

## Photo Description



This image shows a white Ford truck with a tall crane attached to its back. A person is using the crane to lift a large silver ball (called a "wrecking ball") high into the air. The crane has a long arm that stretches upward, and it uses a pulley system and rope to help lift very heavy objects that a person could never lift by themselves.

## Scientific Phenomena

**Anchoring Phenomenon:** A machine (the crane) using levers and pulleys to lift something much heavier than a person could lift alone.

**Why This Happens:** Machines like cranes are simple machines that make work easier by changing the direction of a force or spreading the effort over a longer distance. The crane's arm acts as a lever, and the pulley system with the rope allows the truck's engine power to be distributed so it can lift extremely heavy objects. Without this simple machine, moving such a heavy ball would be impossible for one person.

## Core Science Concepts

1. Simple Machines – Levers and Pulleys: The crane uses both a lever (the long arm) and a pulley (the rope and wheel system) to lift heavy objects. These simple machines make hard jobs easier.
2. Force and Load: A force is a push or pull. The crane applies force to lift a heavy load (the wrecking ball). Machines help us apply force more easily.
3. Work: Work happens when a force moves something. The crane does work by lifting the heavy ball against gravity.
4. Mechanical Advantage: Simple machines give us a mechanical advantage, meaning we can move or lift heavy things without using as much effort as we would use by hand.

### Pedagogical Tip:

For Second Grade, avoid using complex terms like "mechanical advantage" with students. Instead, use simple language: "The machine helps us lift things that would be too heavy to pick up with our hands alone." Demonstrate this concept by having students try to lift a heavy textbook with one hand versus using a simple lever (pencil under the book with another pencil as a fulcrum).

### UDL Suggestions:

**Representation:** Provide clear, labeled diagrams showing how the crane's arm and rope work together. Use physical models (a ruler balanced on a pencil, with weights on each end) so kinesthetic learners can manipulate the lever themselves. **Action & Expression:** Allow students to show understanding through drawing, building simple machines with blocks, or acting out the motion of a crane lifting an object. **Engagement:** Connect to students' lives by asking them where they see simple machines (playground seesaws, slides, door handles, ramps).

## Discussion Questions

1. "What do you think would happen if we tried to lift this big silver ball with just our hands? Why can't we do it?"  
(Bloom's: Understand | DOK: 1)
2. "How do you think the machine helps the person lift something so heavy? What parts of the crane do the work?"  
(Bloom's: Analyze | DOK: 2)
3. "Have you ever used a simple machine to make something easier? Can you describe what happened?"  
(Bloom's: Recall/Apply | DOK: 2)
4. "If we made the crane's arm even longer, do you think it would be easier or harder to lift the ball? Why?"  
(Bloom's: Analyze | DOK: 3)

## Extension Activities

1. Build a Classroom Crane: Provide students with straws, string, paper cups, and tape. Have them construct a simple model crane using a straw as the arm and string as the pulley. Challenge them to lift small plastic weights or blocks with their homemade crane. Ask: "Which design lifts better? Why?" This hands-on experience helps them understand how the parts work together.
2. Simple Lever Investigation: Provide each student pair with a ruler, a pencil (fulcrum), and small weights (plastic blocks or erasers). Have them place the pencil under the ruler at different distances from the weight and try to lift the weight with the same hand force. Record where it feels easiest. Discuss why some positions make lifting easier (fulcrum placement changes mechanical advantage).
3. Community Machines Hunt: Take students on a walk around the school or neighborhood to spot simple machines in action. Point out playground seesaws (levers), door handles, ramps, and flagpoles (pulleys). Have students draw or photograph these machines and explain to the class which simple machine they saw and how it helps people.

## NGSS Connections

Performance Expectation:

2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Disciplinary Core Ideas:

- K-PS2.A Forces and Motion – Effects of Forces
- 2-ETS1.A Engineering Design – Defining and Delimiting Engineering Problems

Crosscutting Concepts:

- Cause and Effect – The crane's force causes the ball to move upward.
- Systems and System Models – The crane is a system of interconnected parts (truck, arm, pulley, rope) working together.
- Energy and Matter – The truck's engine provides energy to power the crane's lifting motion.

## Science Vocabulary

\* Simple Machine: A tool that makes work easier by helping us push, pull, or lift things.

\* Lever: A long stick or bar that can rock back and forth on a fixed point to lift or move heavy things.

- \* Pulley: A wheel with a rope around it that helps lift heavy objects by changing the direction of force.
- \* Force: A push or pull that makes something move or change direction.
- \* Load: Something heavy that needs to be moved or lifted.
- \* Machine: A tool made of parts that work together to help us do work more easily.

### External Resources

Children's Books:

- Simple Machines by David Adler (Scholastic Press) – An accessible picture book explaining six simple machines with clear illustrations and real-world examples.
- Machines by Clive Oppenheimer (DK Findout) – Large, colorful photos of machines in action with short, engaging explanations for early readers.
- How Do Simple Machines Work? by Syl Sobule (Cartwheel Books) – A Rookie Read-About Science book with lift-the-flap activities perfect for Second Grade.

YouTube Videos:

- "Simple Machines for Kids - Levers" by Crash Course Kids  
A 4-minute video showing real-world examples of levers, including construction equipment and seesaws. Clear animations help students visualize how levers work.  
<https://www.youtube.com/watch?v=oE-x8QVfcI8>
- "Pulleys and Simple Machines" by KidsEduc  
A 3-minute video with bright visuals demonstrating how pulleys make lifting easier. Shows everyday examples like cranes and flag poles.  
<https://www.youtube.com/watch?v=Fvv6dYAb5bl>

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Teacher Notes: This lesson connects physical science (forces, motion, and work) to engineering practices by helping students understand that humans design tools to solve real problems. The crane is an excellent real-world example of how combining simple machines makes difficult tasks possible. Encourage curiosity and hands-on exploration!