Infrared Thermometer

Physical Science | Engineering Design Process

Engineering Challenge

Visible Elements in Photo

- An infrared (non-contact) thermometer with orange housing and digital display showing 119.5°F
- A human hand holding the device
- Concrete paved surface (appears to be a driveway or sidewalk) with gray mortar lines
- Sunlight casting shadows from overhead structures (likely a roof or overhang)
- Temperature reading displayed on LCD screen with Celsius/Fahrenheit toggle buttons

Reasonable Inferences

- From the high temperature reading (119.5°F) + sunlit concrete: The surface is absorbing significant solar heat, suggesting this measurement was taken in direct sunlight on a warm day.
- From the infrared thermometer's presence: Someone is investigating heat differences in outdoor materials, implying a need to measure or compare surface temperatures.
- From the concrete surface + visible shadows: Some areas receive direct sun while others are shaded, meaning temperature varies depending on exposure.

Engineering Task

K-2 Challenge:

> Build a sun shield to keep things cool! Use materials like paper, cloth, or leaves to create a cover that blocks sunlight. Test it on a warm spot outside. Does your shield make the ground feel cooler in the shade it creates? Try different materials and see which one works best.

3-5 Challenge:

> Design a passive cooling structure that reduces surface temperature by at least 15°F compared to an exposed control surface. You may use only natural materials (leaves, branches, cardboard, cloth, or sand). Your structure must be no larger than 12 inches × 12 inches and must stand on its own for at least 10 minutes in direct sunlight. Measure surface temperature under your structure and in open sun using a thermometer. Which materials worked best and why?

EDP Phase Targeted

Ask / Define Problem

This photo shows evidence of a real-world observation (measuring heat differences on concrete) without showing an existing solution. Students need to first identify why we care about temperature differences in outdoor spaces (shade comfort, material durability, heat management), then design a cooling strategy. Starting with "Ask" allows students to observe, measure, and articulate the problem before jumping to design.

Suggested Materials

1. Cardboard, newspaper, or kraft paper
2. Cloth scraps, old t-shirts, or burlap

3. Natural materials: leaves, branches, straw, grass
4. Sand or soil in shallow containers
5. A simple dial thermometer or infrared thermometer (if available for comparison)

Estimated Time

45–60 minutes (one extended session or two 30-minute blocks)
- Discuss & plan: 10 minutes
- Build structures: 15–20 minutes
- Test & measure: 15 minutes
- Compare results & reflect: 10–15 minutes

Why This Works for Teachers

This task directly addresses NGSS ETS1.B (Developing Possible Solutions), requiring students to test different material properties and select designs that meet a specific performance criterion (temperature reduction), while grounding the challenge in observable, measurable real-world phenomena.