Thermal Energy

Physical Science | Lesson Guide

3rd Grade

Photo Description

This image shows a fried egg cooking on a dark skillet over a blue gas flame. The egg white has turned from clear and runny to white and solid, while the yellow yolk in the center remains soft. Heat from the stove is causing the egg to change from its raw state into a cooked meal.

Scientific Phenomena

Anchoring Phenomenon: Heat energy from the stove is causing the egg proteins to permanently change structure—a process called denaturation.

Why It's Happening: When thermal energy (heat) is applied to the egg, it causes the protein molecules in both the white and yolk to unwind and bond together in new ways. This creates a solid or semi-solid texture that cannot be reversed back to raw. The egg white denatures at a lower temperature (~60°C) than the yolk (~65°C), which is why we see different rates of cooking. This is a chemical change—not just a temperature change, but an actual transformation of the material itself.

Core Science Concepts

* Thermal Energy Transfer: Heat flows from the hot skillet into the egg, raising the egg's temperature and causing physical and chemical changes.

* States of Matter & Phase Change: The egg changes from a liquid/semi-liquid state to a more solid state. While not a traditional phase change (like ice to water), it demonstrates how heat affects matter's properties.

* Chemical Change vs. Physical Change: Cooking an egg is a chemical change because the proteins are permanently altered at the molecular level—you cannot return the egg to its raw state just by cooling it.

* Temperature & Energy: Different parts of the egg cook at different rates because different proteins denature at different temperatures, showing that thermal energy affects materials in specific ways.

Pedagogical Tip:

Use the egg-cooking phenomenon as a concrete, relatable anchor. Third graders have likely eaten eggs! Ask them to predict what will happen BEFORE cooking, then observe carefully during cooking. This builds scientific thinking by connecting real-world experiences to abstract concepts like "thermal energy."

UDL Suggestions:

Provide multiple means of engagement by offering choice in how students document observations: drawings, written descriptions, or labeled diagrams. Use real eggs or high-quality videos for students who benefit from visual/tactile learning. Create a word wall with "thermal energy," "heat," "cooking," and "change" so all learners can reference vocabulary independently.

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Discussion Questions

1. What changes do you notice happening to the egg as it cooks? (Bloom's: Observe | DOK: 1)

2. Why do you think the egg white cooks before the yolk? (Bloom's: Analyze | DOK: 2)

3. If we let the cooked egg cool down in the refrigerator, will it turn back into a raw egg? Why or why not? (Bloom's: Evaluate | DOK: 3)

4. What other foods do you eat that change when they are heated? What changes do you observe? (Bloom's: Apply | DOK: 2)

Extension Activities

1. Egg Cooking Prediction & Observation Chart: Have students predict what the raw egg will look like at different cooking stages (1 minute, 2 minutes, 3 minutes), then observe a live egg cooking (or watch a video). Have them record observations with labeled drawings and compare to their predictions. This builds hypothesis testing skills.

2. Temperature & Cooking Investigation: Using boiled eggs, provide students with eggs cooked for different lengths of time (3 minutes, 5 minutes, 7 minutes, 10 minutes). Have them cut or observe the eggs and record how the yolk changes from runny to soft to fully cooked. Discuss how time and temperature work together to cause change.

3. Heat Transfer Exploration: Use warm water, thermometers, and various materials (cloth, plastic, foil, paper) to investigate which materials transfer heat fastest. Ask: "If you were cooking an egg, which material would cook it fastest?" This connects the egg phenomenon to heat transfer properties.

NGSS Connections

Performance Expectation: 3-PS1-4 Observe and record the results of mixing substances together to determine if a new material is formed.

Disciplinary Core Ideas:
- 3-PS1.A (Matter and Its Interactions)
- 3-PS1.B (Types of Interactions)

Crosscutting Concepts:
- Energy and Matter
- Cause and Effect

Science Vocabulary

* Thermal Energy: The heat energy from something hot that can make other things warmer.

* Heat: The flow of thermal energy from something hot to something cooler.

* Cooking: Using heat to change how food looks, feels, and tastes.

* Protein: A material found in eggs and other foods that changes shape when heated.

* Denaturation: When heat causes the proteins in food (like eggs) to permanently change and become firm or solid.

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* Chemical Change: A change that creates a completely new material that cannot be changed back.

External Resources

Children's Books:
- The Egg by M.P. Robertson (explores egg concepts through imaginative storytelling)
- From Egg to Chicken by Gail Gibbons (simple, visual explanation of chicken life cycles and eggs)
- What Happens When You Cook? by Rozanne Lanczak Williams (explores cooking and chemical changes)

YouTube Videos:
- "What Happens When You Cook an Egg?" by SciShow Kids — A clear, engaging explanation of protein denaturation with visuals. https://www.youtube.com/watch?v=gfNkAI16u4I

- "Cooking with Science: Eggs" by National Geographic Kids — A short video showing different ways eggs cook and why. https://www.youtube.com/watch?v=e8C1h8Dk1So

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