**Solar Energy Lab**

## Introduction

**Purpose** To investigate solar energy in relation to alternative energy resources.

**Discussion**

Solar energy is (renewable / non-renewable) and can be converted to electricity in two ways:

a. Photovoltaic (PV devices) or “solar cells” change sunlight directly into electricity. Individual PV cells are grouped into panels and arrays of panels that can be used in a wide range of applications ranging from single small cells that charge calculator and watch batteries, to systems that power single homes, to large power plants covering many acres.

b. Concentrating Solar Power Plants generate electricity by using the heat from solar thermal collectors to heat a fluid which produces steam that is used to power the generator.

c. Distinguish between passive and active solar energy:

Passive solar energy is used when radiant energy is collected and not mechanically converted. Example: positioning a home in the proper location to collect the maximum amount of radiant energy.

Active solar energy uses the radiant energy from the sun along with some mechanical equipment to utilize the radiant energy. Example: PV Cells.

**Hypothesis**

?

## Materials

Large tin can (coffee can, etc.) Thermometer Styrofoam Pellets Steel Wool

Small tin can (tomato juice, etc.) Masking tape Cotton Stop watch

Scrap paper Waxed paper Plastic Wrap Graph paper

Aluminum Foil Clip Board or Notebook *for recording data outdoors*

Sun Lamp (*If you do the temperature increase*)

**Procedures**

1. This experiment can performed in cold weather for temperature drops or in warm weather for temperature increases.
2. Obtain a large tin can and a small tin can.
3. Cover the top of the small tin can with one of the following materials:

a) plastic wrap b) waxed paper c) cloth d) aluminum foil e) wood

1. Place a thermometer through the cover of the small can and into the small can. You need to be able to read the temperature of this thermometer later.
2. Use one of the following insulating materials: a) nothing b) wadded up scrap paper

c) shredded up scrap paper d) Styrofoam pellets d) steel wool e) cotton f) other

1. Place one to two inches of insulating material into the bottom of the large tin can.
2. Place the small can inside the large can so it sits on top of the insulating material you added.
3. Insulate around the sides of the small can by using more of the same material in procedure 5. Use the following diagram to help you set up the experiment:

Thermometer

Large can

Insulating Material

small can

1. Complete the “**Data Table”** provided.
2. Place the solar collector in the sun or outside in the cold on the ground. Be sure that the top of the can faces the sun (light source).
3. Use another thermometer to measure the outdoor temperature. You can use the weather app to find the outdoor temperature.
4. Take the temperature of your “system” every 30 seconds for a total of ten minutes. Record the temperature on the data table provided.
5. Repeat all the procedures TWO more times using different “cover” and insulating materials. Label the materials below the data table**.**
6. Plot a graph as described and below (refer to the diagram below for help):
7. Label the graph “Temperature versus Time in a Solar Collector”
8. Draw and label the vertical axis (y axis): “Temperature”
9. Draw and label the horizontal axis (x axis): “Time in Minutes”
10. On the vertical axis, label each line in degrees Celsius, starting at -2° C and adding one degree per line up to the room temperature (~25° C).
11. On the horizontal axis, label every other line in minutes, starting at 0° C and adding ½ minute per line
12. Place a Title at the top of your Graph.
13. Plot the points, one column at a time, from all four columns on your “Data Table and Answer Sheet.” Your graph will look similar to the one drawn below:

Temperature vs. Various Insulators & Covers

15

Temperature (° Celsius)

Label the lines as to which Insulating Material & cover was used

10

5

0

Outside Temperature

-2

3

7

5

10

Time In Minutes

1

Data Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time in Minutes** | **Outside Temp**  **(° Celsius)** | **Temperature Inside Collector** | | |
| **#1** | **#2** | **#3** |
| Starting Temp |  |  |  |  |
| 0:30 |  |  |  |  |
| 1:00 |  |  |  |  |
| 1:30 |  |  |  |  |
| 2:00 |  |  |  |  |
| 2:30 |  |  |  |  |
| 3:00 |  |  |  |  |
| 3:30 |  |  |  |  |
| 4:00 |  |  |  |  |
| 4:30 |  |  |  |  |
| 5:00 |  |  |  |  |
| 5:30 |  |  |  |  |
| 6:00 |  |  |  |  |
| 6:30 |  |  |  |  |
| 7:00 |  |  |  |  |
| 7:30 |  |  |  |  |
| 8:00 |  |  |  |  |
| 8:30 |  |  |  |  |
| 9:00 |  |  |  |  |
| 9:30 |  |  |  |  |
| 10:00 |  |  |  |  |

**List the “cover” material and “insulating materials:**

**#1 🡪**

**#2 🡪**

**#3 🡪**

**QUESTIONS**

1. According to your graph, which insulating material worked best? In other words, for which insulating material (procedure #5) did the temperature go up the LEAST?

2. According to your graph, which insulating material worked the LEAST? In other words, for which insulating material (procedure #5) did the temperature go up the MOST?

3. Give an explanation for your observations in questions #1 and #2.

4. Do you think that the “cover material” on the small tin can applied in procedure #3 made a difference? Which material seemed to insulate the best and keep the temperature from raising as much?

5. Which “cover material” applied to the small tin can in procedure #3 seemed to insulate the LEAST and allowed temperature to raise more?

6. Would changing the color of the solar collector affect the amount of solar energy collected? In other words, if the tin cans were darker in color would they collect more temperature from the sun than if they were lighter in color? EXPLAIN your answer.

7. Now we can attempt to apply this simple lab to our everyday, practical lives. Name some practical steps that one can take to increase the use of the sun’s energy. Keep in mind what caused the temperature to raise the most (*poor insulator*) verses what caused the temperature to raise the least (*good insulator*).

8. Watch the video link: Solar Energy <http://somup.com/c0XIrbgqSh> (1:54).

a. Define photovoltaics

b. What are advantages and disadvantages of solar power?