Tires

Physical Science | Lesson Guide

2nd Grade

Photo Description

This image shows car tires with deep grooves and patterns carved into the rubber surface. The tread (the bumpy, patterned part) helps tires grip the road and push water away. You can see how the tire tread is designed with special shapes that help cars stop safely and drive smoothly on different surfaces.

Scientific Phenomena

Anchoring Phenomenon: Why do tires have bumpy patterns on them?

Tire tread exists because of friction and water displacement. The grooves in tire tread create grip (friction) between the tire and the road, which helps cars stop, start, and turn safely. The patterns also channel water away from the tire's contact point, preventing skids on wet roads. This is an example of how humans design objects based on understanding how materials interact with their environment.

Core Science Concepts

* Friction: The force that happens when two surfaces rub together. Tire tread increases friction between the tire and road, making it harder for the tire to slip.

* Material Properties: Rubber is flexible, stretchy, and grips well. These properties make it perfect for tires, but the rubber alone isn't enough—the tread pattern makes tires work even better.

* Design and Function: Objects are designed in specific ways to help them work better. The bumpy tread pattern on tires is intentionally designed to solve a problem (slipping and skidding).

* Wear and Erosion: Over time, tires wear down from friction with the road. The tread becomes smoother and shallower, which makes the tire less safe.

Pedagogical Tip:

Help students understand tread by making a connection to their own shoes: Ask them to examine the soles of their sneakers. Compare smooth-soled shoes to shoes with bumpy soles. Which shoes grip better on a slippery surface? This concrete comparison helps Second Graders understand why tires need tread without requiring abstract thinking about cars.

UDL Suggestions:

Provide multiple representations: (1) Tactile exploration—let students feel real tire tread samples or shoe soles with different patterns, (2) Visual models—show pictures of worn vs. new tires side by side, and (3) Kinesthetic activity—have students walk on smooth tile and textured carpet to feel the difference in grip. This multi-sensory approach supports learners with different strengths and learning preferences.

Zoom In / Zoom Out

Zoom In: Molecular Level - Rubber Molecules and Friction
When you zoom in really close to a tire's surface (much smaller than you can see), you would see that rubber is made of long, tangled chains of molecules. When the tire presses against the road, these tiny molecular chains actually grab onto the small bumps and rough spots on the road surface. The grooves in the tread create even more places for these invisible chains to hook onto the road, making the grip stronger. This is why rougher surfaces create more friction than smooth surfaces!

Zoom Out: Transportation System and Road Safety
When you zoom out and look at the big picture, tires are just one part of a massive system that keeps people safe while traveling. Tire tread connects to road design (smooth vs. rough pavement), weather conditions (wet roads need more grip), vehicle speed, and driver safety. A city or town needs to think about all these things together: Do we need to salt icy roads? Should we have speed limits in wet weather? Are our tires in good condition? Tire tread is one small but important piece of how communities keep everyone safe on roads.

Discussion Questions

1. What would happen if tires were completely smooth like a rubber ball? (Bloom's: Predict | DOK: 2)

2. Why do you think tire tread looks different from the tread on the bottom of your shoes, even though they both need to grip? (Bloom's: Analyze | DOK: 3)

3. How do you think a tire's tread changes after someone drives a car for many years? (Bloom's: Infer | DOK: 2)

4. If you were designing a tire for a race car on a wet track, what would you change about the tread pattern and why? (Bloom's: Create | DOK: 3)

Potential Student Misconceptions

Misconception 1: "Tires are made of bumps, not grooves."
Students may think the tread is raised bumps sticking up, rather than grooves (dips) cut into the rubber. Clarification: The tread is made of grooves (deep lines carved into the tire) and sipes (smaller cuts). The raised parts between the grooves are what touch the road. You can show this by having students trace their fingers along a tire and feel both the raised rubber and the empty grooves.

Misconception 2: "Smooth tires are better because they're newer looking."
Young students may think that smooth, shiny objects are "better" because they look new. Clarification: A smooth tire is actually more dangerous, not better! The grooves in the tread are there on purpose to help the tire do its job. As tires wear and become smoother, they become less safe. This is why car owners need to replace old tires.

Misconception 3: "All tires have the same tread pattern."
Students may think all tires look and work the same way. Clarification: Different tires are designed for different purposes. Winter tires have different tread patterns than summer tires. Racing tires, truck tires, and bicycle tires all have different tread patterns based on where and how they'll be used. The tread is designed by engineers for its specific job.

Extension Activities

Activity 1: Texture Testing
Provide students with various materials (sandpaper, smooth plastic, textured rubber, cloth). Have them predict which materials have the most "grip," then test each one by seeing which material can hold a toy car best on a tilted board. Record observations and discuss why rougher textures grip better.

Activity 2: Design Your Own Tread
Give students modeling clay or playdough and ask them to create a tire with a tread pattern they design. Have them predict what their tread pattern should do (stop cars, move through mud, drive in snow), then test their models on different surfaces to see if their designs work. Discuss what worked and what they would change.

Activity 3: Tire Wear Investigation
Show students pictures or video of new tires versus extremely worn tires with barely any tread. Ask: "Why is a tire with very little tread dangerous?" Create a simple safety poster as a class about why tire tread matters.

Cross-Curricular Ideas

Math Connection: Measuring and Comparing Tread Depth
Have students use simple rulers or measuring tapes to measure the depth of tire grooves in pictures or actual tire samples. Create a bar graph showing the tread depth of new tires versus worn tires. This builds measurement skills while reinforcing the science concept that tread wears down over time. Students can also count the number of grooves in a section of tread and practice skip-counting.

ELA Connection: "Why Tires Matter" Informational Writing
After learning about tire tread, have students create a simple informational poster or booklet using the sentence frame: "Tires need tread because _____." Students can draw pictures of tires and write 2-3 sentences explaining what they learned. This connects science vocabulary to writing practice and helps students organize their thinking in a logical way.

Social Studies Connection: Community Helpers and Transportation Safety
Invite a local mechanic, tire shop worker, or vehicle safety inspector to talk briefly with the class about why they check tires. Discuss how different community workers (police officers, bus drivers, delivery workers) depend on safe tires to do their jobs. This helps students understand that tire safety affects the whole community and that many adults work to keep people safe.

Art Connection: Design Your Own Tire Tread Pattern
Have students create artwork showing their own tire tread designs using markers, collage, or printing techniques. First, discuss what job their tire needs to do (drive in snow, go very fast, climb mountains, drive in cities). Then have them create a tread pattern to match. Display the designs and have students explain why they chose their particular pattern—connecting art, design thinking, and scientific reasoning.

STEM Career Connection

Tire Engineer / Product Designer
Tire engineers design and test new tire tread patterns to make cars safer and better. They use computers and science to figure out what shape and pattern works best for different types of roads and weather. They test tires to make sure they grip well and last a long time. It's like being a puzzle solver—you have to figure out the best design to solve the problem of keeping cars safe!
Average Annual Salary: $68,000 - $85,000

Automotive Mechanic / Tire Technician
A tire technician checks people's tires, fixes them when they're damaged, and replaces them when they're too worn down. They know all about tire tread and can tell if a tire is safe to drive on by looking at how much tread is left. They use special tools to balance tires and make sure cars run smoothly and safely.
Average Annual Salary: $38,000 - $52,000

Safety Inspector / Quality Control Tester
Safety inspectors test tires in factories and labs to make sure they're made correctly before they go to car owners. They test tires on wet roads, dry roads, and different surfaces to make sure the tread pattern works like it's supposed to. If there's a problem, they figure out how to fix it. They're like detectives who make sure tires are safe!
Average Annual Salary: $42,000 - $58,000

NGSS Connections

Performance Expectation:
K-2-ETS1-2: Develop a simple sketch, drawing, or physical model that represents how the shape of an object helps it function to solve a given problem.

Disciplinary Core Ideas:
- K-PS2.A Forces and Motion: Pushes and pulls can change the speed or direction of an object's motion.
- K-2-ETS1.B Developing Possible Solutions: Designs can be tried, tested, and improved.

Crosscutting Concepts:
- Structure and Function The shape and materials of objects relate to what they can do.
- Systems and System Models Objects have parts that work together.

Science Vocabulary

* Tread: The bumpy, grooved pattern on the bottom of a tire that helps it grip the road.

* Friction: A force that happens when two things rub together and makes it harder for them to slide past each other.

* Grip: When something holds onto another thing tightly so it doesn't slip.

* Groove: A long, narrow cut or channel in a surface.

* Wear: When something gets thinner, smoother, or damaged from being used over and over.

External Resources

Children's Books:
- Cars by Leslie Pate Mackinnon (simple introduction to how cars work)
- Tires by Rebecca Stefoff (part of the "How It Works" series; explains tire design for early readers)
- Wheels by Mick Manning (explores different wheel and tire designs across transportation)