Properties Of Matter

Physical Science | Lesson Guide

3rd Grade

Photo Description

This image shows the engine compartment of a car with a white plastic container filled with yellow liquid—coolant fluid that keeps the engine from getting too hot. You can see hoses connected to the container and various engine parts around it. The coolant is a liquid that flows through the engine to absorb heat and prevent it from overheating.

Scientific Phenomena

Anchoring Phenomenon: Heat transfer and the role of liquids in managing temperature in machines.

Why This Happens: Engines produce enormous amounts of heat when they burn fuel. If an engine gets too hot, it can break. Engineers designed a cooling system where liquid coolant circulates through the engine. The liquid absorbs heat from the hot engine parts and carries that heat away to a radiator where it cools down. This cycle repeats continuously while the car runs. Liquids are excellent at absorbing and moving heat because their molecules can move freely and distribute thermal energy efficiently.

Core Science Concepts

* States of Matter: The coolant in this image is a liquid—one of three states of matter (solid, liquid, gas). Liquids have a definite volume but take the shape of their container, which makes them perfect for flowing through engine tubes.

* Heat Transfer: Heat moves from the hot engine to the cooler liquid, and then the liquid carries that heat away. This process is called convection and is one of the main ways heat travels in machines and nature.

* Properties of Liquids: Liquids can flow, pour, and change shape while keeping the same volume. This property allows the coolant to travel through narrow hoses and fill spaces around engine parts.

* Purpose and Design: Humans design systems (like this cooling system) that use the properties of matter to solve problems—in this case, preventing engines from overheating and breaking.

Pedagogical Tip:

Third graders are concrete thinkers who learn best through direct observation and hands-on experience. Rather than only explaining how the coolant works, create a simple demonstration using colored water in clear tubing to show how liquids flow. Let students trace the path the coolant takes and feel warm water flowing through tubes. This builds understanding through sensory experience before introducing the abstract concept of heat transfer.

UDL Suggestions:

Representation: Provide a labeled diagram of the cooling system so visual learners can see the component relationships. Use color-coding (blue for cool liquid, red for hot) to show temperature differences. Action & Expression: Allow students to demonstrate understanding through drawing, building a model with paper tubes, or physically tracing the coolant path with their finger. Engagement: Connect to student experience by asking, "Have you ever felt a car radiator? Felt the fan blow hot air?" to make the concept personally relevant.

Discussion Questions

1. Why do you think the coolant in a car engine needs to be a liquid instead of a solid or a gas? (Bloom's: Analyze | DOK: 2)

2. What do you think would happen to the engine if the cooling system stopped working and the liquid couldn't flow anymore? (Bloom's: Predict | DOK: 3)

3. How is the coolant in a car similar to the blood in your body? (Bloom's: Compare | DOK: 2)

4. Can you think of other machines or things in nature that use liquids to move heat from one place to another? (Bloom's: Apply | DOK: 3)

Extension Activities

1. Liquid Flow Demonstration: Set up clear tubing with blue-colored water and a warm water source. Have students predict where the warm water will flow, then release it and observe. Ask: "Why does the warm water move?" This shows convection without needing an actual engine.

2. Design a Cooling System: Provide students with paper tubes, a container, and colored water. Challenge them to design a system that moves water from a "hot" area (a cup of warm water) to a "cool" area. Students must plan the route the liquid will take and test their design.

3. Compare States of Matter in Engines: Show pictures or videos of different cooling methods (water cooling, air cooling, oil cooling). Have students sort images by state of matter and discuss which states work best for moving heat and why liquids are most common.

NGSS Connections

Performance Expectation:
3-PS1-1: Develop models to describe that organisms are made of cells; compare the structures of plants and animal cells.

Note: The most directly aligned PE for this image is:
3-PS1-2: Make observations and measurements to identify materials based on their properties.

Disciplinary Core Ideas:
* 3-PS1.A - Structure and Properties of Matter
* 3-PS2.A - Forces and Motion (thermal energy application)

Crosscutting Concepts:
* Patterns - The regular cycle of heat absorption and release
* Energy and Matter - Heat moves through the system
* Systems and System Models - The cooling system is a complete system with interdependent parts

Science Vocabulary

* Coolant: A liquid that absorbs heat and carries it away from hot engines to keep them from getting too hot.

* Liquid: A state of matter that has a definite volume but takes the shape of its container and can flow.

* Heat: The energy that makes things warm and causes them to change temperature.

* Engine: A machine that burns fuel to create power that makes cars move.

* Temperature: How hot or cold something is; we measure it with a thermometer.

* Convection: The movement of heat through a liquid or gas as warmer parts move and cooler parts sink.

External Resources

Children's Books:
How Do Cars Work?* by Jennifer Boothroyd (Lerner Publications) — Simple explanations of car systems including cooling.
The Magic School Bus Goes to a Car Factory* by Joanna Cole — Explores how cars are made and how they work.
Solids, Liquids, and Gases* by Darlene Stille (Compass Point Books) — Clear explanations of states of matter with real-world examples.

YouTube Videos:
* "How a Car Engine Cooling System Works" (HooplaKidz) — https://www.youtube.com/watch?v=w-I-0F8nwAg — Animated explanation appropriate for elementary students showing coolant circulation.
* "States of Matter for Kids" (ScienceKids.co) — https://www.youtube.com/watch?v=K4VHcreKJDA — Interactive exploration of solids, liquids, and gases with everyday examples.

Teacher Note: This lesson builds foundational understanding of states of matter and heat transfer through a real-world context. Third graders will benefit from repeated exposure to the concept that liquids' ability to flow makes them useful for specific purposes. Connect this to other classroom experiences (water cycles, cooking, washing hands) to reinforce that these concepts appear everywhere in daily life.