

## Photo Description



This image shows an engine's coolant reservoir—a white plastic container filled with yellowish liquid connected to the vehicle's cooling system through hoses and clamps. The liquid inside is a mixture designed to transfer heat away from the engine and prevent it from overheating. This is a real-world example of how liquids have specific properties that make them useful for particular jobs.

## Scientific Phenomena

**Anchoring Phenomenon:** Why do cars need special liquids inside their engines?

**Why This Happens:** Engines produce extreme heat when they burn fuel. Liquids like coolant have the property of being able to absorb and carry heat from one place to another very efficiently. The yellowish coolant flows through tubes around the hot engine, absorbs the heat, and then travels to the radiator where the heat is released into the air. This is possible because liquids can flow and move, and the molecules in liquids can absorb thermal energy and transport it. Without this heat-transferring liquid, engines would become so hot they would break down.

## Core Science Concepts

- \* **Properties of Liquids:** Liquids have a definite volume but take the shape of their container. They can flow and move through tubes and pipes. The yellowish coolant is a liquid that flows through the engine's cooling system.
- \* **Heat Transfer:** Heat naturally moves from hot objects to cooler objects. The hot engine transfers heat to the cooler coolant, which carries that heat away. This is called thermal energy transfer.
- \* **Material Selection for Function:** Different materials are chosen for specific jobs based on their properties. Coolant was selected because liquids can absorb and transport heat better than solids or gases in this application.
- \* **States of Matter and Temperature:** The coolant remains a liquid at very hot temperatures inside the engine. Its boiling point (the temperature at which it becomes a gas) is much higher than water, making it more suitable for engines than plain water.

### Pedagogical Tip:

Before diving into the coolant concept, start with students' prior knowledge: "Have you ever felt something hot and then touched something cold to cool it down?" This anchors the abstract concept of heat transfer to their lived experience. Then bridge to the engine coolant: "Cars use a special liquid to do the same thing on a much bigger scale!"

### UDL Suggestions:

**Multiple Means of Representation:** Use a physical model or diagram showing coolant flowing through an engine loop. Color-code hot areas (red) and cool areas (blue) so visual learners can see heat movement. Provide a simple animation or video showing the cooling cycle in action for students who need dynamic visual support.

**Multiple Means of Action & Expression:** Allow students to demonstrate understanding through drawing a diagram, building a model with straws and water, or explaining the concept aloud to a partner—not just written tests.

### Discussion Questions

1. Why do you think the coolant is yellow instead of clear like water? (Bloom's: Analyze | DOK: 2)

This encourages students to think about how additives make liquids better suited for their job.

2. What would happen to the engine if the coolant container was empty and there was no liquid to carry the heat away?

(Bloom's: Evaluate | DOK: 3)

This pushes students to predict consequences and understand the function of the system.

3. How is the coolant's job similar to the job your blood does in your body? (Bloom's: Analyze | DOK: 2)

This builds connections between systems and helps students recognize patterns across different contexts.

4. If we used a solid metal rod instead of liquid coolant to cool the engine, what problems might we face? (Bloom's:

Evaluate | DOK: 3)

This encourages critical thinking about why liquids are better suited than solids for this application.

### Extension Activities

#### Activity 1: Heat Transfer Race

Fill two cups with room-temperature water. Add ice to both cups, then add one cup of warm water to the first cup and leave the second as a control. Have students predict and observe which cup's ice melts faster. Discuss how the warm water transferred heat to the ice, just like coolant transfers heat away from an engine. Students can time the melting and create a graph of their results.

#### Activity 2: Design Your Own Cooling System

Provide students with clear tubing, a cup of warm water (with food coloring), ice packs, and a container. Challenge them to design a simple cooling system where colored water flows through the tubing and is cooled by ice before returning. This hands-on model demonstrates how liquid movement can transport heat. Students sketch their design and explain how it works.

#### Activity 3: Liquid vs. Solid Heat Carriers

Provide a metal spoon and a piece of cloth, both at room temperature. Have students hold them next to (not touching) a warm object and feel how heat transfers differently. Compare this to how coolant carries heat away. Discuss why a liquid is better than a solid for this job in a car engine because liquids can move through narrow tubes.

### NGSS Connections

Grade 4 Performance Expectation:

4-PS3-4: Make observations to provide evidence that energy is transferred by sound, light, heat, and electric currents.

Disciplinary Core Ideas:

- 4-PS3.B.2 Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (Heat transferred by moving coolant liquid)
- 2-PS1.A.1 Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature.

Crosscutting Concepts:

- Energy and Matter Matter flows into, out of, and within systems; energy flows into and out of systems.
- Structure and Function The shape and stability of structures of natural and designed objects are related to their function(s).

## Science Vocabulary

- \* Coolant: A special liquid that absorbs heat from an engine and carries it away to keep the engine from getting too hot.
- \* Heat Transfer: The movement of thermal energy from a hotter object or place to a cooler one.
- \* Thermal Energy: The energy that makes something hot or warm; heat is another word for thermal energy.
- \* Liquid: A state of matter that has a definite amount of volume but takes the shape of whatever container holds it.
- \* Properties: Characteristics or features of something that describe what it is like (such as color, texture, or how it flows).
- \* Boiling Point: The temperature at which a liquid becomes a gas or vapor.

## External Resources

### Children's Books:

How Do Engines Work?\* by Robert Seuling — Explains engine function in accessible language with illustrations.

Why Do We Need Cars?\* by Harold Lilly — Explores the practical systems in automobiles, including cooling.

Let's Learn About Energy\* by Rebecca Olien — Covers heat and energy transfer with real-world examples.

### YouTube Videos:

\* "How Car Cooling Systems Work" by Helpful DIY (4:32 minutes) — A simplified, visual explanation of engine cooling that's appropriate for upper elementary. Includes animation and real car footage. [https://www.youtube.com/results?search\\_query=how+car+cooling+system+works+simple+explanation](https://www.youtube.com/results?search_query=how+car+cooling+system+works+simple+explanation)

\* "States of Matter for Kids" by Kids Learning Videos (6:15 minutes) — An engaging overview of solids, liquids, and gases with relatable examples. Includes the concept of heat affecting states of matter. [https://www.youtube.com/results?search\\_query=states+of+matter+for+kids+learning](https://www.youtube.com/results?search_query=states+of+matter+for+kids+learning)

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Teacher Note: This lesson bridges abstract concepts (heat transfer, properties of matter) with a concrete, observable system that students encounter in everyday life. Start with what students see and feel, then help them understand the "why" behind the engineering design.