**Heat Transfer Lab**

Every surface on earth absorbs and reflects energy at varying degrees, based on its color and texture.

In this activity, students will investigate how different surfaces absorb heat and apply their experience with the surfaces to interpret real-world situations.

* The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of the light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

http://www.ucar.edu/learn/images/horzbar.gif

**Learning Goals**

1. Students will understand that the physical characteristics of a surface have a powerful effect on the way that surface absorbs and releases heat from the sun.

http://www.ucar.edu/learn/images/horzbar.gif

**Testable Question: Does the type of surface effect the rate in which energy is absorbed and release?**

**Hypothesis :\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**The DV:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Constants:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Materials for Each Group of Students**

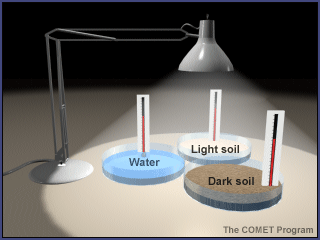
* Three Styrofoam cups
* Dark potting soil
* Light-colored sand or perlite
* Water
* Three thermometers
* Reflector lamp with a 200-watt bulb
* Graph paper
* Timer http://www.ucar.edu/learn/images/horzbar.gif

**Procedure**

1. Have students make data tables to record the time and temperature of the three experimental cups. Examples:

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| **Heating Cycle** | | | | | | | | | | | | |
| **Surface material** | **Start time** | **Start temp.** | **Temperature each minute** | | | | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
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| **Cooling Cycle** | | | | | | | | | | | | |
| **Surface material** | **Start time** | **Start temp.** | **Temperature each minute** | | | | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
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1. Fill the cups to the same level, one with dark soil, one with light sand, and one with water.
2. Place the cups on a table or desk and position the lamp about 12 inches above them.   
     
   
3. Place a thermometer into cup, securing it so it measures the temperature just under the surface of the substance in the pan.
4. Record the starting temperatures on the data table.
5. Turn on the lamp and record the temperature of each substance every minute for ten minutes.
6. At the end of ten minutes, turn the lamp off.
7. Continue to record temperatures for each substance every minute for ten minutes.
8. Using the data tables, graph the heating and cooling cycles to compare the rates at which the various substances heated and cooled.

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**Observations and Questions**

**After graphing the results answer the following questions:**

1. Which material absorbed more heat in the first ten minutes? Why ?
2. Which material lost the most heat in the last ten minutes?
3. Imagine that it's summer and that the sun is shining on the ocean and on a stretch of land. Which will heat up more during the day?
4. Which will cool more slowly at night? Explain.
5. Imagine three cities in the desert, all at about the same altitude and latitude.
   * One city (A) is surrounded by a dark-colored rocky surface.
   * Another city (B) is surrounded by a light-colored sandy surface.
   * The third city (C) is built on the edge of a large man-made desert lake.
   * Which city would likely have the highest average summer air temperature and why?
6. The earth's surface tends to lose heat in winter. Which of the above cities would have the warmest average winter temperature? Why?