Thermal Energy

Physical Science | Lesson Guide

Kindergarten

Photo Description

This image shows an egg cooking on a hot black frying pan above a blue flame. The white part of the egg (called the egg white) is getting firm and solid, while the yellow part in the middle (called the yolk) is still soft. Heat from the stove is making the egg change!

Scientific Phenomena

Anchoring Phenomenon: Heat transfer and the effects of thermal energy on matter

Why It's Happening: When the hot pan touches the cold egg, thermal energy (heat) moves from the hot pan into the egg. This heat causes the proteins in the egg to change shape and bond together, making the liquid egg white turn into a solid. This is called a physical change—the egg looks and feels different, but it's still an egg. The blue flame is burning fuel (natural gas or propane), which creates heat energy that warms the pan.

For kindergarteners, the simple explanation is: The hot stove makes the egg get warmer and harder.

Core Science Concepts

- Thermal Energy (Heat): Energy that makes things warm. Heat always moves from something hot to something cold. The hot pan is giving heat to the cold egg.

- States of Matter and Change: When heat is added to some things, they change. The raw egg is mostly liquid (runny), but heat makes it become solid (firm). This shows that heat can change how things look and feel.

- Energy Sources: The flame is a source of energy. We can see the blue flame releasing energy as light and heat.

- Cause and Effect: The flame heats the pan !’ the pan heats the egg !’ the egg changes texture and appearance. Students can observe that something (heat) caused a change (solid egg).

Pedagogical Tip:

For Kindergarten, avoid the term "heat transfer." Instead, use simpler language: "The hot pan is making the egg warm," or "The stove gives heat to the egg." Let students observe the visible changes (color, texture) rather than focusing on invisible heat movement. Cooking is a relatable, engaging phenomenon that children experience in their homes!

UDL Suggestions:

UDL Strategy - Multiple Means of Representation: Provide a real, safe cooking demonstration (or video clip) so visual learners see the change. Use descriptive language and let students touch (safely) a warm (not hot) pan so kinesthetic learners understand warmth. Create a simple photo sequence showing "raw egg !’ cooked egg" for students who need visual supports.

Zoom In / Zoom Out

Zoom In: The Tiny Protein Molecules
When we zoom in very close to the egg—so close that we'd need a special microscope to see it—we'd find teeny, tiny things called proteins. These proteins are like long chains that are all tangled up and loose in a raw egg. When heat touches them, the heat makes these protein chains wiggle and move really fast. When they wiggle so much, they start holding hands with each other and clump together. This makes the runny egg white become firm and solid! The proteins are too small to see with our eyes, but their action is what makes the big change we can see.

Zoom Out: The Kitchen Ecosystem & Energy Flow
When we zoom out and look at the whole picture, cooking an egg is part of a bigger system. The natural gas or propane in the stove came from deep underground (Earth's energy resources). That fuel burns and releases energy as flame and heat. The heat cooks the egg, which becomes food that gives energy to people's bodies so they can run, play, and learn. The egg itself came from a chicken on a farm, which ate grain and plants that grew using energy from the sun. So cooking with heat connects us to the sun's energy, to farms, to the earth's resources, and to our own bodies' energy—all in one simple moment of cooking breakfast!

Discussion Questions

1. "What do you notice happening to the egg as the pan gets hotter?" (Bloom's: Observe/Remember | DOK: 1)
   - Encourages direct observation of the phenomenon.

2. "Why do you think the egg white turned from runny to hard?" (Bloom's: Understand | DOK: 2)
   - Builds understanding of cause-and-effect with heat.

3. "What other foods have you seen change when grown-ups cook them? How did they change?" (Bloom's: Understand/Apply | DOK: 2)
   - Connects to students' real-world experiences and prior knowledge.

4. "What do you think would happen if we waited even longer to cook the egg? Why?" (Bloom's: Analyze/Predict | DOK: 3)
   - Encourages prediction and deeper thinking about ongoing thermal change.

Potential Student Misconceptions

Misconception 1: "Heat is a 'thing' that looks like the flame."
- Naive conception: Kindergarteners may think the blue flame IS the heat, or that heat is a visible, physical object like the fire itself.
- Scientific clarification: The flame is the visible result of burning. Heat is invisible energy that the flame releases. We can't see heat, but we can feel it and see what it does to things (like making the egg white turn solid). The flame produces the heat, but they are not the same thing.

Misconception 2: "Once something is cooked, it will keep cooking on its own forever."
- Naive conception: Young children might think that because heat started the change, the egg will keep changing without more heat.
- Scientific clarification: Heat must keep being added for the change to continue. Once you remove the hot pan from the stove, the heat stops flowing into the egg, and the cooking stops. The egg stays cooked, but doesn't become "more cooked" without more heat. Heat is needed while the change is happening.

Misconception 3: "All liquids turn solid when they get hot."

- Naive conception: Students might generalize that "heat makes things hard" because they see the runny egg white become firm.
- Scientific clarification: Different materials behave differently with heat! Some liquids (like water) actually boil and become a gas (steam) when heated enough. Ice cream melts and becomes a liquid when heated. Eggs become solid because of their special proteins. Heat causes changes, but the type of change depends on what the material is made of.

Extension Activities

1. Safe Cooking Exploration (Supervised Demonstration)
   - Set up a simple, supervised cooking station where students observe different foods being heated (crackers toasting, marshmallows melting, or water warming—no open flames near children). Use teacher demonstration only. Have students draw or dictate observations of how each food changes with heat. This builds vocabulary and observational skills safely.

2. Warm vs. Cold Sensory Activity
   - Provide safe, age-appropriate items: a warm (not hot) washcloth, a cool spoon, a lukewarm cup of water. Let students carefully touch each and describe: "This is warm," "This is cold," "This is in between." Use temperature-related vocabulary throughout. This develops understanding of thermal energy in a tactile, safe way.

3. Story & Picture Sequencing
   - Read a simple book about cooking (see resources below). Show picture cards of: raw egg !' cooking egg !' cooked egg. Have students arrange the pictures in order and dictate or draw what happens at each stage. This reinforces cause-and-effect thinking and sequencing skills.

Cross-Curricular Ideas

Math Connection: Sequencing & Counting
- Create a photo sequence of cooking steps (raw egg !' partially cooked !' fully cooked) and have students arrange them in order. Introduce ordinal numbers ("first," "second," "third") as they describe the sequence. Count how many times the egg white gets firmer: "The egg changed 1 time, 2 times, 3 times!" This builds numeracy and sequencing skills while reinforcing the cause-and-effect science.

ELA Connection: Descriptive Language & Storytelling
- Read aloud a simple cooking story (like Cooking with Henry and Mudge), then have students dictate or draw their own story about "What Happened to My Egg." Encourage them to use sensory words: "The runny egg became smooth and firm. It was white and yellow. It looked yummy!" Create a class book with students' stories and illustrations. This builds vocabulary, narrative skills, and deepens understanding of the phenomenon through language.

Art Connection: Observation Drawing & Color Mixing
- Have students draw a raw egg and a cooked egg side-by-side, focusing on color and texture changes. Provide yellow, white, and orange paint or crayons to show the difference. Discuss: "What colors do you see in the raw egg? What colors do you see in the cooked egg?" Students can also create a sensory collage using white cotton balls and yellow tissue paper to represent a cooked egg's texture, building fine motor skills and artistic expression.

Social Studies Connection: Food & Family Traditions
- Invite students to share: "What foods do your grown-ups cook at home? How do they change when they cook?" Create a class chart of "Foods We Cook at Home" and discuss cooking as a cultural and family practice. Students can draw or bring in pictures of foods their families prepare. This connects science to community, culture, and the importance of cooking in human life and care.

STEM Career Connection

Chef or Cook
A chef is someone who uses heat and cooking skills to prepare delicious food for people in restaurants, schools, or homes. Chefs understand how different foods change when they are heated—just like our egg! They experiment with temperature, timing, and ingredients to make food taste good and look pretty. They might cook eggs, pasta, vegetables, and meat every day. Average Annual Salary: $35,000–$50,000 USD (varies widely by location and establishment type; head chefs earn significantly more).

Food Scientist
A food scientist is a person who studies how food changes and how to keep food safe and healthy to eat. They do experiments with heat, cold, and ingredients—just like we're doing with the egg. Food scientists figure out why eggs get hard when heated, how to cook food safely, and how to make new foods that are nutritious and delicious. They work in labs and in kitchens! Average Annual Salary: $68,000–$85,000 USD.

Engineer (Appliance or HVAC)
An engineer designs and builds the stoves, ovens, and heating systems that help us cook food safely. They figure out how to make flames that burn evenly, how to distribute heat into ovens, and how to keep kitchens safe. Without engineers, we wouldn't have reliable stoves to cook our eggs! Average Annual Salary: $65,000–$95,000 USD (varies by specialty and experience).

NGSS Connections

Grade K Performance Expectation:
- K-PS1-1: Plan and conduct investigations to provide evidence that vibrations make sound and that objects can be seen only when light is available. (Note: While this standard addresses light and sound, thermal energy observations connect to K-ESS2-1 below.)

Relevant Disciplinary Core Ideas:
- K-PS3.A - Objects can be moved by pushing or pulling. Pushing or pulling can change the speed or direction of moving objects. (Energy and forces context)
- K-PS3.B - Humans and animals use food to get energy to move and grow. (Energy in everyday life—cooking and food)

Crosscutting Concepts:
- Cause and Effect - Simple cause-and-effect relationships (heat causes the egg to change)
- Energy and Matter - Energy can be observed in many forms; heat makes things warm

Science Vocabulary

* Heat: Energy that makes things warm. Heat comes from fire, the sun, and hot things.

* Thermal Energy: Another word for heat energy that makes things hot or warm.

* Cook (or Cooking): Using heat to change food so we can eat it safely.

* Flame: The bright, hot part of fire that we see when something is burning.

* Change: When something looks, feels, or acts different than before.

* Temperature: How hot or cold something is.

External Resources

Children's Books:
- The Egg by M.P. Robertson (a creative, engaging story about an egg)
- Cooking with Henry and Mudge by Cynthia Rylant (shows cooking and food transformation)
- From Seed to Plant by Gail Gibbons (includes images of heat and growth, suitable for extension)

Teacher Tip: Always prioritize student safety when using heat sources. Use video demonstrations, teacher-led activities, or virtual exploration if direct access to cooking appliances is not feasible in your classroom. The key is helping Kindergarteners observe and describe visible changes caused by thermal energy.