

HAT Stickers

(Heat Activated Thermochromic Stickers)

HAT Sticker Facts

HAT Stickers are coated with a mixture of colorants (substances with color). The colorants are heat activated thermochromic (HAT) dye and acrylic paint. Thermochromic means a change in color due to a change in temperature.

HAT Sticker Challenges

Determine what happens when:

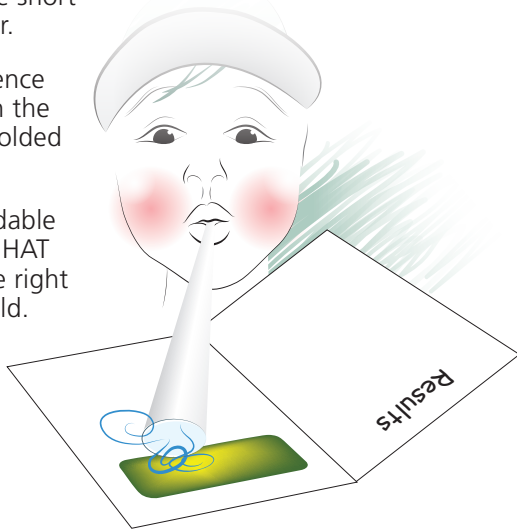
1. HAT Stickers are heated
2. Heated HAT Stickers are cooled

Materials

- 1 sheet of copy paper
- 1 Janice VanCleave HAT Sticker
- 1 drinking straw

Make a Foldable

1. Fold the paper in half by placing the short sides together.
2. Write the science challenges on the front of the folded paper.
3. Open the foldable and stick the HAT Sticker on the right side of the fold.



Investigation #1 Heating a HAT Sticker

1. Using the straw, exhale on the HAT Sticker.
2. Move the end of the straw around to different areas of the sticker. Make note of any color changes in the HAT Sticker.

Expected Results

When heated to about 27°C (81.6°F), HAT Stickers change color. The color change for the example HAT Sticker is from green at room temperature to yellow when heated.

The shape of heated HAT dye molecules is transparent to visible light. This means visible light, such as in sunlight and indoor lighting, passes through the HAT dye molecules, much like glass in a window. Thus, when heated, the color of the HAT Sticker is the color of the acrylic paint in the colorant mixture. For the example sticker, when heated the sticker is yellow.

Investigation #2 Cooling a Heated HAT Sticker

1. Heat as much of the HAT Sticker as possible by exhaling on the sticker as in investigation #1.
2. Observe the color of the sticker as it air cools to room temperature.

Expected Results

Hat Stickers are reversible, meaning they change color when heated and return to their original color when cooled back to room temperature. This color change will continue with fluctuations in temperature.

When a heated HAT Sticker is air cooled, the HAT dye molecules return to their room temperature shape and again reflect visible light as before. Thus, the sticker color at room temperature is the addition of the light reflected from the HAT dye molecules and the paint molecules.

What Scientists Do

Like any scientist, you investigate to find answers to science problems. Now, like a scientist, in your own words, record in your foldable what you did, what happens, and why.

HAT Sticker Science/Art Activity

Fashion a Heat Detecting Bracelet

Materials

ruler
pencil
1 sheet of white copy paper
scissors
1 black marker
1 Janice VanCleave HAT Sticker
transparent tape

What to Do

1. Measure and cut a 2 in x 8 in (5 cm x 20 cm) strip from the white copy paper.
2. Wrap the paper strip around your wrist to make sure it will fit. You want the strip to overlap about 1 in (2.5 cm). Adjust the length by cutting off any excess.
3. Lay the paper strip flat and use the black marker to decorate the paper.
4. Tear pieces from the HAT Sticker and stick them on your bracelet.
5. Again, wrap the paper strip around your wrist and this time secure it with transparent tape.

When you wear the bracelet, heat from your body will cause the HAT Sticker pieces to change color.

To make a multicolored bracelet, use different color changing HAT Stickers.



Did You Know

Visible light, such as sunlight or indoor lighting can be separated into a spectrum of rainbow colors – red, orange, yellow, green, blue, indigo, violet.

HAT Stickers are coated with a mixture of HAT molecules and acrylic paint molecules. At room temperature, when visible light shines on the HAT Sticker, some of the light is absorbed and some is reflected from these two types of molecules.

You see the colorant mixture as one color even though the dye molecules and paint molecules remain separated. This is because the molecules are tiny and close together. The different colors of reflected light rays are so close there is an addition of the two colors inside your eyes. Thus, the color of the colorant mixture on HAT Stickers is the addition of the visible light color reflected from the HAT dye molecules and the acrylic paint molecules.

**You will find more Janice VanCleave Sticker investigations and Science/Art Activities
HERE:**

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