

MEASURING THE EFFECTIVENESS OF SUNSHADES

In this experiment, you will measure how effective a sunshade is in protecting an ice-water mixture from melting in sunlight. Consider some of the physics in this experiment:

▼ Heat transfer: heat passes from one substance or an object to another by:

1) Conduction

- Heat is transferred through material without any of the material moving.

2) Convection

- Heated material moves and carries heat with it.

3) Radiation

- Energy from heat is transmitted via electromagnetic radiation (e.g., infrared rays) – either through a medium (such as air) or without need for intervening material (such as through vacuum).

▼ Insulation: To combat the three ways in which heat can travel, there are three basic methods of insulation:

1) To fight conduction, some materials are used as insulators (a material with a small thermal conductivity is a poor heat conductor and therefore a good insulator).

2) To fight convection, the space between hot and cold areas can be filled with "dead air."

3) To fight radiation, reflective or blocking materials can be used.

- E.g., reflective car sunshades, sunscreen used to prevent sunburn.

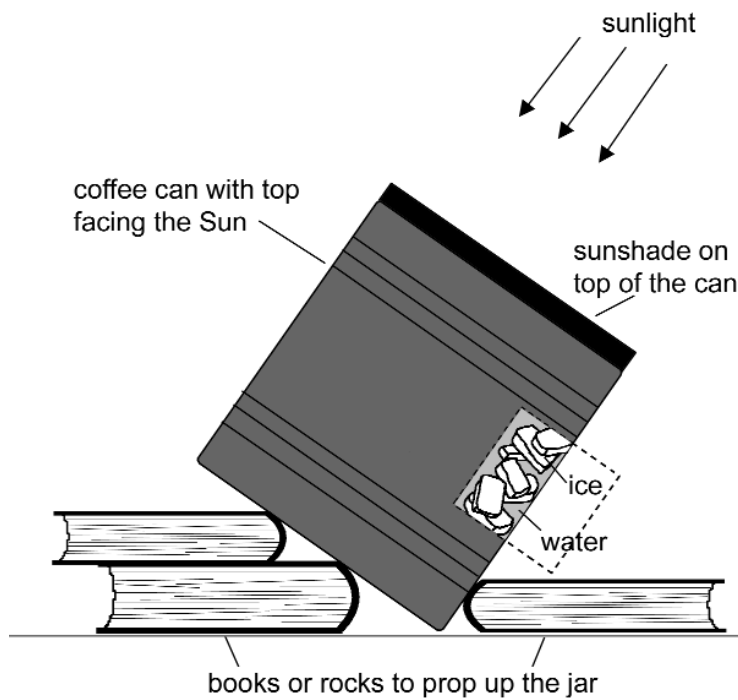
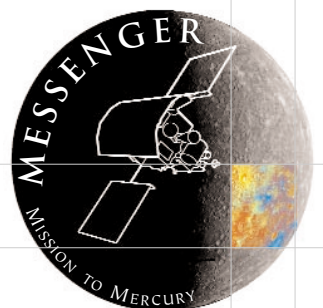
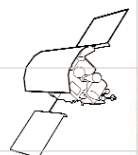


Figure S1. Setup for the experiment measuring the effectiveness of sunshades. A coffee can is filled with an ice-water mixture (see cut-away box in picture). A shade is placed on top of the can, and the device is placed in sunlight. By measuring the amount of ice melted by the sunlight, the effectiveness of the shade can be calculated.



Procedures:

1. As a group, examine the basic setup for the experiment (Figure S1). Decide among yourselves what sort of (inexpensive) materials would make the best sunshade. Keep in mind that you want to minimize your cost. Draw your design on Page 3 of this worksheet.
2. Design a plan for your coffee can shade, including a design drawing, a list of materials needed and their estimated cost (not to exceed the assigned cost cap), and a brief explanation as to why your group thinks your shade will succeed. Record this information and create a design for your shade on Page 3 of this worksheet. The final result of the experiment will be the cost-effectiveness of your sunshade: you must design as effective a shade as possible as inexpensively as possible.
3. Decide who in the group will buy which materials, and bring the shading materials with you to class on the day you do the activity. Keep your receipts so that you can later calculate the cost-efficiency of your shade. If you bring supplies from home, find out how much they cost at a store or on the Internet.



Team Members: _____

Sunshade Design

List of materials, with cost for each (fill in the cost after you have bought the materials):

Explain why you think the shade design will work well:

Sunshade Design drawing
The scale of your drawing: _____

