



Curiosity Guide #607

Convection

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

Convection Chimney

Investigation #5

Description

Pinwheels are great fun to make, and they can help us learn, too!

Materials

- 2 books
- 3 tin cans
- Can opener
- Duct tape
- Black paper
- Heat lamp
- Paper clip
- Pliers
- Scotch tape
- Tack
- Paper
- Scissors
- Pencil
- Ruler
- Metal washer
- Paper punch
- Flat brad

Procedure 1: Prepare a chimney

- 1) Cut both ends off each tin can.
- 2) Stack the cans and tape them together with duct tape.
- 3) Use pliers to bend the paper clip into a u-shape.
- 4) Position the bent paper clip on the top of the tin chimney and tape the paper clip in place. This will resemble a wire handle.
- 5) Turn the tack upside down so the point faces up. Secure the tack to the peak of the wire handle with tape. The point of the tack should be fully exposed.
- 6) Cover the chimney with black paper taped around it.

Procedure 2: Make a pinwheel

- 1) Measure and cut a 6-inch square of paper.
- 2) Use a ruler to connect the diagonal corners of the paper. Draw 2 lines with a pencil to make an X from corner to corner.
- 3) Center the small metal washer in the middle of the drawn X. Trace the outside circle with the pencil.
- 4) Use the paper punch to punch a hole in the bottom right corner of the paper. The hole should be $\frac{1}{2}$ inch above the line and $\frac{1}{2}$ inch in from the edge.
- 5) Rotate the paper and repeat in each of the corners.
- 6) Use the point of the pencil to poke a hole in the very center of the paper.
- 7) Use the scissors to cut along each line toward the center, stopping at the circular pencil line.
- 8) Carefully fold each corner flap toward the center, lining up the punched holes with the center hole. Be sure to start in one corner and move around the paper to the next flap and so on.
- 9) Insert the metal brad through the pinwheel to secure it.

Procedure 3: Set up the model and perform the investigation

- 1) Balance the bottom of the chimney on two books or blocks so that there is an air gap beneath the chimney.
- 2) Balance the pinwheel on top of the chimney.
- 3) Set up the heat lamp facing the chimney.
- 4) Turn the heat lamp on.
- 5) What do you notice?

My Results

Explanation

As the heat lamp warms the air inside the metal tube, the air particles begin to collide more quickly and more forcefully, making the air less dense. As a result, the warm air begins to rise through the chimney above it. As those particles begin to create an air current, the particles collide with the pinwheel. The pinwheel starts to rotate. This will also work by simply placing the chimney in direct sunlight. This is a visible example of the convective updraft. Convective updrafts occur in fluids like liquids and gases. Your model shows the rising of the warmer, less dense air and the sinking of the cooler, denser air. This is the same kind of motion of energy transfer that is observed in the atmosphere, the ocean, and even in the mantle of the earth.

Investigate further. Because gases are fluids, we know that convection can happen in the air. As the ground heats up, that energy is transferred to the air that contacts the ground. At the same time, the ground heats unevenly. For example, the blacktop may be hotter than the grass, which is warmer than the surface of a pond. As gas particles react to the different temperatures, columns of air and moisture begin to rise to different heights and can even cool and form clouds like cumulus clouds. Convection affects our weather, atmosphere, and even the air getting heated by you! Amazing!

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