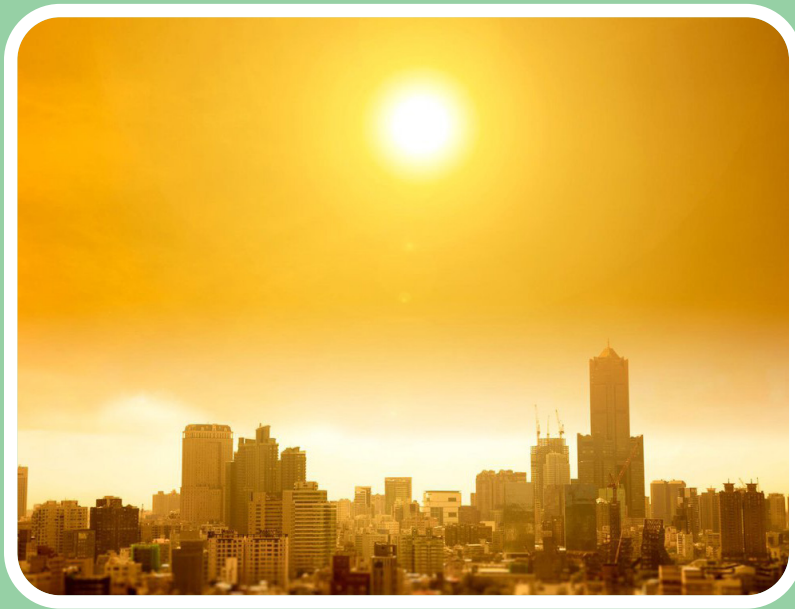


Steady State

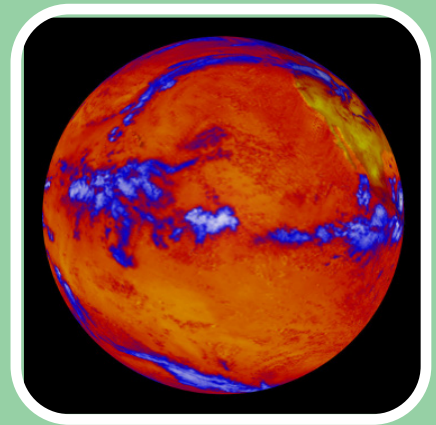


Steady State

**Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.**

Heat energy is a measure of the kinetic energy that moves from one place or object to another place or object. Take the following brief quiz to see how much you already know about the movement of heat energy. See the bottom of page 4 to check your answers.

1. What is the highest natural temperature ever recorded on the surface of Earth?
 - a. 46.1 °C (115 °F)
 - b. 50.6 °C (123 °F)
 - c. 56.7 °C (134 °F)
 - d. 112.4 °C (234.3 °F)
2. What is the highest temperature ever reached by a device created by people?
 - a. 400,000 °C (720,000 °F)
 - b. 4.0 million °C (7.2 million °F)
 - c. 4.0 billion °C (7.2 billion °F)
 - d. 4.0 trillion °C (7.2 trillion °F)
3. What is the lowest natural temperature ever recorded on the surface of Earth?
 - a. -68.7 °C (-91.7 °F)
 - b. -89.2 °C (-128.6 °F)
 - c. -96.4 °C (-141.5 °F)
 - d. -109.7 °C (-165.5 °F)
4. What is the lowest temperature ever reached by a device made by people?
 - a. -243.77 °C (-406.79 °F)
 - b. -259.39 °C (-434.90 °F)
 - c. -266.34 °C (-447.41 °F)
 - d. -273.15 °C (-459.67 °F)
5. What is the temperature of outer space?
 - a. -120 °C (-184 °F)
 - b. -270 °C (-455 °F)
 - c. 120 °C (248 °F)
 - d. 270 °C (518 °F)



How Does It Feel?

The human body is a great detector of the surrounding environment. But can the body be fooled into making incorrect determinations about the temperature of objects? Get started now investigating heat and temperature.

Materials Required

1 – desk or chair with metal legs

1 – sheet of notebook paper

Procedure

1. Place the sheet of notebook paper on a flat surface.
2. Place the palm of your hand on the notebook paper.
3. In Table 1, record how the temperature of the notebook paper “feels” to your hand.
4. Place your hand around the metal leg of a desk or chair.
5. In Table 1, record how the temperature of the metal leg “feels” to your hand.

Table 1. Observations

Object	Observations
Sheet of notebook paper	
Metal leg of desk or chair	

Questions

1. Which object felt warmer to your touch?
2. Which object felt colder to your touch?
3. Both objects were actually at the same temperature (room temperature). Construct an explanation as to why the two objects felt differently.
4. Based on your answers to the previous questions, are your hands measuring temperature or heat when you touch objects?

Steady State

The Big Chill

Currently, about 200 people who recently died have had their heads and/or bodies frozen with the hopes of future science being able restore their health and life. The process, called cryonics, has the body parts stored in cylinders with liquid nitrogen that preserves the bodies at a temperature of $-196\text{ }^{\circ}\text{C}$ ($-321\text{ }^{\circ}\text{F}$). Most of the people who died had a terminal disease for which there is currently no cure. These people hoped that in the future doctors will find a cure for their illness and determine a safe method for thawing the bodies without damaging their critical organs and tissue.

Once a person has agreed to take part in this program, after the person dies the body is immediately moved into an ice-bath to slow down the decomposition process. Next, the person's blood is replaced with an organ-preserving solution that further reduces the deterioration of the body. Members of the cryopreservation team add chemicals to the body that prevent the formation of ice crystals in the body, which can burst cells and render them permanently damaged. The body is then placed into the liquid nitrogen tanks and cooled to the final storage temperature.

Two problems arise for the people choosing to be cryonically preserved: 1) The current cost is around \$200,000 per person and 2) no one knows if the technology will ever work to thaw and restore a human. Although scientists have successfully frozen and restored the brain of a rabbit that did not result in any structural damage to the rabbit's brain, no human has ever been successfully restored.



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Answers: Page 2 Answers: 1) c, 2) d, 3) b, 4) d, 5) b. Page 3 Answers: How Does It Feel? 1) The notebook paper generally feels warmer. 2) The metal usually feels colder. 3) Metals conduct heat away from your body better than paper, so as the hand "loses" heat energy, the hand feels colder. 4) Hands generally measure temperature differences and heat energy transfer between body temperatures and the temperatures of other objects.

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