Curiosity Guide #607
Convection

Accompanies Curious Crew, Season 6, Episode 7 (#607)

Convection Refraction

Investigation #7

Description

Use the power of convection to create a light show!

Materials

3 D-cell batteries
Tape
2 alligator clips
Clear jar
Water
Pencil lead from a mechanical pencil
Maglite or strong flashlight
Block
White poster board
Food coloring

Procedure

1) Attach an alligator clip on either end of a long piece of pencil lead.
2) Carefully drape the clips over the top edge of the clear container.
3) Position the wires so that the pencil lead is inside the jar. The pencil lead should be several inches above the bottom of the jar and parallel to its top.
4) Tape the wires in place.
5) Carefully add enough water to the container so that the lead is deeply submerged.

6) Line up the three batteries, positive to negative, in front of the jar. Check to make sure the two battery ends are in reach of the free alligator clip ends. Tape the batteries in place on the table.
7) Stand up the poster board behind the jar.
8) Place a block in front of the batteries.
9) Turn on the Maglite. Place the Maglite on the block so that the light shines over the batteries, through the jar, and onto the poster board.
10) What do you observe?
11) Attach the alligator leads to the batteries and observe.
12) What do you notice now?
13) Add several drops of food coloring to the jar. What patterns do you notice now?

My Results

Explanation

As the electricity flows from the battery and through the carbon pencil lead, the electricity begins to transfer heat energy into the water around the lead. As this happens, the heated water starts to expand, which causes the water to become less dense and rise towards the top of the jar. There the water begins to transfer heat into the air, cooling the water down. The cooling water becomes denser, continues to move to the side of the jar, and sinks again.

Adding food coloring drops makes this pattern more visible. As the light travels through the jar, the light casts shadows on the poster board. Light also bends or refracts when traveling through different densities of materials. As a result, the light bends one way and then the other from the moving colder or warmer water. The bending light makes the lit poster board areas fluctuate from darker to lighter. That shimmer effect is like what when we observe heat waves above a candle or over a hot blacktop road.

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