# Forms Of Energy

Physical Science | Lesson Guide

1st Grade

## Photo Description


This image shows a large yellow and orange train engine next to a small red car. The train is much bigger and heavier than the car. Both vehicles use engines that burn fuel to create energy that makes them move down tracks and roads.

## Scientific Phenomena

Anchoring Phenomenon: How do vehicles move, and why is one so much bigger than the other?

The train and car both demonstrate energy transformation and motion. Inside each vehicle's engine, fuel burns to create heat energy. This heat energy pushes parts of the engine, which turns the wheels and makes the vehicles move. The train is bigger because it needs more power (energy) to move heavier loads down the railroad tracks. This image beautifully contrasts two different machines that solve the problem of transportation by converting chemical energy (from fuel) into motion energy (kinetic energy).

## Core Science Concepts

1. Energy and Motion: Vehicles need energy to move. The fuel inside engines provides this energy, which makes the wheels turn and move the vehicle forward.

2. Force and Mass: Larger, heavier objects (like trains) need more force to move them. The train's bigger engine produces more force than the car's engine.

3. Materials and Design: Different vehicles are designed differently because they do different jobs. The train carries heavy cargo, so it's built strong and large. The car carries fewer people, so it's smaller and lighter.

4. Cause and Effect: When fuel burns in an engine (cause), the vehicle moves (effect). The more powerful the engine, the heavier the load it can move.

**Pedagogical Tip:**

For First Grade students, avoid technical jargon like "combustion" or "kinetic energy." Instead, use concrete language: "The engine burns fuel and gets hot. The heat makes the engine push. The push makes the wheels spin, and that makes the car move." Use physical demonstrations—have students push toy cars to show that bigger pushes make things move faster or farther.

**UDL Suggestions:**

Representation: Show students real pictures and videos of trains and cars moving so they can see the motion happening. Use slow-motion videos to help them notice the wheels turning.

Action & Expression: Let students build simple vehicles with wheels using blocks and toy cars, then roll them down ramps. This lets them experience the relationship between energy, force, and motion firsthand.

Engagement: Connect to students' own experiences: "You have energy in your body. What happens when you run? Your muscles push, and your legs move—just like a car's engine!"

## Zoom In / Zoom Out

### Zoom In: Unseen Processes
At the microscopic level, fuel molecules break apart during combustion (burning). These broken molecules release chemical energy as heat and light inside the engine. The heat expands gases, which push pistons and create motion. Students cannot see molecules, but they can feel heat from a warm engine or a candle flame, which helps them understand that burning fuel creates heat energy.

### Zoom Out: Larger Systems
In the transportation system, trains and cars are just two of many vehicles that move people and goods across distances. These vehicles connect communities, allow trade, and help people visit family members far away. The entire system depends on energy sources (fuel), infrastructure (roads and tracks), and people (drivers and engineers) working together. Students can think about how the train and car are part of a larger world where different tools help us travel and transport things.

## Discussion Questions

1. "Why do you think the train is bigger and heavier than the car?" (Bloom's: Understand | DOK: 1)
   Students should think about what each vehicle carries and why size matters for different jobs.

2. "What do you think is happening inside the engine to make the wheels turn?" (Bloom's: Analyze | DOK: 2)
   Students should consider that something is burning and creating energy to push parts that make wheels spin.

3. "If we took away the engine from the car, would it still move? Why or why not?" (Bloom's: Analyze | DOK: 2)
   Students should recognize that the engine is necessary because it provides the energy/force to move the vehicle.

4. "How is the train like your body when you run? How is it different?" (Bloom's: Evaluate | DOK: 3)
   Students should compare energy sources: your muscles (biological energy) vs. an engine (chemical energy from fuel), and how both create movement.

## Potential Student Misconceptions

1. Misconception: "Bigger vehicles are always faster."
   - Clarification: Bigger doesn't mean faster. A train is huge but moves slower than a race car. Speed depends on how much energy the engine has and what the vehicle is designed to do. Trains carry heavy loads slowly; cars can go faster because they carry less weight.

2. Misconception: "Vehicles move because the wheels are round."
   - Clarification: The wheels don't make the vehicle move by themselves. The engine creates force that spins the wheels. The spinning wheels push against the ground, and that push moves the vehicle forward.

3. Misconception: "Gasoline just makes the car go; I don't need to know what happens inside."
   - Clarification: Gasoline is a fuel that has stored energy. When the engine burns gasoline, it releases that energy as heat. The heat creates pressure that moves parts inside the engine, and those moving parts turn the wheels.

## Extension Activities

1. Toy Car Ramp Experiment: Give students toy cars and build ramps at different angles using blocks. Students push cars down ramps with different amounts of force (a gentle push, a medium push, a big push). They observe and discuss: "Does a bigger push make the car go farther? Does the angle of the ramp matter?" This shows cause and effect with force and motion.

2. "Make It Move" Challenge: Provide students with small objects (blocks, toy animals) and ask them to figure out what they need to do to make the objects move. They can push, pull, or roll them. Discuss: "What made it move? Was it a push or a pull? How big was the push?" This builds understanding of force as the cause of motion.

3. Draw and Compare: Have students draw their own vehicle and compare it to the train and car in the photo. Ask: "What is your vehicle used for? How big does it need to be? Does it need a big engine or a small engine? Why?" This reinforces the connection between structure (size and design) and function (what the vehicle does).

## Cross-Curricular Ideas

1. Math: Measure and compare the length of the train and car using non-standard units (blocks, paper clips). Create a simple bar graph showing "Train Length vs. Car Length." This reinforces measurement and data representation.

2. ELA - Story Writing: Students write or dictate a short story: "A Day in the Life of a Train" or "A Day in the Life of a Car." What do these vehicles see? Where do they go? Who rides in them? This builds narrative skills while reinforcing vocabulary and concepts.

3. Social Studies - Community Helpers: Discuss the different people who work with trains and cars: train engineers, mechanics, drivers, construction workers. Create a simple chart showing what each person does. This connects to the theme "People and Jobs in Our Community."

4. Art - Vehicle Collage: Students cut out pictures of different vehicles from magazines and create a transportation collage. They sort vehicles by type (land, water, air) and discuss: "Which vehicles have engines? Which ones move the fastest?" This builds classification skills and reinforces the variety of machines in our world.

## STEM Career Connection

1. Locomotive Engineer: A locomotive engineer drives the train and makes sure it gets to the right place safely. They press buttons and levers to make the train go faster or slower, and they know all the train tracks and schedules. Average Salary: $63,000 USD/year

2. Automotive Mechanic: An automotive mechanic fixes cars and trucks when they break down. They find out what's wrong with the engine and repair it so the car can run properly. They use special tools and know a lot about how engines work. Average Salary: $44,000 USD/year

3. Transportation Engineer: A transportation engineer designs roads, bridges, and rail systems so that cars, trains, and other vehicles can move safely and smoothly. They plan where roads should go and how big they should be. Average Salary: $89,000 USD/year

## NGSS Connections

While this image primarily illustrates energy and motion concepts, it does not directly align with the 1-PS domain standards provided. The 1-PS4 standards focus specifically on sound, light, and communication—not on engines, combustion, or transportation mechanics.

However, there are relevant conceptual bridges:

- Cause and Effect is strongly present: Burning fuel (cause) !' vehicle moves (effect)
- Energy and Matter is central: Energy from fuel is transformed into motion
- Structure and Function applies: The train and car have different structures because they have different functions (hauling heavy cargo vs. carrying passengers)

Note for the Teacher: This image does not match the validated 1-PS4 standards (sound, light, and communication). To use this image effectively, consider:
- Focusing on grade 2 or higher standards related to forces and motion (2-PS2 domain)
- Pairing this image with investigations of sound (1-PS4-1) or light (1-PS4-2) as comparative examples of energy
- Using this as a hook to introduce the concept that energy makes things happen—preparing students for later studies of forces and motion

## Science Vocabulary

* Engine: A machine that burns fuel to create energy that makes something move.

* Fuel: Something that burns to create heat energy, like gasoline or diesel in cars and trains.

* Force: A push or pull that makes something move or change direction.

* Energy: The power to make something happen or to make something move.

* Motion: When something moves or changes position from one place to another.

* Wheels: Round objects that spin to help vehicles move forward.

## External Resources

- Children's Books:
  - Little Blue Truck by Alice Schertle (illustrated by Jill McDonald)
  - The Little Engine That Could by Watty Piper (illustrated by George and Doris Hauman)
  - Cars by Byron Barton

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Teacher Reflection: This photograph is an excellent entry point for discussing energy, force, and motion, even though it doesn't perfectly align with 1-PS4 standards. Use it as a "phenomenon hook" to spark curiosity about how things move. As you move forward with formal 1-PS4 investigations (sound and light), remind students that energy appears in many forms—heat from an engine, sound from wheels on tracks, and light from headlights. All of these are forms of energy that make things happen in our world.