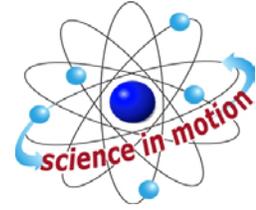


WEATHER

SECTION 3: THE SUN HEATS THE EARTH

From *Hands on Science* by Linda Poore, 2003



Westminster College

STANDARDS:

Students know the sun warms the land, air, and water.

Students will record observations and data with pictures, numbers, or written statements.

Students know the weather changes from day to day, but that trends in temperature or of rain (or snow) tend to be predictable during a season.

NOTE:

SUMMER is hotter in North American than winter because the Earth tilts on its axis toward the Sun at this time, receiving more direct rays. The days are longer also due to the Earth's tilt and this provides more hours a day for the Sun to warm the Earth. In the summer the Sun shines 15 hours a day, but only 9 hours in the winter (December). If you are studying the Earth in your class, integrate the seasons and the Earth with this section using a globe.

MATERIALS:

For Each Pair

1 thermometer

1- 8 ½ x 11" piece of black paper

student worksheet, *The Sun Heats the Earth*

DISCUSS:

WHY IS THE SUMMER WARMER THAN THE WINTER? COLLECTING SOLAR ENERGY

1. Which season does it stay light in the evening? (summer)
Which season does it get dark early? (Winter)
The Sun shines for more hours in the summer than the winter.

2. **EXPERIMENT:**

Do these experiments on a hot day. To test why the weather is hotter in the summer, predict what will happen if you leave the thermometer out for a longer period of time. Place a thermometer on a black piece of paper. (The paper is dark like the soil and absorbs the Sun's energy.) Check the temperature after 5, 10, and 15 minutes. Color in the thermometer drawings on the worksheet, *The Sun heats the Earth*, to show the temperature. Discuss. (The thermometer is getting hotter each time they check.)

SCIENTIST:

FAHRENHEIT: Gabriel Fahrenheit, a German scientist, developed his mercury thermometer in 1714. He used the normal body temperature of his cow (instead

of a person) as the standard and called it 100 degrees. He froze salt water and called that point 0 degrees. That is why the boiling point is 212°F, the freezing point is 32°F for pure water, and human body temperature is 98.6°F.

MATERIALS:

For the Class

- 18 thermometers
- 6 cups with 1" each of sand
- 6 cups with 1" each of soil
- 6 cups with 1" each of water
- 18 textbooks

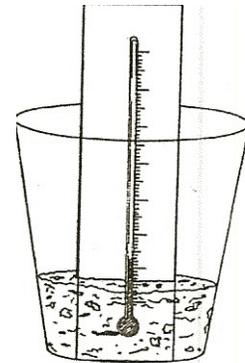
For the Teacher

- 1 empty cup (air)
- 1 thermometer

EXPLORE:

DOES LAND OR WATER COLLECT MORE HEAT FROM THE SUN?

1. Pass out the thermometers in the cups of sand, soil, and water, and the worksheet *Which Gets Hotter*.
Each pair of students will watch one experiment and then compare their results with the results of other experiments.
This can be done as a group discussion.
Record each team's results on the board for comparison.
2. Have students predict which materials will collect the most heat. Place a thermometer in each cup with the bulb pushed into the soil, sand, or water. Students record the material they are testing (#1) and then read the thermometer and record the temperature on the worksheet (#2). Place all experiments together in a sunny location on a textbook so the hot cement does not affect the results.
3. *Have students:* Check the temperature in 10 minutes. Record the temperature on the worksheet. Check the temperature in 20 minutes and 30 minutes. Feel the textbook. Record the temperatures. How does it feel each time you check? (hotter) Bring the experiments into the class. Check again in 10 minutes. Which experiment remained the hottest? How hot did the air get? (Probably the soil and sand cooled quickly and the water held the heat longer.)



4. **WHICH MATERIAL COLLECTED THE MOST HEAT?**
WHICH STAYED THE COOLEST?

Sand and soil keep the heat on the surface since sunlight cannot pass through them. When you push your toes under the hot sand at the beach,

the sand is cooler. Sand and soil heat up quickly but lose heat quickly when the Sun goes down.

The light energy penetrates the water, heating the water underneath. Water holds the heat for a longer time. Therefore the ocean temperature does not vary by many degrees over the year, but the land temperature does!

5. **CLEAN-UP:** Store the cups with sand and soil so they are ready for the next class.

NOTE:

TEMPERATURES DETERMINE WIND PATTERNS

During the day winds blow from the ocean onto the shore as the hot air rises over the land and the cooler air over the water replaces it. At night, the temperature over the land cools quickly and wind moves from the cooler land air toward the ocean. The water retains its heat for a longer period of time. That's why ocean temperatures vary only 10-20°F during the year in Southern California, while land temperatures vary greatly.

The Sun Heats the Earth

First the temperature was _____ °F.

Now, put your thermometer on black paper in the sun.

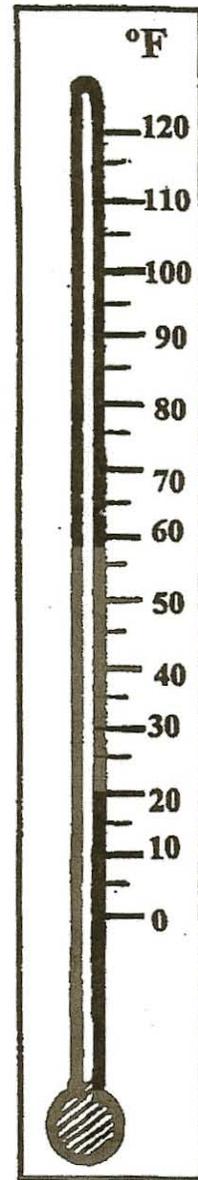
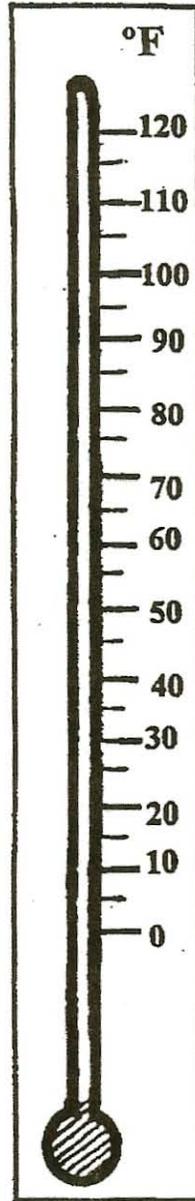
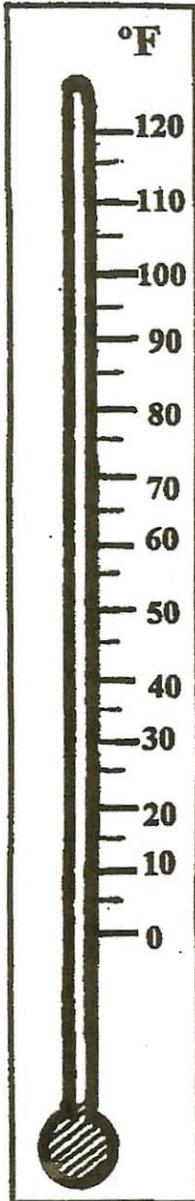
Color in each thermometer.

The hottest temperature was _____ °F.

After 5 minutes.

After 10 minutes

After 15 minutes.



**Which gets hotter?
Experiments with Sand, Soil, Air, And Water**

1. My experiment tested _____.
2. First the thermometer said _____ °F
3. After 10 minutes it was _____ °F
4. After 20 minutes it was _____ °F
5. After 30 minutes it was _____ °F
6. _____ stays cooler.
7. _____ gets hotter.
8. I used a _____
to measure the temperature.
9. I brought my experiment into the classroom after 30 minutes.
10. The temperature after 10 minutes in the classroom was _____ °F.

Draw your experiment.