

A CURRENT AFFAIR

BENCHMARK and TASKS

SC.B.1.2.6 The student knows ways that heat can move from one object to another.

- The student recognizes that energy comes in many different forms: (e.g., **mechanical**, energy of position and motion; **electrical**, energy of moving electrons; **chemical**, energy stored in chemical bonds; **thermal**, heat energy - the energy of moving and vibrating molecules; **nuclear**, energy contained in the nuclei of atoms; and **radiant**, energy that travels in waves like sunlight).
- The student experiences that heat energy moves from one place to another in three different ways: radiation, convection, and conduction.

KEY QUESTION

How are rooms heated or cooled?

BACKGROUND INFORMATION

Convection is the transfer of **heat** (thermal **energy**) in a fluid through currents. The fluid can be any substance that flows—**liquids** such as water, coffee, molasses, and even **gases**, such as air. An example of convection in a liquid would be a pot of coffee heating. Fluid right above the heat source rises, spreads out, then cools, sinks and is heated again in a continuous cycle. This continuous cycling of a fluid is called a convection current.

On the earth, parts near the **equator** receive more direct rays of sunlight than do parts of the earth near the poles. The sunlight is concentrated, and therefore warms the earth more near the equator than it does farther north or south. This uneven heating sets up convection currents in the **atmosphere**.

MATERIALS

Teacher

1 hot plate
overhead projector
several thermometers

Per student

spiral pattern
aluminum foil (20 cm x 30 cm)
scissors
1 metric ruler
thread
1 candle
matches
tape
glue

TEACHING TIP

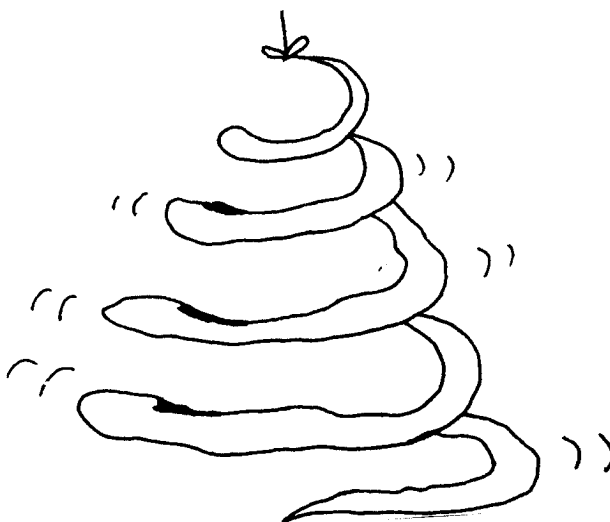
Make copies of the spiral pattern on cardstock. Have students glue aluminum foil to the back of the pattern and then cut out the spiral OR tape insulation tape to the back of the spiral pattern before cutting it out.

ENGAGE

1. Remind students that they observed evidence of convection in water in the Get a Rise Out of Heat activity and now they are going to explore convection currents in another fluid – air.
2. Turn a hot plate on high. Project a strong light from an overhead or slide projector so that it shines over the hot plate and onto a screen. Darken the room.
3. Students should be able to see the rippling shadows of part of a convection current projected directly onto the screen. Explain that while a complete convection current cannot be seen using this method, you can see the air being drawn in from next to the hot plate and then rising above it. Remind students of what they learned in the previous lesson: convection currents occur in all fluids, both liquids and gases, when the fluid is heated unevenly.
4. Based on this demonstration of hot air rising, ask students to predict where the warmest area in the room is located.
5. Place thermometers at a few locations in the room (base of the wall, middle of the wall, top of the wall, near the ceiling). After a short while, have students record the temperatures at each location and display the results. Compare the results to their predictions. (Note: Try this ahead of time. Temperatures in some rooms with central heat/air will not vary.)

EXPLORE

1. Distribute materials. Have students use the spiral pattern to cut a circle of aluminum foil 10-15 cm in diameter.
2. The circle should then be cut into a spiral as shown. Use a small piece of tape to attach a length of thread to the center of the foil circle.



3. Based on their knowledge of convection currents, have students predict what will happen to the spiral when it is hung near a heat source.
4. Attach the spiral to a table edge so that it is approximately 10 cm above a heat source. (This could be a hot plate or a small votive. **Stress safety precautions and supervise closely if students are using matches and lighted candles.**)

EXPLAIN

What happened to the spiral? (It began to spin.)

What caused this to happen? (Rising air caused it to spin.)

Where have you observed convection currents making objects move? (roof turbines, holiday decorations suspended over candles)

EXTEND/APPLY

Discuss the turbines found on the roofs of some buildings.

Can you explain why those turbines turn? (Hot air rises in the building vents through the turbines, making them spin.)

Where would be the most efficient place to locate heating vents when a home is built?

ASSESSMENT

Have students reflect on this question: Where in a house should air conditioning vents be installed for maximum cooling efficiency?

SPIRAL PATTERN

