

Name \_\_\_\_\_  
Lab # \_\_\_\_\_

Date \_\_\_\_\_  
Period \_\_\_\_\_

**Lab:** Surface properties and absorption of electromagnetic radiation

**Problem:** How does the color of an object affect its ability to **radiate** energy?

**Introduction:** We all have experienced the pain of walking on hot summer pavement with bare feet, or sitting on a dark leather car seat on a sunny day and we know that the sun can heat up materials to different temperatures. For instance: Which car hood would be able to fry an egg faster a dark colored car hood or light colored car hood? We wear darker color clothes in the winter and lighter color clothes in the summer because we want to absorb energy in the winter to stay warm and reflect the sun's energy in the summer to stay cool. And so we should understand that the darker the object the more energy it will absorb and therefore the more the object will heat up. This lab is not about how fast different colored objects absorb energy but instead about how fast different colored objects radiate heat energy into space. Essentially you will be discovering which colors radiate heat faster. In order to do that, you need to design an experiment that compares the heating and cooling of different colored objects. Make sure that the only thing you change in your experiment is the color of the objects. In other words keep all other factors equal such as lighting angle, focus, distance to objects, etc.... Good luck!

**Directions:**

1. State your problem for the lab
2. Design a hypothesis that states your opinion about the problem.
3. List materials Needed
4. Design the procedure for testing your hypothesis (show procedures in numbered sequence).  
**Note:** You should have sufficient time heating and cooling the cans (approx. 10 minutes for each).  
**Hint:** What should you do with the lamp after you are through heating up the objects?
5. Make a **data table** of your information similar to the example below
6. Do your experiment and collect data.
7. Make a **graph** of your data (Time v. Temperature). Label one line for each container (different colors?).
8. Make a **conclusion** based on your data.  
What is the relationship between the amount of energy radiation and the color of the object?  
Did your conclusion support your hypothesis?
9. Answer analysis and conclusion questions.

Example of Data Table:

| Time in Minutes     | Temperature Silver Can | Temperature of Dark Can |
|---------------------|------------------------|-------------------------|
| 0 minutes           |                        |                         |
| 1 minute (heating)  |                        |                         |
| 2 minutes (heating) |                        |                         |

**Analysis and Conclusion Questions: Answer all in complete sentences.**

1. Name three things that you did to make sure your experiment gave you good data.
2. Which colored can absorbed energy more rapidly?
3. Which colored can radiated heat more rapidly?
4. How did the heat get to the thermometers inside the cans?
5. List three examples from your own experience in which the principles of your experiment apply.
6. What do you think would happen if you placed squares of black and white colored cloths of the same size on the surface of snow during a sunny day? Why?
7. If you were to do your experiment again how could you improve your results?
8. How would the texture of an object affect an object's ability to absorb and radiate energy?
9. How could you change your experiment to test the affect of texture on energy absorption and radiation?
10. Which road do you think will be warmer a few hours after sunset, a concrete (light gray colored road) or an asphalt (dark black colored road)? Why?