Properties Of Matter

Physical Science | Lesson Guide

Kindergarten

Photo Description

This image shows a car engine compartment with a white plastic container filled with yellow liquid (coolant). We can see tubes connected to the container, metal engine parts, and various mechanical components. The liquid inside the container is a liquid—a type of matter that flows and takes the shape of its container.

Scientific Phenomena

Anchoring Phenomenon: Why does a car need liquid inside containers to help it work?

Scientific Explanation: The yellow liquid shown is engine coolant (or antifreeze), which is a liquid matter. Unlike solids that keep their shape, liquids flow and change shape based on their container. This particular liquid has special properties: it can absorb heat from the hot engine and carry it away through tubes. The coolant prevents the engine from overheating, demonstrating how different types of matter have different properties that make them useful for different jobs. Liquids also have a maximum fill line (visible on the container) because they take up a specific amount of space and can spill if overfilled.

Core Science Concepts

1. States of Matter – Liquids: Liquids flow, change shape to fit their container, and have a fixed volume (amount). The yellow coolant is an example of a liquid.

2. Properties of Matter: Different materials have different characteristics (color, texture, ability to flow). This liquid is yellow, slippery, and flows freely.

3. Purpose and Function: Materials are chosen for specific jobs based on their properties. This liquid was selected because it can absorb heat and flow through tubes to cool the engine.

4. Observation and Comparison: Students can compare liquids (water, milk, juice) with solids (blocks, toys) to understand how matter behaves differently.

Pedagogical Tip:

For Kindergarteners, use sensory-safe explorations with everyday liquids (water, cornstarch slime, paint) rather than engine coolant. Focus on observable features: "Does it pour? Does it keep its shape? What color is it?" This concrete experience builds foundational understanding of liquid properties before introducing abstract concepts.

UDL Suggestions:

Multiple Means of Representation: Provide pictures, real containers, and tactile exploration stations so students can see, hear descriptions, AND feel (within safe boundaries) how liquids behave differently from solids. For English learners, pair vocabulary with images of liquid examples: water, milk, juice, paint.

Multiple Means of Action/Expression: Allow students to show understanding through pouring, sorting real objects into "liquid" vs. "solid" categories, drawing what they observe, or acting out how liquids move (flowing motions) versus solids (staying still).

Zoom In / Zoom Out

Zoom In (Microscopic Level): If we could shrink down and look inside the yellow coolant liquid with a special microscope, we'd see millions of tiny, tiny molecules (the smallest pieces of matter) moving around and bumping into each other. These molecules move faster when the liquid is warm and slower when it's cold. The yellow color comes from special dye molecules mixed into the water. These invisible molecules are so small we can never see them, but together they create the liquid we observe flowing through the tubes.

Zoom Out (Larger System): The engine coolant is just one small part of a larger cooling system that includes the engine (which gets very hot), tubes carrying coolant throughout the car, a radiator (a special part that releases heat into the air), and a fan (that helps blow the heat away). Together, all these parts work as a team to keep the whole car engine working properly. If we zoom out even further, we see how this cooling system connects to the car's other systems: the fuel system provides energy, the electrical system powers the cooling fan, and the structural system holds everything together. The car itself is part of an even bigger system—our transportation network and community!

Discussion Questions

1. "What do you notice about the yellow liquid inside the container? Can you describe what it looks like?" (Bloom's: Remember | DOK: 1)

2. "Why do you think this liquid needs to be in a container instead of just sitting loose in the engine like a solid block?" (Bloom's: Understand | DOK: 2)

3. "How is this yellow liquid different from a toy block or a piece of wood? What can liquids do that solids cannot?" (Bloom's: Compare | DOK: 2)

4. "If we poured this liquid into a different-shaped container (like a cup instead of this rectangular one), what would happen to its shape?" (Bloom's: Analyze | DOK: 3)

Potential Student Misconceptions

Misconception 1: "All liquids are water."
- Clarification: While water is a common liquid, there are many different types of liquids. The yellow coolant is a liquid, but it's not water—it's a special mixture made to help cars stay cool. Other liquids include milk, juice, honey, and oil. Liquids can be different colors, thicknesses, and have different jobs, but they all share the property of flowing and taking the shape of their container.

Misconception 2: "If you fill a container all the way to the top, the liquid won't spill."
- Clarification: Liquids take up a specific amount of space. If you pour a liquid into a container that's already full, it WILL spill out because there's no room left. That's why the coolant container has a "MAX" line—it shows the highest you should fill it. When the engine gets hot, the liquid expands (gets bigger), so leaving space at the top prevents overflow and spills.

Misconception 3: "Liquids are always wet and sticky like water."
- Clarification: Not all liquids feel the same! Some liquids, like water, feel slippery and wet. Other liquids, like honey or maple syrup, are thick and sticky. Some liquids, like gasoline, evaporate quickly and feel dry. The engine coolant is slippery like water but may have a different smell and color. All liquids flow, but they can feel and behave differently.

Extension Activities

1. Liquid Exploration Station: Set up safe, edible liquids (water, food coloring, dish soap, honey, maple syrup) for students to observe and pour into clear cups. Ask: "Which liquids flow fast? Which flow slowly? Which are thick? Which are thin?" This builds vocabulary and observational skills.

2. Solid vs. Liquid Sort: Provide real objects (wooden block, plastic ball, toy car, paper cup filled with water, sponge) and have students sort them into two groups: "Keeps its shape" (solids) and "Flows and changes shape" (liquids). Create a class chart with pictures.

3. Paint Pouring Art: Let students pour washable paint between two paper plates (sealed with tape) and tilt them to watch the liquid move. Discuss: "Why does the paint slide around? Because it's a liquid!" This is engaging, safe, and demonstrates liquid properties creatively.

Cross-Curricular Ideas

Math Connection – Measurement and Capacity: Use the coolant container as a reference to explore "full," "empty," and "half-full" concepts. Provide clear containers of different sizes and have students practice pouring water to different levels, counting how many small cups equal one big container, or measuring "how high" the liquid reaches. Create a simple bar graph showing "which container holds more liquid?"

ELA Connection – Descriptive Language and Storytelling: Read or create stories about the car's journey and the coolant's job keeping it cool. Have students dictate or draw stories about a "drop of coolant" that travels through the engine. Create a word wall of descriptive words: yellow, flows, smooth, cold, hot, liquid, container. Play "I Spy" games using the photo: "I spy something yellow and liquid that flows!" Students describe what they observe using rich vocabulary.

Social Studies Connection – Community Helpers and Jobs: Discuss how mechanics, engineers, and car repair technicians use knowledge about liquids like coolant to help families stay safe. Invite a parent or community member who works with cars to visit (or show a brief video) and explain why checking coolant is important. Connect to the idea that many community helpers use science knowledge in their daily work.

Art Connection – Color Mixing and Sensory Exploration: The coolant is yellow, but coolants come in many colors (green, orange, pink, blue). Set up a safe color-mixing station with washable paint or water and food coloring to explore how colors change. Have students paint or color pictures of engines, containers, and flowing liquids. Create a class mural showing the "journey of coolant through the engine" with students painting different sections and flowing lines.

STEM Career Connection

Automotive Technician/Mechanic: An automotive technician is a person who fixes and maintains cars to keep them running safely and smoothly. They check the coolant level, change fluids, and repair engine parts. Technicians need to understand how liquids like coolant and oil help cars work. They use tools, follow instructions, and solve problems when something doesn't work right. Average Salary: $38,000–$48,000 USD per year

Mechanical Engineer: A mechanical engineer designs and builds machines and engines, including car engines and cooling systems. They figure out what liquids to use, how to make tubes and containers, and how to make engines work better without overheating. Engineers use math, science, and creativity to solve real-world problems. Average Salary: $88,000–$110,000 USD per year

Chemical Technician: A chemical technician works in laboratories to develop and test special liquids like engine coolant, antifreeze, and other fluids. They test whether liquids work well, are safe, and have the right properties (color, thickness, temperature). These technicians help create the products that keep cars and machines running properly. Average Salary: $44,000–$62,000 USD per year

NGSS Connections

Performance Expectation (K-PS1-1): Plan and conduct investigations to provide evidence that objects can be sorted and classified by their observable properties.

Disciplinary Core Ideas:
- K-PS1.A:Properties of Matter – Objects have observable properties, including the ability to be pushed, pulled, rolled, or changed in shape; liquids flow differently than solids.

Crosscutting Concepts:
- Patterns – Recognizing that all liquids have similar behaviors (pouring, flowing) is an observable pattern.
- Structure and Function – The liquid's properties (flowing, filling containers) relate to its function (cooling the engine).

Science Vocabulary

* Liquid: A type of matter that flows and takes the shape of its container (like water or juice).

* Container: A holder that keeps liquids or other materials inside (like a cup, bottle, or tank).

* Cool/Cooling: To make something less hot or to lower its temperature.

* Properties: The special characteristics or features of something (like color, shape, or how it moves).

* Flow: To move smoothly and continuously from one place to another (the way water moves).

External Resources

Children's Books:
- Oobleck: Exploring Slime and Other Non-Newtonian Fluids by Jill McDonald (Capstone Press) – Explores unusual liquids in an accessible way.
- What Are the Three States of Matter? by Christy Mihaly (Lerner Publications) – Simple, colorful introduction to solids, liquids, and gases.
- Liquids by Rebecca Olien (Pebble Books) – Beginner-friendly exploration of liquids in everyday life.