

Part B – The Nature of Earth’s Surface and Atmospheric Heating

The various materials that comprise Earth’s surface play an important role in determining atmospheric heating. Two significant factors are the albedo of the surface and the different abilities of land and water to absorb and reradiate radiation. *Albedo* is the reflectivity of a substance, usually expressed as the percentage of radiation that is reflected from the surface. Since surfaces that have high albedo are not efficient absorbers of radiation, they cannot return much long-wave radiation to the atmosphere for heating. Most light-colored surfaces have high albedo, causing light-colored surfaces (and the air above them) to be typically cooler than dark surfaces.

Activity 1: Albedo Experiment

To better understand the effect of albedo on atmospheric heating, conduct the experiment below using the provided apparatus and answer the questions. Before getting started, predict which will have the higher albedo – the black can or the silver can.

Procedure:

Step 1: Place the black and metallic containers (with lids and thermometers) about 6 inches away from the light source.

- **Make certain** that both containers are equal distance from the light and are not touching one another.
- Have the light is **shining on the sides** of the cans, not on the white foam lids.
- **Use cans that have cooled** since another group did the activity.
- Be sure thermometers are **not touching the sides** of the cans.

Step 2: Start recording the temperature of both containers with the computer by pressing ‘start’, or fill out Table 2 “Albedo Experiment Data” by reading the thermometer.

Step 3: Turn on the light and allow the computer to continue to record the temperature of both containers **for 5 minutes**, or read it from the thermometers and record on the data table at about 30-second intervals **for 5 minutes**.

Step 4: Print the graph, or plot the temperatures from the data table on Figure 4, the albedo experiment graph. Be sure to label which line represents the black can and the metallic can.

Do not fill out if you used the computer.

Use the printout instead of the table and graph.

Table 2: Albedo Experiment Data	Starting Temperature	30 sec	1 min	1.5 min	2 min	2.5 min	3 min	3.5 min	4 min	4.5 min	5 min
Black Container											
Silver Container											

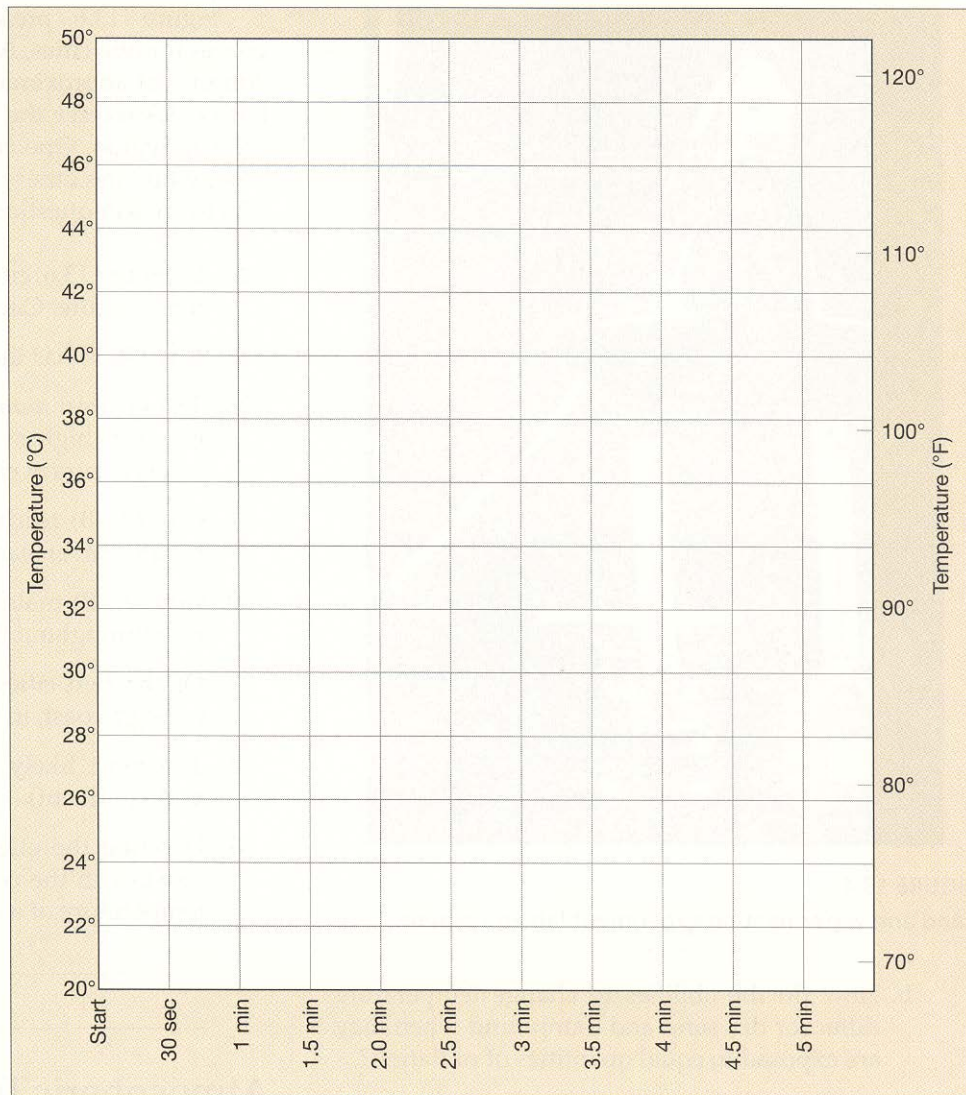


Figure 4: Graph of data from the albedo experiment.

Questions:

1. Which container has the higher albedo? _____
2. Does this result match your prediction?
3. Write a brief summary of the results of the albedo experiment.

NOTE: Read Ch 16 Text, p. 502-504 and answer questions 4-8 below.

4. List two examples of natural Earth surfaces or materials that have high albedo.
5. List two examples of natural Earth surfaces or materials that have low albedo.
6. Given equal amounts of radiation reaching the surface, the air over a snow-covered surface will be (**colder / warmer**) than air above a dark-colored, barren field. Explain your choice fully in terms of what you have learned about albedo.
7. Why is it wise to wear light-colored clothes on a sunny, hot day?
8. If you lived in an area with long cold winters, a (**light / dark**) –colored roof would be the best choice.