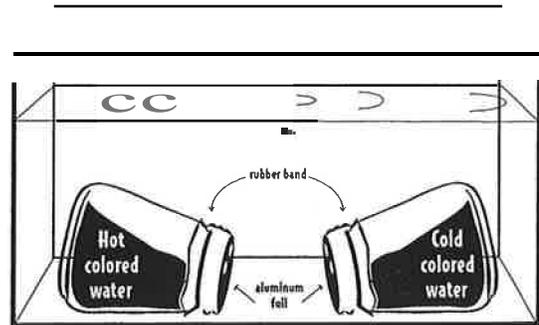


Activity #2 - Three Temperatures Meet, When Hot and Cold Meet Warm - Convection

1. Ask the students what happens when hot and cold meet warm. Tell them they are to work together as the Three Musketeers to discover what will happen when hot water and cold water are introduced into warm water. They are to discuss and come up With a prediction of what will happen. Pass each group a copy of the *When Hot and Cold Meet Warm* worksheet.
2. Fill the transparent container with room temperature water.
3. Fill one baby food jar with boiling water and add three drops of red food coloring. Cover the jar with aluminum foil and put a rubber band around the neck.
4. Gently lower it into the container, turning it on its side.
5. Puncture the aluminum foil in the middle and again near the edge with a pencil point so the colored hot water can flow out. If the water doesn't flow out, you may need to put the pencil

into one of the holes to release any trapped air bubbles. (The hot red water will float to the top of the room temperature water.) Have the students observe and draw what is happening on their worksheet.

6. Fill the other baby food jar with ice water and add three drops of blue food coloring. Cover the bottle with aluminum foil and put a rubber band around the neck.
7. Repeat steps four and five with this jar.
8. Have the students discuss within their groups what happened, compare it to their predictions, and determine why it happened. Have them share their thoughts with the class and discuss how convection works. Discuss other examples of convection. Have each group list as many examples of convection (completely described) as they can on the back of their worksheet. They may use textbooks and other sources, and the group with the most examples wins the prize.

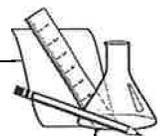


Activity #3 – The Tale of Three Colors-Radiation

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
- 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.