

Energy, Heat, & Temperature Mapping





Our Blue Marble: Energy, Heat, & Temperature Mapping

Activity 1: Energy & heat

Objective:

Students will experiment with liquid crystals to see how energy affects the crystals.

Materials Needed:

- ✓ 3 liquid crystal sheets
- ✓ 2 infrared thermometers
- ✓ 1 dry erase board
- ✓ 1 dry erase board marker
- ✓ 1 dry erase board eraser
- ✓ 1 global heat map
- ✓ 1 United States heat map

Summary of Student Action:

Students will experiment with how energy affects the surface temperature of different materials. When students put their hand against the liquid crystal sheet, they will be able to see how the liquid crystals react to the added heat energy from their hand. Using the infrared thermometer, students will be able to take two temperature readings: 1. The surface temperature of the liquid crystal sheet where they placed their hand, and 2. The surface temperature of the liquid crystal sheet that was not touched by their hand.

Setup Instructions:

Set out the liquid crystal sheets and infrared thermometers.



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Activity 1: Energy & heat

Activate Your Knowledge:

What does it feel like when you stand in the sunlight? What about in the shade? Energy from the Sun serves as the primary source of energy for the Earth. This energy is what plants rely on to grow and produce food. It is also what helps to keep our planet warm. We can observe the energy from the Sun in two ways: heat and light. Today you will experiment with liquid crystals to see energy in action.

Materials You Will Need:

- | | |
|----------------------------|----------------------------|
| ✓ 1 liquid crystal sheets | ✓ 1 dry erase board eraser |
| ✓ 1 infrared thermometer | ✓ 1 global heat map |
| ✓ 1 dry erase board | ✓ 1 United States heat map |
| ✓ 1 dry erase board marker | |

Procedures:

NOTE – Use the dry erase board to write down your observations, record your answers to the questions, and jot down notes or data you think is important.

 **Safety tip: Do NOT point the laser of the thermometer at a person.** 

1. Without touching it, observe the liquid crystal sheet. What color is it?
2. Lay your hand on top of the sheet and hold it there for 10 seconds. Remove your hand from the sheet. What happened?
3. Again, lay your hand on top of the sheet and hold it there for 10 seconds. Remove your hand from the sheet. Quickly use the infrared thermometer to measure the temperature of your handprint on the liquid crystal sheet by pointing the thermometer at the sheet and pulling the trigger button. You should be able to see a red dot from the laser pointer on the surface of the crystal sheet.
4. Measure the temperature on a part of the sheet without your handprint. Was the temperature the same, higher, or lower?
5. Try the experiment again with your hand on the sheet for 30 seconds. How does it compare to when you put your hand down for 10 seconds? How does your handprint on the sheet compare to the two heat maps on the table?
6. Make sure to erase the dry erase board before you leave.



Our Blue Marble: Energy, Heat, & Temperature Mapping

Activity 2: Temperature Mapping

Objective: Students will measure the surface temperature of different materials.

Materials Needed:

- | | |
|--------------------------------|----------------------------|
| ✓ 2 infrared thermometers | ✓ 2 heat lamp bulbs |
| ✓ 1 container of 9 black tiles | ✓ 1 dry erase board |
| ✓ 1 container of 9 white tiles | ✓ 1 dry erase board marker |
| ✓ 2 heat lamps | ✓ 1 dry erase board eraser |

Summary of Student Action:

Students will use the infrared thermometer to measure the temperatures of the tiles on the table. With the heat lamp, students will be able to observe how the surface temperatures of the materials change when exposed to energy from the lamp.

Setup Instructions:

- Cut the mesh to separate the black tiles. Do the same for the white tiles.
- Set up one part of the table with the heat lamp positioned so it is shining on one black tile and one white tile.
- Place the remaining black tiles and white tiles on the table away from the light of the lamp.

Additional Notes:

- Use caution when handling the heat lamp. Turn off the heat lamp between participants and remind participants that it is too hot to touch.
- You may want to have the students set a timer for how long the heat lamp in Activity 2 must be on to give the tiles adequate time to heat up. If you do not have a timer, then have the students count to a specific number.
- Remind students not to point the infrared thermometer at anyone – especially someone's eyes.



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Activity 2: Temperature Mapping

Activate Your Knowledge:

When light from the Sun reaches Earth, it touches many different surfaces. Look around you. What do you see? Do you think each of the things you react to sunlight the same way?

Materials You Will Need:

- | | |
|--------------------------|----------------------------|
| ✓ 1 Infrared Thermometer | ✓ 1 Dry Erase Board |
| ✓ 1 Black Tile | ✓ 1 Dry Erase Board Marker |
| ✓ 1 White Tile | ✓ 1 Dry Erase Board Eraser |
| ✓ 1 Heat Lamp | |

Procedures:

NOTE – Use the dry erase board to write down your observations, record your answers to the questions, and jot down any notes or data you think is important.

 **Safety tip: The lamp is HOT. Do NOT touch the lamp.** 

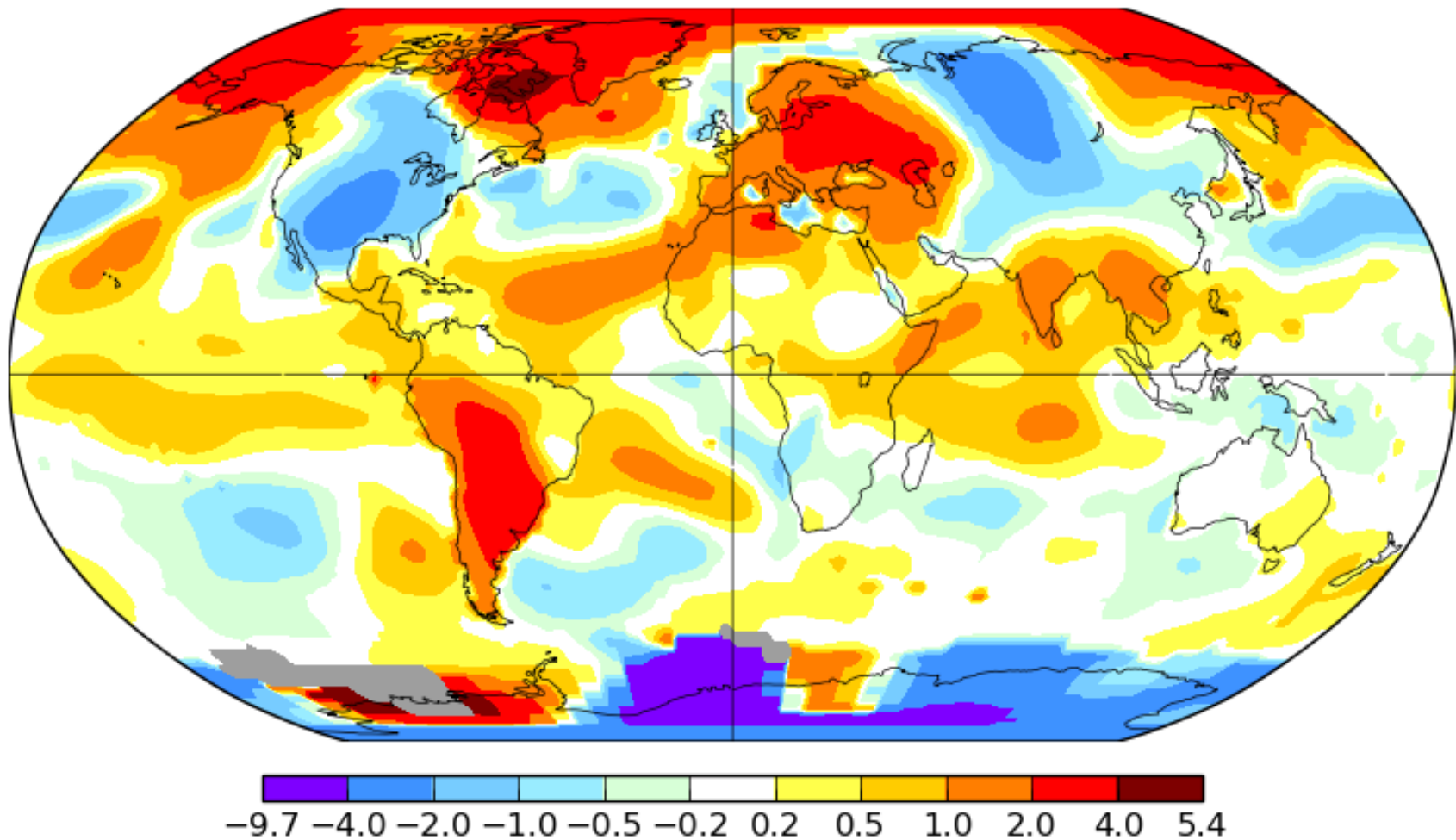
1. Observe the tiles on the table. What kind of surfaces could the tiles represent in our experiment?
2. Turn the lamp on and slowly count to 30 before testing. Now, place the tiles underneath in the lamp's light.
3. Using the infrared thermometer, measure the temperature of the tiles that are NOT under the light. Write down the temperature on to your dry erase board.
4. Make a prediction: What will happen to the temperature of the tiles under the light? Write down your answer on the dry erase board.
5. Now use the infrared thermometer to measure the temperature of the tiles under the light. How does that compare to the tiles not under the light? How do your results compare to your prediction? Write down your answers on the dry erase board.
6. Look back over the information you have recorded on your dry erase board. What impacted your results? How do you expect the temperature to change if you leave the light on longer?
7. Erase the dry erase board after you have completed the station.

Global Heat Map

June 2019

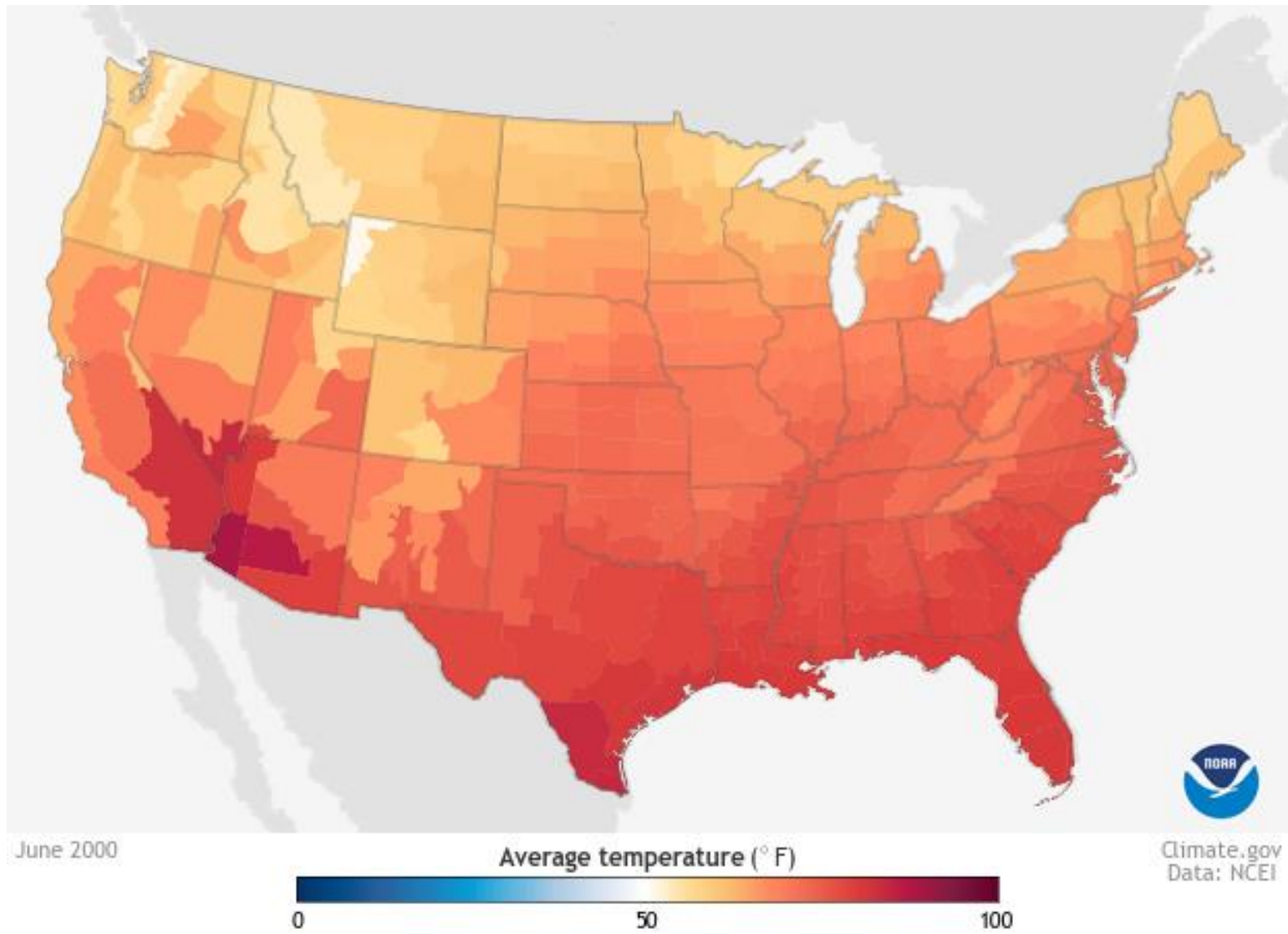
L-OTI(°C) Anomaly vs 2018-2018

0.14



Source: <https://data.giss.nasa.gov>

United States Heat Map



Source: <https://data.giss.nasa.gov>

CAUTION: LAMP IS HOT

PLEASE DO NOT TOUCH

