

# Super Heat Holders



## Objectives

Students will investigate how water absorbs and holds heat (energy) longer than sand does.

## Materials

### Per student group:

- two coffee cans with lids
- two laboratory thermometers
- black paint
- water
- clean sand

## Background

Water can absorb a great deal of heat (energy) with only a very small change in temperature. One gram of water needs 4.18 joules of heat to warm 1°C. Compare this to glass that needs only 0.837 joules to rise 1°C. Scientists define the heat required to raise the temperature of one gram of a substance one degree Celsius as its specific heat.

You can see and feel the ability of water to absorb and hold heat at a beach along a lake or sea. On a hot summer day, beach sand may quickly warm to the point that it's too hot to stand on (sand needs only 0.836 joules to rise 1°C) while ocean or lake water remains cool or even cold.

The slower heating and cooling of water also causes characteristically mild temperature changes along coastal cities. As land masses cool quickly at night, ocean water releases heat slowly, all night long. If winds blow this warm air landward, temperature remain mild.

## Action

1. Cut a hole in the center of the coffee can lid to fit the thermometer. Paint the outside of each lid and coffee can black.
2. Fill one can . full with sand. Fill the other . full with water.
3. Place lids on both cans. Equalize sand and water temperatures by placing both cans in the refrigerator overnight.
4. The next day, place thermometers through holes in the lids. If needed, wrap a rubber band around each thermometer to hold it upright through the hole.
5. Have students record the starting temperature of each can. Having the starting temperature the same would be optimal.
6. Place cans in a sunny spot inside or outside the classroom. The cans should be near each other to receive the same exposure to sunlight.
7. Have students record temperatures at lunchtime and at day's end. Next create a graph to show their data.
8. Discuss why the temperatures began to differ. Which got hotter faster? If possible, take the temperatures one hour and three hours after sunset. Which cools faster?