Thermometer

Purpose
To make a model of a gas thermometer.

Materials
Ruler       Drinking straw       Red food coloring
Tap water   Timer                  Glass soda bottle
Golf ball-size piece  1-quart (1-L) jar
               of modelling clay

Procedure
1. Pour about 2 inches (5 cm) of water into the jar.
2. Add enough drops of food coloring to the water to make the water a deep red color.
3. Insert about 2 inches (5 cm) of one end of the straw into the mouth of the soda bottle.
4. Mold a piece of clay around the straw to seal the mouth of the bottle.
5. Turn the bottle upside down and stand it in the jar. The jar should support the bottle with the open end of the straw just above the bottom of the jar. If necessary, adjust the length of the straw outside the bottle.
6. Remove the bottle and hold it in your hands. Wrap your hands around the sides of the bottle. Press as much of the palms of your hands as possible against the glass, but do not press hard enough to break the glass.
7. At the end of 1 minute, turn the bottle upside down and stand it straw side down in the jar of colored water. The straw should extend below the surface of the water.
8. Observe the straw for 2 or more minutes.
Thermometer

Results
The colored water rises in the straw and flows into the bottle.
Why? Temperature is a measure of how cold or hot an object is.
Temperature is measured by an instrument called a thermometer. Modern thermometers measure temperature numerically, but the thermometer you made in this experiment is a simple model of a thermoscope, which was invented by Galileo (1564-1642) to indicate changes in the temperature of materials. Thermoscopes, as well as some modern thermometers, use the fact that a fluid expands when heated and contracts (draws together) when cooled to indicate a change in temperature.
The bottle and straw in the thermoscope in this experiment are filled with air. Holding the bottle in your hand causes the gas inside to be heated. The heated gas molecules move faster and farther apart. The expanded molecules escape through the open end of the straw. As the bottle cools, the gas molecules move slower and closer together. Since there are now fewer gas molecules in the bottle, the contracted molecules take up less space, and a partial vacuum (an empty space) is created. The air pressure inside the bottle is less than that inside the jar above the water. Thus, air pushing on the surface of the water forces the water into the straw.