Tires

Physical Science | Lesson Guide

4th Grade

Photo Description

This image shows the deep grooves and patterns carved into a vehicle tire's surface. The treads (the raised parts) and grooves (the valleys between them) are designed to help tires grip the road. You can also see the metal wheel rim in the background where the tire is mounted.

Scientific Phenomena

Anchoring Phenomenon: Why do tires have patterns on them, and how do those patterns help cars stay safe on the road?

Scientific Explanation: Tire tread exists because of friction—the force that happens when two surfaces rub together. The grooves in tire tread are engineered to increase the contact area between the tire and the road surface, which increases friction. This greater friction helps tires grip wet, icy, or slippery surfaces, preventing the car from sliding. The pattern also allows water and mud to escape from under the tire, keeping the rubber in direct contact with the road. Without tread, tires would have much less grip, making it harder for drivers to control the vehicle, especially in wet conditions.

Core Science Concepts

1. Friction – A force that occurs when two surfaces rub against each other; it can slow things down or help them grip surfaces. Tire tread increases friction between tires and roads.

2. Material Properties – Rubber tires are made from specific materials chosen because they are flexible, durable, and create good friction with asphalt and concrete.

3. Design and Engineering – The tread pattern is deliberately designed to solve a real-world problem: keeping vehicles safe by maintaining grip on various road conditions.

4. Surface Area – The grooves in tire tread create more surface area for the rubber to contact the road, which strengthens the grip and improves traction.

Pedagogical Tip:

When teaching about tire tread, help students make a personal connection by asking them to think about their own shoes. Do their sneakers or rain boots have special patterns on the bottom? This bridges everyday observation to the scientific principle of friction and grip.

UDL Suggestions:

Provide multiple ways for students to explore this concept: tactile (touching real tire tread samples), visual (examining high-quality photos or videos), and kinesthetic (sliding objects across smooth vs. textured surfaces). Allow students to demonstrate understanding through drawings, verbal explanations, or physical models—not just written responses.

Discussion Questions

1. What do you think would happen if a tire had no tread at all—just a smooth, flat surface? (Bloom's: Analyze | DOK: 2)

2. Why might tire tread be especially important on rainy days or icy roads? (Bloom's: Explain | DOK: 2)

3. How is the tread pattern on a tire similar to the tread pattern on the bottom of your shoes? (Bloom's: Compare | DOK: 3)

4. If you were designing a tire for a race car that only drives on dry roads versus a tire for a truck that drives in snow, how might you make them different? (Bloom's: Create | DOK: 3)

Extension Activities

1. Friction Shoe Experiment: Have students examine the tread patterns on different types of shoes (sneakers, rain boots, dress shoes). Create a chart comparing the patterns and predicting which shoes would work best on ice, wet floors, and smooth surfaces. Test predictions by sliding shoe soles across different surfaces at angles.

2. Design Your Own Tire: Provide students with paper, clay, or foam circles and have them design and create their own tire tread patterns. Challenge them to think about different environments (desert sand, mountain snow, city streets) and how tread might need to change. Have them explain their design choices using friction as a reason.

3. Water Drainage Investigation: Use two identical shallow pans—one with a smooth plastic sheet and one with a textured surface (like a kitchen scrubber). Pour water on each and observe how the grooved surface allows water to drain differently. Connect this observation to how tire grooves help water escape from under the tire.

NGSS Connections

Performance Expectation:
4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.

Disciplinary Core Ideas:
- 4-PS3.A – Energy can make things move; friction is a force that affects motion
- 4-ETS1.A – Defining and delimiting engineering problems involves understanding the constraints of real-world solutions

Crosscutting Concepts:
- Cause and Effect – Tire tread causes increased friction, which affects how well a vehicle can grip the road
- Structure and Function – The structure (grooves and patterns) of the tire serves the function of improving safety and traction

Science Vocabulary

* Tread: The raised pattern or grooves on a tire that help it grip the road.
* Friction: A force created when two surfaces rub together that can slow things down or help them stick to each other.
* Traction: The ability of a tire or shoe to grip a surface without slipping.
* Groove: A long, narrow valley or channel cut into the surface of a tire.
* Grip: The ability to hold onto or stay attached to a surface.

External Resources

Children's Books:
- How Do Tires Work? by Maria Nelson (Simple explanations with illustrations)

- Trucks by Gail Gibbons (Includes tire design and function)
- Traction Man by Mini Grey (Whimsical story that references grip and movement)

YouTube Videos:
- "Why Do Tires Have Treads?" – Crash Course Kids (2:45 min) – Clear, animated explanation of tire tread function and friction
  https://www.youtube.com/watch?v=3n1D3WMiGXI

- "Friction Experiment: Smooth vs. Bumpy" – National Geographic Kids (3:10 min) – Hands-on friction investigation using everyday materials
  https://www.youtube.com/watch?v=gkNDpkXMdJU