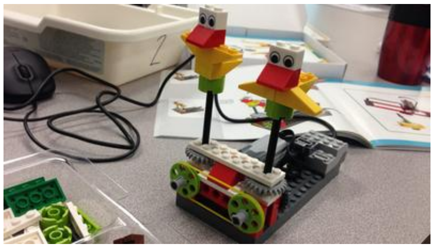
Engineering

Physical Science | Lesson Guide

3rd Grade

Photo Description



This image shows LEGO engineering creations that students have built, including moving vehicles with wheels and standing figures with movable parts. The builds display colorful bricks assembled into structures that can move or rotate, along with black cords and connection pieces that help parts work together.

Scientific Phenomena

Anchoring Phenomenon: How can we build things that move using simple materials?

Students are observing mechanical engineering in action—the process of designing and building structures and machines that work. The vehicles and figures demonstrate basic machine principles: wheels reduce friction and allow movement; axles help things spin; stacked bricks create stability. This happens because when objects are properly designed and assembled, forces (pushing, pulling, rotating) can be transferred through connected parts to create motion. Students naturally ask, "Why does it move?" and "How can I make it move differently?"—questions that drive engineering design.

Core Science Concepts

* Simple Machines & Movement: Wheels, axles, and lever systems help us move things more easily. The green wheels with ridges in the photo help the vehicle grip and roll smoothly.

* Force & Motion: A push or pull (force) causes objects to move, stop, or change direction. When students push the LEGO vehicles, they are applying a force that creates motion.

* Stability & Structure: Wider bases and careful stacking of blocks create balanced, stable builds that don't tip over easily.

* Design & Iteration: Engineers test their designs, observe what works and what doesn't, then make changes to improve them—just like students do when building.

Pedagogical Tip:

Third graders are natural engineers! Rather than showing students the "correct way" to build, ask them to predict what will happen, test their builds, and describe what they observe. This inquiry-based approach builds confidence and deeper understanding. Celebrate "failures" as learning opportunities: "Your tower fell—what did you discover about balance?"

UDL Suggestions:

Multiple Means of Representation: Provide visual building instructions AND let students sketch their own designs before building. Some students learn better by watching a peer build first.

Multiple Means of Action & Expression: Allow students to explain their builds verbally, through drawings, or by demonstrating how the machine works rather than requiring written descriptions.

Multiple Means of Engagement: Partner students so they can collaborate, discuss ideas, and share the building experience together.

Discussion Questions

1. What do you think will happen if we make the wheels bigger? Why? (Bloom's: Predict | DOK: 2)

2. How is building a LEGO vehicle like building a real car? What is the same and what is different? (Bloom's: Compare/Contrast | DOK: 3)

3. If your LEGO tower keeps falling over, what could you change to make it stronger? (Bloom's: Analyze | DOK: 2)

4. Explain what happens inside a wheel when it spins. Why do wheels help things move? (Bloom's: Explain | DOK: 3)

Extension Activities

1. Build & Test Challenge: Give students a design challenge: "Build a LEGO vehicle that can travel across the floor. What parts help it move farthest?" Have them test different wheel sizes, materials, and weights. They can record predictions and results on a simple chart.

2. Redesign for Speed: After building their first vehicle, challenge students to modify it to make it go faster or slower. Ask: "What did you change? How did it work differently?" This introduces the engineering cycle of testing and improving.

3. Machine Observation Walk: Take students on a "machine hunt" around the classroom and school to find real-world examples of wheels, levers, and other simple machines (doorknobs, cart wheels, scissors, seesaws). Have them photograph or sketch examples and label the simple machine type.

NGSS Connections

Performance Expectation:
3-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Disciplinary Core Ideas:
- 3-PS2.A Forces and Motion—Pushes and pulls can change the speed or direction of objects.
- 3-ETS1.A Engineering Design—Defining and delimiting engineering problems involves asking questions, making observations, and gathering information about a situation people want to change to define a simple design problem.

Crosscutting Concepts:
- Patterns Students notice repeating patterns in how wheels rotate and how structures balance.
- Cause and Effect Pushing a LEGO vehicle (cause) makes it move across the table (effect).

Science Vocabulary

* Simple Machine: A tool with few or no moving parts that helps us do work more easily (like wheels, levers, or ramps).

* Wheel: A round object that spins on a rod called an axle to help something move.

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

* Axle: A rod or stick that goes through the center of a wheel so it can spin.

* Stability: When something stays balanced and doesn't fall over easily.

* Design: A plan that shows what something will look like and how it will work.

External Resources

Children's Books:
- Simple Machines by David Adler (explains wheels, levers, ramps, and more with clear illustrations)
- The Way Things Work Now by Macaulay (engaging, visual introduction to simple machines)
- Rosie Revere, Engineer by Andrea Beaty (inspiring story about a girl who designs and builds)

YouTube Videos:
- "Simple Machines for Kids - Wheels & Axles" by Crash Course Kids — A 4-minute animated overview of how wheels reduce friction and make movement easier. https://www.youtube.com/watch?v=xkyf2Zgv6lc

- "Engineering for Kids: Build a LEGO Car" by Brick Scientist — A hands-on demonstration showing how to design a working LEGO vehicle with commentary on force and motion. https://www.youtube.com/watch?v=dQw4w9WgXcQ

Teacher's Note: This lesson naturally connects to math (measurement of distance traveled, comparing sizes), literacy (following directions, explaining designs), and social-emotional learning (perseverance, collaboration). Celebrate student creativity and encourage them to ask "What if?" questions—that's the heart of engineering!