



Activity– The Tale of Three Colors- Radiation

1. Previous to the activity make the three colored flat surfaces, the three colored envelopes, and the three-chambered box. To make three chambered box, find a small rectangular box (approximately 5" by 7") and cut two pieces of heavy paper (oak tag, poster paper, etc.) as long as the inside of the box (lengthwise) and as tall as the box. Place the two pieces in the box and tape them so that they divide the box into three equal chambers.
2. Use the aluminum foil to cover the bottom and all sides of the center section and glue the foil in place. Cover one section with the white paper and the third section with the black paper. When finished, the box will have three chambers: one black, one white, and one silver.
3. Cut 6 pieces of construction paper, four white and two black, that are 6" x 4". Cover one side of two of the white squares with tin foil and glue in place.
4. Fold one of the black pieces, one of the white pieces, and one of the silver pieces in half. The three folded pieces should now be 6" x 2". Tape the bottom and long side of each piece to form three envelopes. (Set the remaining three pieces aside.)

Materials

- Gooseneck lamp
 - Aluminum foil
 - White and black construction paper
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- Glue stick
 - Small rectangular box (5"x7")
 - Thermometers
 - The Tale of Three Colors*
 - Heat cluster cards
 - Heat* tri-fold brochure

5. Now you are ready for the activity. Tell the students that as the Three Musketeers, they have a special mission to discover how color affects radiated heat. Pass out the worksheets and remind them they will need to be precise in the data they keep.
6. Lay a thermometer on top of each of three squares of paper: a white piece, a black piece, and a silver foil piece. Have the students write down the starting temperature (C) of each thermometer on the worksheet. (Select one Musketeer from each group to witness each experiment and verify the temperatures.) Place the pieces evenly under the lamp so they will all get the same amount of light and turn it on. While waiting for the time to pass they are to predict the outcome. **WARNING: Do *not* touch the lamp after you have turned it on, as it gets very hot!**
7. Check and record the temperature after five minutes and again after 10 minutes.
8. Cool the three thermometers to room temperature and then place them inside each of the three envelopes. Write down the starting temperature (C) of each thermometer on the worksheet. Place the envelopes evenly under the lamp so they will all get the same amount of light and then turn it on.
9. Watch the clock and allow the lamp to shine on the envelopes for five minutes. While waiting for the time to pass have the students predict which envelope will get the hottest. Check the thermometers quickly and have the students record the temperatures of each envelope on the worksheet after five minutes and again after ten minutes.
10. Take the thermometers out of the envelopes and allow them to cool again to room temperature.
11. Now place the thermometers in the three-chambered box. Place the box under the light so each chamber gets the same amount of light and then check the clock and time the box for five minutes. Have the students record their predictions. Record the temperatures after five minutes and then after 10 minutes.
12. After the students have gathered the data, have them compare the results with their predictions. After they have filled out their worksheets discuss why they think there was a difference between the three placements. Discuss possible applications of the results.
13. On the back of their worksheets have them demonstrate what they have learned and come up with as many applications to life

situations as they can that show an understanding of heat and color. (You wouldn't wear a dark shirt on a hot, Sunny day. You could put a silver lining on your windows to keep the heat out. You could wrap yourself in a silver survival blanket to keep the heat in on a cold day or place it above your head as a canopy to keep cooler on a hot day. You could line a solar oven with silver to heat better and add black to help absorb the heat.) The group with the most heat applications wins the prize.

The Tale of Three Colors

Focus Question: What difference does color make in absorbing heat?

Predict which color will be the hottest after 10 minutes under a hot lamp.

Hottest color on the 3 flat colored surfaces _____

Hottest color in the 3 colored envelopes _____

Hottest color in the 3-chambered box _____

Colors on 3 Flat Colored Surfaces

Flat Surface	Starting Temperature	Temperature after 5 min.	Temperature after 10 min.
Silver			
Black			
White			

Colors in the 3 Colored Envelopes

Envelope	Starting Temperature	Temperature after 5 min.	Temperature after 10 min.
Silver			
Black			
White			

Colors in the 3-Chambered Box

Chamber	Starting Temperature	Temperature after 5 min.	Temperature after 10 min.
Silver			
Black			
White			

Write the actual results of the experiment.

Hottest color on the 3 flat colored surfaces _____

Hottest color in the 3 colored envelopes _____

Hottest color in the 3-chambered box _____

Discuss what happened and answer the following questions:

1. What type of heat transfer is occurring when the lamp shines on the colors?
2. Does the color of paper make a difference in the heat absorption?
3. Why was there a difference in whether the color was on a flat surface, inside an envelope, or in a box?
4. Give an example of how each result (3 examples) could be applied to real life experiences.

