

Core Science Concepts



- Heat energy causes objects to glow and change color — The red-orange glow of the heating element demonstrates energy transfer and visible light production from thermal energy.
- Light and heat travel through space — The visible glow emanating from the heater shows how light energy radiates outward from a heat source.
- Materials have different properties that affect how they respond to heat — The mesh/perforated material allows heat and light to pass through while providing structure.
- Observation of cause and effect — The heating element's electrical energy is...

Lesson Overview

- Grade Level: Kindergarten
- Subject: Science (Physical Science — Energy)
- Time Allotment: 90–110 minutes across two sessions (Session 1: 45 minutes; Session 2: 45-65 minutes)
- NGSS Standards:
 - K-PS3-2: Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area
 - K-PS3-1: Make observations to determine the effect of sunlight on Earth's surface

Learning Objectives

Students will be able to:

1. Observe and describe how heat energy can make objects glow and produce light.
2. Identify sources of heat and light in their environment (sun, lamps, heaters).
3. Predict and test how different materials block or allow heat and light to pass through.
4. Explain in simple terms that heat and light are forms of energy that travel and change things.

1. ENGAGE

Objective: Capture student curiosity about heat, light, and energy by examining the glowing heater photograph.

Materials:

- Projected image of the propane heater with red-orange glowing elements
- Optional: A flashlight or small safe lamp to demonstrate glow (do NOT use actual heater)
- Chart paper or whiteboard for recording student ideas

Activity:

1. Display the photograph on a screen or as a large printed image. Dim the classroom lights slightly to mimic the photograph's dramatic lighting effect if possible.
2. Pose opening question: "What do you see in this picture? What is making it glow red and orange?"
3. Ask curiosity-building questions:

- "Why do you think this thing is glowing? What's happening inside?"
- "Have you ever seen something glow like this? When?"
- "Is the glow hot or cold? How do you think you know?"
- "What do you think would happen if you put your hand near this glow?" (Discuss safety—we don't touch!)

4. Prediction prompt: "Today we're going to discover how heat makes things glow. Before we start, can you show me with your hands: Is a glow hot or cold? Can you make a warm motion?"

5. Record student predictions on chart paper. Use drawings, words, or both.

Transition: "Great questions! Now let's do some safe experiments to figure out how heat makes light. We'll use the sun and other tools to explore."

2. EXPLORE

Objective: Students investigate how heat and light interact with different materials through hands-on exploration.

Materials:

- Sunny window or bright outdoor area
- 5–6 thermometers (analog dial or large-number digital ones)
- Small black paper squares (construction paper)
- Small white paper squares
- Small squares of aluminum foil
- Small pieces of transparent plastic (clear food wrap or page protectors)
- Small pieces of dark fabric or felt
- Dark box or cardboard cube with one transparent side (optional: pre-made)
- Paper towels for recording
- Clipboards (1 per pair of students)
- Camera or smartphone to document findings

Activity:

Station-Based Exploration (Divide class into 2–3 groups; rotate stations)

Station 1: Light and Heat Through Materials

- Students place different materials (white paper, black paper, foil, plastic, fabric) on a sunny windowsill or in direct sunlight.
- They place a thermometer under or near each material.
- After 5 minutes, they carefully touch each material (with teacher supervision) and describe: "Is it hot or cold?"
- Encourage descriptions: "This one is very warm!" "This one is still cool!"
- Document: Teacher helps students draw or mark which materials got the hottest.

Station 2: The Dark Box Heat Trap

- Place a dark box in sunlight with a clear plastic side facing the sun.
- Place thermometers inside and outside the box.
- Discuss: "Why do you think it's hotter inside the box?"
- Hypothesis-building: Guide students: "Does the clear material let heat in? Can heat get back out?"

Station 3: Light Through Different Materials

- Shine a flashlight through transparent, translucent, and opaque materials.
- Students observe which materials let light through, which block it, and which let some through.
- Record: Draw pictures showing "light comes through" vs. "light doesn't come through."

Teacher Role:

- Ask guiding questions without giving answers: "What do you notice? Is that material warming up? Why might that be?"
- Help students feel safe materials carefully (temperature check yourself first).
- Encourage specific vocabulary: "That material is letting light through—can you see the light?" "The heat is building up inside the box."
- Take photos of student predictions and findings.

Expected Student Outcomes:

- Students discover that dark materials absorb more heat.
- Students observe that transparent materials let light and heat pass through.
- Students make the connection: glow = heat + light moving through space.

3. EXPLAIN

Objective: Formalize vocabulary and connect discoveries to the heater photograph.

Materials:

- Chart paper with vocabulary words and simple drawings
- The original heater photograph displayed again
- Picture cards showing: sun, lamp, fire, glow stick (various light/heat sources)
- Kindergarten-friendly reference chart

Activity:

1. Group share-out: Gather students in a circle. Ask each station group to share one discovery:
 - "What did you learn about dark materials?"
 - "What surprised you about the clear box?"
 - "Which material let the most light through?"
2. Introduce key vocabulary with Kindergarten-friendly definitions:
 - Heat: Energy that makes things warm. When you feel warm, heat is moving into you.
 - Light: Energy that we can see. It travels through space and helps us see things. It comes from hot things like the sun and from glowing things.
 - Glow: When something gets so hot that it makes light. The heater in the picture glows red-orange because it's very hot.
 - Energy: The power to make things move, get warm, or light up.
 - Absorb: To take in or soak up. Dark materials absorb (soak up) more heat from the sun.
3. Connect back to the photograph:
 - "Remember the picture of the red-orange glow? That's a heater getting very, very hot. The heat is so strong that it makes light—it glows! That's the same idea we explored with our materials and the sun."
 - Point to the glowing parts: "This is what happens when something gets very hot. It makes light."
4. Check for Understanding:

- "Can you show me with your body: Are you glowing like the heater? How would you need to feel to glow?" (Prompt: "Very hot!")
- "Which material did we find keeps heat in the most?" (Dark materials, box)
- "If the sun is hot and makes light, how is that like the heater in the picture?"

Vocabulary Chart (Display in classroom):

| Word | Picture | Simple Definition |

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| Heat | Sun, flame | Makes things warm |

| Light | Glow, sun rays | We can see it; travels through space |

| Glow | Red heater, fire | Super hot things that make light |

| Energy | Lightning bolt, sun | Power to make things warm, move, or light up |

| Absorb | Dark fabric on sun | Takes in and holds heat |

Expected Student Outcomes:

- Students use vocabulary words to describe what they observed.
- Students make connections: sun = heat + light; heater = heat + light.
- Students explain why dark materials got hotter (they absorb energy).

4. ELABORATE

Objective: Students apply heat and light concepts to a design challenge inspired by the heater image.

Materials:

- Large sheets of paper or cardboard
- White, black, and colored construction paper
- Aluminum foil, plastic wrap, dark fabric, straw, blocks
- Tape, glue stick, scissors
- Small thermometers
- Sunny location or strong lamp
- Design worksheet (teacher-created, simple line drawings for labeling)

Activity: Design a Shade Structure to Keep a Spot Cool

Challenge (inspired by K-PS3-2): "The heater makes light and heat that glow bright. But sometimes we want to block heat and light to keep things cool. Can you build a shade or shelter to keep a thermometer from getting too hot in the sun?"

Student Steps:

1. Discuss: "What keeps heat and light out? What did we learn?"
 - Dark materials, thick materials, foil that bounces light
2. Plan: Students sketch their idea on paper—what materials will they use to block heat?
3. Build: Provide time for students to construct a simple shade structure over a thermometer placed in sunlight.
 - Ideas: folding dark paper into a tent, wrapping foil around the thermometer, layering materials
4. Test: After 10 minutes in the sun, check: Did your thermometer stay cooler than one in the open?
5. Compare: Place two thermometers side by side—one in shade, one in sun.

Teacher Role:

- Guide without building for them: "Tell me your idea. What material will you try first?"
- Ask reflective questions: "Is your structure blocking the light? How can you tell?"
- Celebrate all attempts: "You used foil because it bounces light away—that's thinking like an engineer!"

Expected Student Outcomes:

- Students apply understanding that dark and reflective materials reduce heat absorption.
- Students recognize that blocking light helps reduce warmth.
- Students demonstrate design thinking: try, observe, adjust.

5. EVALUATE

Objective: Assess student understanding of heat, light, and energy concepts.

Formative Assessment (ongoing throughout lesson):

- Observation during Explore: Do students describe temperature changes? Do they make observations about light passing through materials?
- Listen during group share-out: Do students use newly learned vocabulary? Can they connect discoveries to the heater photo?
- Watch during Elaborate: Do students apply concepts to the design challenge? Do they adjust their structure based on results?

Exit Ticket / Summative Assessment (choose one or combine):

Option A: Picture Sort & Label

- Show four pictures: (1) sun, (2) glow stick, (3) lamp, (4) ice cube
- Ask: "Which of these make heat and light like the heater in our picture?"
- Students point to or circle the correct ones
- Success criteria: Students correctly identify 3 of 4 heat/light sources

Option B: Observation Drawing

- Provide a simple drawing of the sun shining on two objects: one wrapped in dark paper, one wrapped in white paper
- Ask: "Draw which one will get hotter. Why?"
- Success criteria: Student shows dark material and can explain (even with simple words or drawings) that dark holds more heat

Option C: Verbal Assessment (for small groups or individuals)

- Ask: "The heater in our picture glows red-orange. Why does it glow?"
- Expected responses: "Because it's hot," "Heat makes light," "When something is very hot, it makes light"
- Success criteria: Student makes connection between heat and light/glow

Option D: Hands-On Demonstration

- Place a thermometer in sunlight and one in shade
- Ask: "Which one will show a higher number? Why?"
- Success criteria: Student correctly predicts and explains that sunlight brings heat energy

Expected Student Outcomes (Overall):

- 90% of students can identify heat and light as forms of energy
- 85% of students can explain that dark materials absorb more heat

- 80% of students can make a connection between the heater photograph and concepts learned (sun, heat, light, glow)
- Majority of students use vocabulary words (heat, light, glow, energy) in context

Differentiation

Extension Activities

1. Heater Science Scavenger Hunt: Provide a classroom scavenger hunt where students find items that make heat (lamp, sunny window, oven—teacher must point out, not touch) and items that block heat (shade, dark cloth, hat). Create a simple checklist with pictures. Students check off what they find and explain to a friend why each item is on the list.
2. Sun Journal (Multi-Day): Over one week, students observe the sun's warmth and light at different times of day. Each day, they draw or mark on a calendar: "Sun is hot and bright," "Sun is warm but not as bright," "Sun is not here." Discuss: "When is the sun most powerful?" This connects to K-PS3-1 (observations of sunlight's effect on Earth).
3. Make a Glowing Model: Provide battery-powered LED lights and dark paper or tissue tubes. Students create a "glow model" by taping the light inside a tube and wrapping it with different materials (foil, dark tissue, clear plastic). They observe which materials let the glow show through best. Display in a dark corner of the classroom and discuss: "This light is like the heater in our picture—it makes a glow!"
4. Hot and Cold Sort: Gather pictures of warm things (sun, fire, heater, hot chocolate, soup) and cool things (ice, snow, fan, cold water, freezer). Students sort and create a classroom chart: "Things That Give Heat and Light" vs. "Things That Are Cold." Discuss how heat and light go together but cold is different.
5. Parent Letter & Home Exploration: Send a simple letter home asking families to observe one heat/light source at home (lamp, oven door, heater, sunny window) with their child. Students draw what they saw and bring back to share in a class "Heat and Light Gallery Walk."
