



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

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Project Title
Color vs. Heat Absorption: Comparing the Emissivity of Light for Different Colors

Abstract

Objectives/Goals
The objective was to see which colored jars had the highest emissivity (or absorbed heat the fastest) & which colors radiate heat the fastest by performing independent tests for heating & cooling the colored jars.

Methods/Materials
Nine of the 10 small jars were painted on the outside with different colors of enamel paint. The 10th jar was used as the control variable. For the heating testing, the colored jars were divided into 3 groups. Group 1: red, blue, yellow; Group 2: gold, silver, black; Group 3: white, green, purple. Each jar started with 80 mL of 24 degree C tap water. The worklight had 2 high-powered lights of 500 watts each and 4 jars were tested at a time (each group was tested 1 at a time; one jar always being the control) for a total of 3 tests for 1 heating trial. There were 2 jars per light, both 20 cm from the light and 3 cm from each other. The 4 jars each had calibrated glass thermometers in them to monitor the water temps. A foil wall was put between the 2 lights to keep light & heat from affecting the other light's jars. The temps were checked every 10 min. for a 100-min. period and recorded. For the cooling trial, 59 degree C water was poured into the 10 jars. The temps were checked and recorded the same way as the heating trial.

Results
The green jar heated the fastest with its temp rising to 63 degrees C at the end of the period. Blue followed with 59 degrees C. Black was near average, with 52 degrees C. Gold stayed coolest with 41 degrees C. All colors cooled at almost the same rate but Black always had the coolest temp compared to the other jars.

Conclusions/Discussion
The hypothesis was incorrect in the heating trial, but was supported in the cooling trial. During research a picture of the visible spectrum was found, showing blue and green with the thickest bonds. Maybe that's why the blue and green jars heated the fastest & appeared to have the highest emissivity. The black jar cooled the quickest maybe because it's color had the jar absorb the heat from the water. Green appeared to have the highest emissivity. It may be linked to why chlorophyll is green.

Summary Statement
If the colored jars were placed under a light source, the darkest color of the set would heat the fastest (or have the highest emissivity); if all colored jars were cooled from the same temperature, the darkest would cool the fastest.

Help Received
Mother helped glue pieces to board and assisted in boiling/heating the water.