## \\orhsfs-main\Redirect\teachers\dpower\My Documents\My Pictures\Microsoft Clip Organizer\j0424482.wmf LAB: ABSORPTION AND RADIATION OF HEAT

Purpose:

To learn different surfaces on land differ in the absorption and radiation of heat energy.

**Background:**

On one hand, the surface of water on Earth’s oceans presents a very uniform shape to the sun. On the other hand, the land surface is far from uniform. It may be as barren as a mountaintop or a sandy desert. Grasses like a prairie may cover it. The dense vegetation of a jungle or forest may shape it. How does the nature of the surface affect the absorption and radiation of heat energy? In this investigation, you will compare the absorption of heat by a dull, dark surface with a light, shiny surface. An incandescent light bulb will be used to represent the sun. It will shine on the surfaces of two metal cans, one dull-black and the other shiny-silver. The air temperature inside each can will be observed for 10 minutes at regular intervals while the cans are in “sunlight” and again for the next 10 minutes as they cool off.

**Hypothesis:** 1) Which can do you expect to heat up most rapidly? Which will cool the fastest?

2) Which material (*soil, sand, water, grass*) would you expect to heat up the fastest?

**Procedure:**

1. Turn lab bucket upside down and place the dull and shiny cans on top as shown in the diagram. Set the thermometers so they are at the same angle away from the bulb in the next step.

2. Set the incandescent lamp at a distance of about 12 to 13 centimeters from the cans. Make sure the cans are equal distance and angles from the lamp. Allow the thermometers to reach equilibrium at room temperature. Record the reading of each thermometer.

3. Switch on the lamp. Record the readings of each thermometer at the same time every minute for the next 10 minutes in the table.

4. At the end of ten minutes, turn off the lamp and continue to take readings every minute for another ten minutes as the cans cool.

5. Record initial and final temperature readings of the sand, soil, water, and grass before you leave.



**Data Recording I:** Record temperature with **lamp on for 10 Minutes**, then lamp off for 10 more minutes.

**Comparison in heating & cooling of a dark-dull can versus a light-shiny can**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | HEATING CYCLE (*LAMP ON*) | |  | COOLING CYCLE ( *LAMP OFF* ) | |
| **Time** (min.) | **Shiny Can Temp**  ( ) | **Dull/Dark Can Temp**  ( ) | **Time** (cont.) | **Shiny Can Temp**  (cont.) | **Dull Can Temp**  (cont.) |
| \*0 |  |  | 11 |  |  |
| 1 |  |  | 12 |  |  |
| 2 |  |  | 13 |  |  |
| 3 |  |  | 14 |  |  |
| 4 |  |  | 15 |  |  |
| 5 |  |  | 16 |  |  |
| 6 |  |  | 17 |  |  |
| 7 |  |  | 18 |  |  |
| 8 |  |  | 19 |  |  |
| 9 |  |  | 20 |  |  |
| 10 |  |  |  |  |  |

\* This is your starting temperature BEFORE turning on your lamp.

**Data Recording II: Record DATA POINTS only – Beginning, Middle, & End of Lab.**

**Comparing heat absorption of soil, sand, water, grass**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Initial Temperature (Time Zero) | Temperature(After 10 Minutes) | Temperature(After 20 minutes) | Change in Temperature (Final – Initial) |
| Dark soil |  |  |  |  |
| Sand |  |  |  |  |
| Water |  |  |  |  |
| Grass |  |  |  |  |

**Graph of data:**

1. Make a double line graph with a ruler for the black and white can results over 20 minutes
2. Make a quadruple-line graph for the soil, sand, water, and grass over 20 minutes

***Both graphs need descriptive titles, labels on axes, a key/legend, and COLORED lines drawn with a ruler.***

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**Analysis Questions:**

1. Which can heated up most rapidly? Is this as you expected? Compare your answer to your hypothesis.
2. Which material (sand, soil, water, grass) heated up the most? The least? Explain why using the terms **specific heat** and **surface area.** \\orhsfs-main\Redirect\teachers\dpower\My Documents\My Pictures\Microsoft Clip Organizer\j0406172.wmf
3. Compare the heating patterns to the cooling patterns of your cans, as well as the materials.
4. What can you conclude about different land surfaces’ temperature on a hot day regarding color?
5. What can you conclude about the temperature of the same land surfaces at night?
6. Make a prediction about the heating and cooling of Earth’s continents and oceans. Which will heat up & cool down faster?
7. How would the results of the experiment change if each can were full of water instead of air