



## Neato Albedo!

***How does the type of surface sunlight first encounters affect how much heating occurs?***

### **Key Concept**

Darker-colored surfaces absorb more light and tend to heat up more than lighter-colored surfaces, which reflect more light and tend to stay cooler.

### **What You Should Know**

- The percentage of the Sun's energy that is reflected back by a surface is called the *albedo* and is measured on a scale from 0 to 1.
- Light-colored surfaces (e.g., snow, ice, light-colored desert sand) have an albedo closer to 1, tend to reflect light back into space, and have a cooling effect.
- Dark-colored surfaces (e.g., dark soil or blue ocean water) have an albedo closer to 0, tend to strongly absorb sunlight, and have a warming effect.

### **Materials (per student or group of students)**

- Light source\*
- ½ sheet (approx. 8 ½" x 5 ½ ") each of white and black construction paper
- Scotch tape or stapler
- 2 thermometers

\* This experiment can either be performed indoors using a table lamp as a light source or outside on a sunny day using the Sun as the light source.

### **Investigation**

1. Fold the black construction paper in half lengthwise and tape or staple the side and bottom, leaving an opening at the top.
2. Repeat Step 1 with the white construction paper.
3. Record the starting temperature on both thermometers; they should be the same, but if they are not, students can still graph and compare change over time by subtracting the previous temperature measurement from the current measurement.
4. Slip a thermometer inside each pouch.
5. Place both pouches evenly under the light source.
6. Turn on the light and observe the temperature readings every couple minutes for the next 8-10 minutes.

## **Predicting**

How do you think the temperature in the white pouch will change compared to the temperature in the black pouch?

## **Discussion**

1. What happened to the temperature in both pouches once the light was turned on?
2. Which pouch reached a higher temperature? Why?
3. Which would help keep you cooler on a hot, sunny day—black- or white-colored clothes? Why? Which would have the higher albedo—a black shirt or a white shirt?
4. What effect does albedo have on surface temperature?
5. Currently glaciers cover about 10% of the Earth's land surface. In most areas of the world, glaciers are melting due to increasing global average surface temperatures. In the Arctic Circle, sea ice is melting at record rates. How will Earth's albedo change as the ice melts and the darker surfaces underneath are revealed?

## **What's Happening?**

Dark objects have a low albedo and tend to strongly absorb light. Absorption of light energy causes an object's surface temperature to rise. White objects have a high albedo and thus stay cooler because they reflect much of the incoming light. Much of the sunlight falling on a white glacier surface is reflected back into space, resulting in minimal heating of the surface and lower atmosphere. In contrast, sunlight falling on dark soil or the dark surface of the open ocean is strongly absorbed and contributes to significant heating of the Earth's surface and lower atmosphere. As global average surface temperatures increase, Earth's snow and ice cover is rapidly shrinking. The darker surfaces exposed when snow and ice melt absorb more solar radiation and contribute to further warming.



## Neato Albedo Data Sheet

### Prediction

What do you think will happen to the temperatures in the white and black pouches placed under the light source? How will they differ?

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Record the temperature of each pouch

Elapsed Time	Temperature (White)		Temperature (Black)	
	Actual temp.	Temp. change 0°	Actual temp.	Temp. change 0°
0 minutes				
2 minutes				
4 minutes				
6 minutes				
8 minutes				

To compare how temperature changes in each pouch over time, what should be represented on the x-axis? The y-axis? Graph the data by plotting the points and connecting them into a line for each color pouch. Label each line.