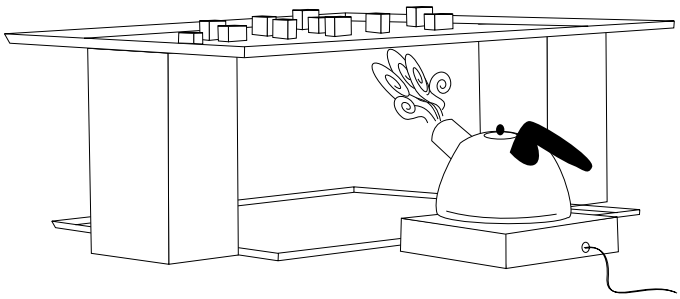
What Goes Up . . . Must Come Down

If the 355 billion gallons of water used in the United States every day were placed in gallon jugs and set side by side, the line would reach to the moon and back 70 times!

Equipment/Materials

hot plate or other heat source
tea kettle (long spout best)
baking pans or cookie sheets (2)*
concrete block (2)***
water
ice
boards (2)**



* pans with a raised rim are necessary for this experiment
** boards must be wide enough to span the pans
*** similar supports may be used

Time Required: 10 to 15 minutes

Procedure

1. Place a rimmed cookie sheet or baking pan beside the heat source.
2. Set two or more blocks or other spacers beside the cookie sheet or baking pan to support a second rimmed sheet or pan above the level of the spout on the tea kettle. [If wooden or other combustible spacers are used, be sure to place them far enough from the heat source to avoid problems.] Set the spacers so they will proved solid support yet allow circulation under the upper pan or sheet.
3. Fill the tea kettle with water and place it on the hot plate or heat source with its spout directed toward the bottom of the top pan or cookie sheet.
4. As the kettle is coming to a boil, place at least 10 to 12 ice cubes or a similar amount of ice on the top cookie sheet or in the top pan. [Have additional ice on hand to replace the ice as it melts.]
5. Have the participants observe the formation of condensation from the steam as it strikes the cooled area of the upper pan, forms droplets and falls as “rain” into the lower pan.
6. Continue by returning the water collected in the lower pan to the tea kettle, completing the water cycle.
7. Ask the participants to discuss the following questions and others you might wish to add.
   a. Which part of the cycle is like a lake?

      The reservoir of the tea kettle and the lower pan both could be considered “lakes.”

   b. Which part of the cycle is like the sun?

      The heat source provides the energy to change water from the liquid to gaseous state.

   c. Which part of the cycle is like the rain?

      The droplets that form on the upper pan and fall to the lower one could be considered like rain.

   d. Which part of this cycle represents the upper atmosphere?

      The cooling effect of the upper atmosphere is represented by the ice in the upper pan.

   e. Why do you end up with less water than you started with?

      The condensation process is not completely efficient, and some of the water is lost by wetting the surfaces of the pans and kettle.

f. Do you think that this happens in the actual water cycle?

Yes and no—the answer depends upon the point of view taken by the responding participant and the time scale being used. Water can be delayed in cycling by many factors, like being tied up in the tissues of plants or animals, becoming part of an underground aquifer, or being bound by soil particles. On the other had, any water on the surface of the earth is subject to evaporation and any water taken up by plants is subject to transpiration as well as evaporation. Water is even broken down in photosynthesis and re-formed in the metabolism of foods by plants and animals. The cycle, however, remains intact, just as the water that is not recovered in this experiment becomes part of the gaseous water in the atmosphere and remains in the cycle. We just failed to recover it completely in the illustration of the cycle.