocolate chips
- Large marshmallows or marshmallow fluff (spread) if available

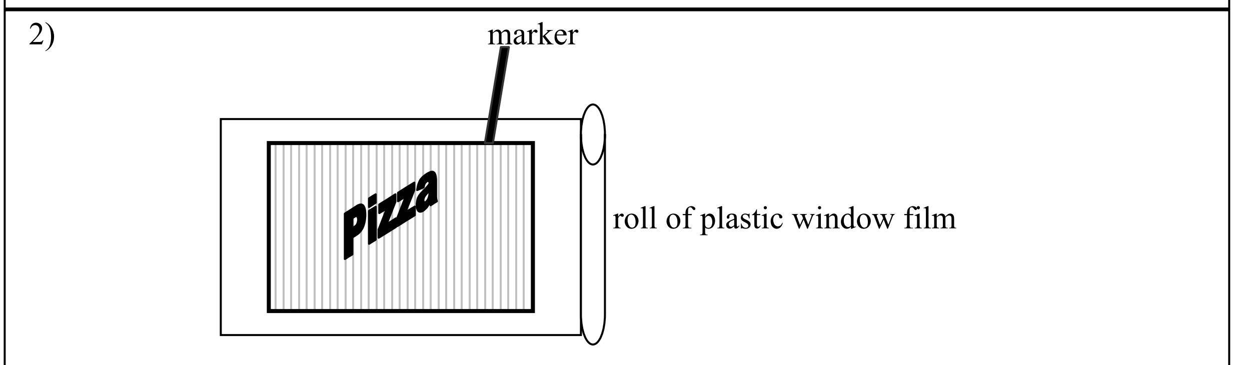
**Solar Sweets Solar Oven**

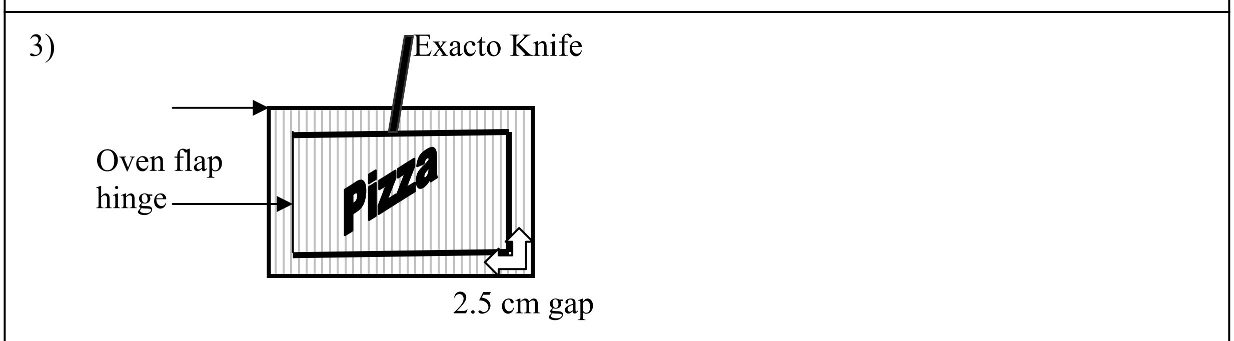
**Procedures:** *Note: Teachers may delegate any or all of these instructions to students as they see fit, i.e. students may be presented with the pre-cut materials for gluing / taping only, or students may take on more of the preparations themselves.

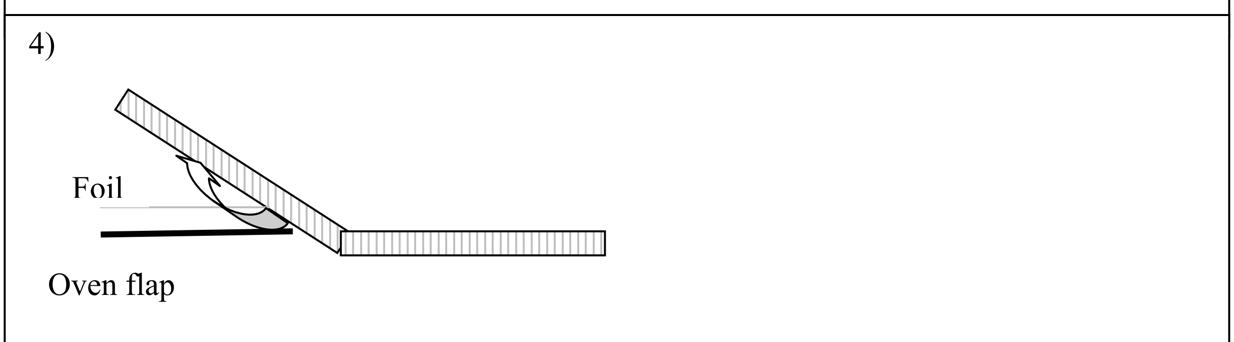
1) Tape aluminum foil to the (entire) inside bottom of the pizza box. Cover this foil with black construction paper and tape it down.
2) Set the pizza box on top of the outstretched plastic film. Trace the outline of the box on the plastic using a marker. Remove the box and draw another outline approximately 5mm inside the original. Cut the plastic along this new outline.
3) On top of the pizza box, draw four lines approximately 2.5cm inside the edges of the box top. Use the Exacto knife to cut along the top and side lines, but not along the line closest to the box hinge. This will also be a hinge – for the oven flap. Carefully fold open this flap.
4) Cut a piece of aluminum foil the size of the flap. Glue it to the side of the flap that faces down into the box. Use a damp rag to smooth out the wrinkles in the foil and to remove excess glue.
5) Tape the plastic film to the inside top of the box. Tape one side first, pull tight, and tape the opposite side. Seal tightly. Tape the other two opposing sides in the same way. Remember this is your oven "window": it should be as smooth as glass and sealed tightly to prevent air leaks.
6) Cut a piece of string as long as the box. Tape one end to the top of the oven flap. Push one thumbtack into the back of the box lid near the hinge. This is your anchor to tie the flap back with during cooking.
7) Get cooking!

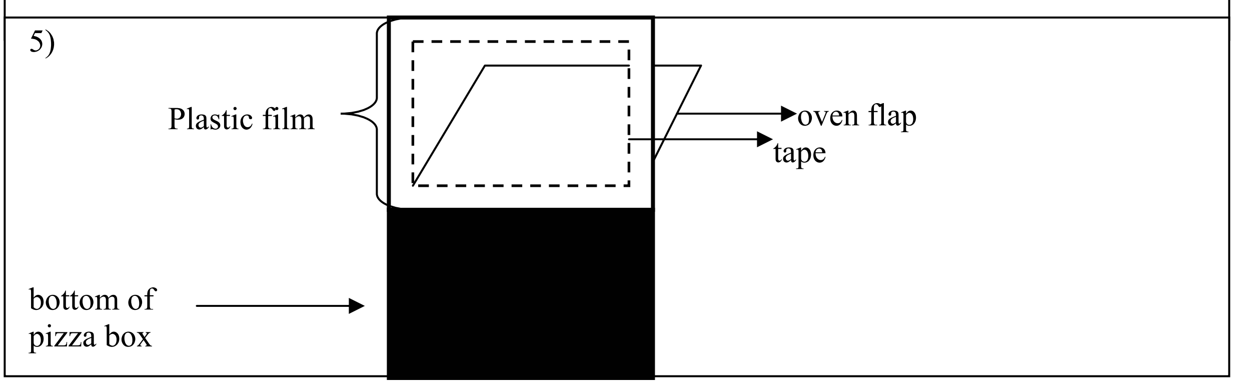
*See attached illustrated instructions for further assistance


1)
Pizza
black construction paper
aluminum foil


2)
marker
Pizza
roll of plastic window film


3)
Exacto Knife
Oven flap
hinge
Pizza
2.5 cm gap


4)
Foil
Oven flap


5)
Plastic film
oven flap
tape
bottom of
pizza box

**<u>Solar Sweets</u>**

**Procedures:**

Explain basic scientific concepts to students:

- the aluminum foil flap will reflect the solar energy down into the "oven"
- plastic film acts as a temperature barrier to allow heat in and keep cool air out
- corrugated cardboard is a good insulator
- black (construction paper) attracts the sunlight, also, and the foil beneath it acts as an insulator keeping it inside the box

Distribute Handout #2 to students for recording the results of the experiment. Each group and each individual within the group is responsible for a completed worksheet.

Post Solar S'mores recipe:

Ingredients: graham crackers
Chocolate chips
Large marshmallows / marshmallow fluff

Break graham cracker in half. Spread a small amount of marshmallow fluff, or half a marshmallow on ½ of cracker. Place a few chocolate chips on top of marshmallow. Cook and place other ½ of graham cracker on top before eating.

Set up a cooking centre where Solar S'mores will be created by each student.

Begin work on Handout#2 ("Before" Temperatures) and proceed with solar cooking! Remember: this is best done on a sunny day, using direct sunshine on the ovens. Be sure that the oven flaps are lined up in direct sunlight, with their shadows cast exactly behind them. Use the string and thumbtack anchor to tie the flap open.
(Pairs or groups of students may cook all Solar S'mores at the same time in their oven).

Continue to complete Handout #2 and then eat the Solar Sweets when finished! (S'mores may be "cooked-to-taste", i.e. when chocolate is melted sufficiently, and marshmallow layer is soft. Please remind students these will be hot!)

**HANDOUT #2: Solar Sweets Science Experiment Sheet!** **Name: ___________**

**Purpose:** To cook "Solar Sweets / S'mores" using solar powered ovens and to identify the sun as a source of heat and light, using our skills of inquiry, design and communication .

**Materials**:

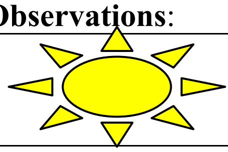
- one medium-sized, empty, clean, corrugated pizza box
- black construction paper
- extra-wide aluminum foil
- plastic window film
- markers
- Exacto knife
- meter stick
- thumbtacks
- string
- tape
- glue
- thermometers
- stop watch / time keeping device

**Ingredients for Solar S'mores:**

- Graham crackers
- Chocolate chips
- Large marshmallows (cut in ½) or marshmallow fluff (spread) if available

**Procedures**:
Design and construct solar ovens according to teacher's instructions.

**Observations**:

|  | **Before Solar Energy is "ON"** | **After 15 minutes of Solar Energy** | **Cooked to Taste!** Total Cook Time:______ (Spread is soft, melted) |
|---|---|---|---|
| **"Oven" Temperature in Degrees Celsius** | ___________ºC | ___________ºC | ___________ºC |
| **Inner Temperature of My Solar S'more** (insert thermometer in marshmallow / chocolate) | ___________ºC | ___________ºC | ___________ºC |
| **Physical Description of Solar S'more** (colours, texture) | | | |
| **Description of Taste, Texture, Temperature** | X | X | |

How did our Solar Ovens work?

______________________________________________

______________________________________________

______________________________________________

______________________________________________