

Phsc 3500 Solar and Alternate Energy

A Practical Solar Oven

Introduction

The objective of this activity is to design and construct a solar oven based on the principles that we have covered in class, and/or are discussed in the textbook. Additional information (in some cases including design plans) is available on the internet.

Background

There are two main design considerations

- admitting as much energy (light) as possible into the box
- not having it bounce back out again
- preventing as much heat as possible from escaping from the box

For the second you might like to read chapter 4 as far as page 79. In that section the author talks about the physics of thermal conduction (the dominant heat loss mechanism from your box), and what makes a poor thermal insulator (which means also a good heat conductor), or alternatively what makes a good thermal insulator (a poor heat conductor). You might also look ahead to chapter 9, between pages 259 and 268.

Rules

The rules are very simple.

1. Working in teams of no more than four, design and then construct a solar oven. The basic design format is a box with a transparent cover.
2. Maximum dimensions of your oven are 60 cm x 60 cm for the base, and 50 cm high. (Approx 24" x 24" x 20"). Note: these are the maximum allowed dimensions when in operation. If any part of your design folds away, then it must be extended before the measurement is made.
3. The interior must be capable of holding a standard 5 qt stockpot.
4. Mark your oven clearly with the names of all the team members.
5. You can use any design you like.
6. You can use any materials you like.
7. No energy source, except for the Sun, is permitted.
8. Ovens will be set out in the Sun on Wednesday October 14th 2009. Thermometers will be placed in each oven. (Note: this date is subject to change, particularly in the case of inclement weather.)
9. The internal temperature of each oven will be taken during class on the same day.
10. Each team is responsible for removing their own oven by October 14th 2009, or on the following Friday at the latest.
11. Make allowances for weather conditions, in particular wind.

Scoring

1. Solar ovens will be ranked in order of the temperature that is recorded at noon (approx) in the afternoon.
2. The team which achieves the highest temperature will receive a grade of 100.
3. The team which achieves the lowest temperature will receive a grade of 65.
4. Other teams will receive a grade between 65 and 100, prorated according to the temperature that they achieve.
5. Any team exceeding a temperature of 100 °C will receive a bonus of 5 points on top of their initial grade.
6. Deductions
 1. Not removing their oven – deduction of 10 points
 2. Exceeding the size limitation - deduction of 25 points

Resources

- Search on the internet for 'solar oven' . You'll find lots of useful sites
- Textbook Chapter 4, particularly on heat transfer through conduction, and the section on radiation.
- Textbook Chapter 9, on solar heating