612-1240 (35-160) Air Convection Kit

Warranty:

We replace all missing or defective parts free of charge. All products guaranteed free from defect for 90 days. This guarantee does not include accident, misuse, or normal wear and tear.

Description:

This metal box houses two candle chimneys. When the candle is lit and placed beneath one of the chimneys, a source of smoke such as smoke paper or incense will clearly show convection currents. Air heated by a candle moves up one chimney while cooler air moves down the other to replace the lost air. A transparent front panel allows the entire demonstration to be seen.

Other materials needed:

- Candle
- Smoke source (incense is recommended. Thin paper or cheese cloth will also work well)

Background:

Convection is an important method by which heat energy is transferred from one place to another. It is the mechanism by which material moves because its density differs from that of surrounding material. Density differences are often brought about by heating.

Convection currents bring about the transference of heat by the circulation or movement of the heated parts of a liquid or gas. When a gas or liquid receives heat from a hot surface, some of the fluid expands and becomes less dense. The fluid surrounding the heated portion is cooler and more dense. The more dense portions settle, pushing the warmer, less-dense fluid upward, which explains why the warmest air in a room is ordinarily found near the ceiling.

Convection is a major cause of atmospheric circulation and ocean currents. In the weather cycle, the circulation of a fluid (air) serves to equalize temperatures. An example is air flow between ocean and land, which reverses during the day and the night.

Convection is also a component of the theory of continental drift, in that the circulating movements of crustal materials push the continents apart.

An analogy to the idea of heat as motion is a crowd of swimmers in the ocean. When hit by a big wave, they are moved and some of the energy of the wave is transferred to them. In a similar fashion, waves of radiant energy can transfer energy to molecules.

The 35-160 Air Convection Kit illustrates the principle that is mainly responsible for the natural draft in chimneys and smokestacks. When a portion of a liquid or gas is heated, that portion generally expands and becomes less dense. A less dense portion within a body of fluid may be thought of as displacing its own volume of the surrounding more dense fluid. In accordance with Archimedes' principle, the less dense portion will then tend to rise and float on the more dense part. Therefore, when a body of liquid or gas is heated so that some parts get hotter than others, the hotter portions tend to rise and the cooler portions tend to settle down, setting up currents.

How to use:

1. Set the device against a dark background so the smoke produced will be visible through he chimneys.
2. Place a lighted candle beneath one of the chimneys.
3. Allow several minutes for the candle to heat the chimney above it and start to move a convection current.
4. Light your smoke source and hold it near the top of the chimney without the candle below it.
5. Observe the path of the smoke against your dark backdrop.
6. You may also insert your smoke source behind the glass panel and beneath the intake chimney.

Questions:

1. Where does energy released by a fire in a fireplace go?
2. Chimneys do not work well when cold and damp. Why?
3. Chimneys sometimes draw better on windy days. Why?
4. Certain well-defined ocean currents are probably caused in part by convection. Find the names of these currents and trace their approximate paths.
5. You are camped on the beach. You are offered a bet to predict the wind direction during day and night. What is your prediction? (Hint: convective currents move air away from hot areas. Which heats up more, land or water? Which cools first?)

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Related Activity
(Create a Thunderstorm):

You need:

- Clear plastic container, large
- Red food coloring
- Ice cubes made with water dyed with blue food coloring
- Colored pencils
- Index cards

1. Fill plastic container 2/3 full with water at room temperature. Let water sit for 30 seconds until the surface is still.
2. Place blue ice cube at one end of the container.
3. Being careful not to disturb the water's surface, add two drops of red food coloring to the water at the opposite end of the container.
4. Observe the path of the red and blue food coloring.
5. Using blue and red colored pencils, draw what you observe.

Questions:

- Where did the red go?
- Where did the blue go?
- What type of air mass does the red represent?
- What type of air mass does the blue represent?
- How do your observations apply to a thunderstorm?

Discussion:

The cold water sinks while the warmer red water rises or remains at a level higher than the blue. Convection is the action of warm air rising and cold air sinking. The blue water represents a cold air mass and the red water represents warm, unstable air. A thunderstorm is caused by unstable air in which convection plays an important role. A body of warm air is forced to rise by an approaching cold front. Other phenomena can also cause warm air to rise, such as a mountain slope.

A strong, persistent updraft of warm, moist air is formed and lifted by the approaching cold front. The air cools as it rises, condenses, and forms cumulus clouds. When the air condenses, heat is released, which encourages the thunderstorm to grow. At some point, condensation high in the cloud, now in the form of water droplets and ice, falls to the ground as rain. A cold downdraft forms as the rain falls.

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