

Photo Description



The image shows a handheld infrared thermometer with an orange and black case displaying a temperature reading of 113.5°F on its digital screen. A person is holding the device and pointing it toward a brick surface to measure the temperature without touching it. The thermometer uses invisible infrared light to detect heat energy coming from objects.

Scientific Phenomena

The anchoring phenomenon here is non-contact temperature measurement using infrared radiation. All objects emit invisible infrared energy (heat waves) based on their temperature. The infrared thermometer contains a special sensor that detects these heat waves and converts them into a temperature reading on the digital display. This happens because thermal energy naturally radiates outward from warmer objects as electromagnetic waves that travel through air at the speed of light.

Core Science Concepts

1. Thermal Energy Transfer: Heat energy moves from warmer objects to cooler surroundings through radiation, which can travel through air and space without needing direct contact.
2. Electromagnetic Spectrum: Infrared radiation is a type of invisible light energy that carries thermal information and exists beyond what our eyes can see.
3. Energy Detection and Measurement: Scientific instruments can detect and measure forms of energy that humans cannot directly sense, converting invisible phenomena into visible data.
4. Temperature vs. Heat: Temperature measures how hot or cold something is, while heat refers to the actual thermal energy moving between objects.

Pedagogical Tip:

Use everyday examples like feeling warmth from a campfire or the sun on your face to help students understand that heat can travel through air without touching the source.

UDL Suggestions:

Provide multiple ways for students to explore temperature by using both contact thermometers and infrared thermometers, allowing kinesthetic learners to handle tools while visual learners observe digital displays and data collection.

Zoom In / Zoom Out

Zoom In: At the molecular level, atoms and molecules in warmer objects vibrate faster, creating electromagnetic waves that travel outward as infrared radiation. The thermometer's sensor contains materials that respond to these invisible waves by generating electrical signals.

Zoom Out: Infrared radiation is essential for Earth's energy balance - our planet receives infrared energy from the sun and radiates heat back to space. Weather satellites use infrared sensors to measure cloud temperatures and track storm systems from orbit.

Discussion Questions

1. "Why might an infrared thermometer give you a different reading than a regular thermometer when measuring the same object?" (Bloom's: Analyze | DOK: 3)
2. "What are some advantages of measuring temperature without touching an object?" (Bloom's: Evaluate | DOK: 2)
3. "How do you think firefighters or doctors might use infrared thermometers in their work?" (Bloom's: Apply | DOK: 2)
4. "If all objects give off infrared energy, why can't we see it with our eyes?" (Bloom's: Understand | DOK: 2)

Potential Student Misconceptions

1. Misconception: "The thermometer shoots out a laser beam to measure temperature."
Clarification: The red dot is just a pointer to show where you're aiming. The thermometer detects invisible heat waves already coming from the object.
2. Misconception: "Only hot things give off heat energy."
Clarification: All objects above absolute zero (-459°F) emit infrared radiation, even ice cubes and frozen foods.
3. Misconception: "You have to point the red dot exactly right or it won't work."
Clarification: The sensor detects infrared energy from a wider area than just the small red dot indicates.

NGSS Connections

- Performance Expectation: 5-PS1-3 - Make observations and measurements to identify materials based on their properties
- Disciplinary Core Ideas: PS3.A - Energy can be moved from place to place by moving objects or through sound, light, or electric currents
- Disciplinary Core Ideas: PS4.B - An object can be seen when light reflected from its surface enters the eyes
- Crosscutting Concepts: Energy and Matter - Energy can be transferred in various ways and between objects
- Crosscutting Concepts: Patterns - Similarities and differences in patterns can be used to sort and classify natural phenomena

Science Vocabulary

- * Infrared radiation: Invisible heat energy that travels as waves from warm objects
- * Thermal energy: The energy that comes from heat and makes molecules move faster
- * Electromagnetic spectrum: All the different types of energy waves, including light we can see and infrared we cannot
- * Radiation: Energy that travels through space without needing to touch anything
- * Sensor: A device that detects and responds to changes in the environment
- * Temperature: A measurement of how hot or cold something is

External Resources

- Children's Books:
- Heat Wave by Helen Kettelman

- Temperature and Heat by David Dreier
- Energy Makes Things Happen by Kimberly Brubaker Bradley

YouTube Videos:

- "How Do Infrared Thermometers Work?" - Simple explanation of infrared detection technology for kids: <https://www.youtube.com/watch?v=x4MBz4xNIPc>
- "Thermal Energy for Kids" - Educational video covering heat transfer and temperature concepts: <https://www.youtube.com/watch?v=rb4wbSdCpNY>