

## Photo Description



This photo shows a tall building with a large clock on its stone wall and an American flag flying above it. The clock has black hands pointing to different numbers, and there are decorative stone carvings around it. Behind the clock tower are modern glass and brick buildings reaching high into the sky.

## Scientific Phenomena

The anchoring phenomenon here is energy transfer through mechanical systems. The clock represents a complex machine that converts stored energy (either from springs, weights, or electrical power) into the controlled, regular movement of gears and hands. This mechanical energy transfer allows the clock to measure and display time consistently, demonstrating how humans engineer systems to harness and control energy for specific purposes.

## Core Science Concepts

1. Energy Transfer and Conversion - Clocks convert one form of energy (potential energy from springs/weights or electrical energy) into mechanical energy that moves the hands in precise, timed intervals.
2. Simple and Complex Machines - Clock mechanisms use gears (a type of wheel and axle) working together to create a complex machine that reduces the speed of energy transfer to match Earth's rotation.
3. Patterns in Motion - The clock hands move in predictable, repeating patterns that help humans track the passage of time based on Earth's rotation and orbit.
4. Human Engineering Solutions - Clocks represent how humans identify problems (needing to measure time) and design solutions using scientific principles about energy and motion.

### Pedagogical Tip:

Use analog clocks as concrete manipulatives during lessons. Have students physically move clock hands while discussing how energy makes the parts move, making the abstract concept of energy transfer more tangible.

### UDL Suggestions:

Provide multiple ways for students to explore clock mechanisms: visual diagrams, hands-on clock models, videos of gear movements, and kinesthetic activities where students act out gear rotations with their bodies.

## Zoom In / Zoom Out

1. Zoom In: Inside the clock mechanism, tiny metal gears with precisely cut teeth mesh together, transferring rotational energy from one gear to another. The gear ratios are carefully calculated so that energy moves at exactly the right speed to make the minute hand complete one rotation every hour.

2. Zoom Out: This clock is part of a larger human timekeeping system that connects to Earth's rotation, the atomic clocks that define official time, and global communication networks that help coordinate activities across different time zones around the world.

### Discussion Questions

1. What type of energy do you think makes the clock hands move, and how does that energy get transferred to the hands? (Bloom's: Analyze | DOK: 3)
2. If you could look inside this clock, what simple machines might you find working together? (Bloom's: Apply | DOK: 2)
3. How might this clock's energy source be different from the clock in your classroom? (Bloom's: Compare | DOK: 2)
4. What would happen to the clock's function if one of its gears broke, and why? (Bloom's: Evaluate | DOK: 3)

### Potential Student Misconceptions

1. Misconception: "Clocks make time happen" or "time comes from clocks"  
Clarification: Clocks measure time that already exists. Time continues even without clocks, just like distance exists even without rulers.
2. Misconception: "Clock hands move by themselves"  
Clarification: Clock hands need energy to move. This energy comes from batteries, springs, weights, or electrical power that gets transferred through gears and mechanisms.
3. Misconception: "All clocks work the same way"  
Clarification: Different clocks use different energy sources and mechanisms - some use springs, others use electricity, and some even use swinging pendulums.

### NGSS Connections

- Performance Expectation: 4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents
- Disciplinary Core Ideas: 4-PS3.A, 4-PS3.B, 3-5-ETS1.A
- Crosscutting Concepts: Energy and Matter, Systems and System Models

### Science Vocabulary

- \* Energy Transfer: The movement of energy from one object or place to another
- \* Mechanism: The working parts inside a machine that make it function
- \* Gear: A wheel with teeth that meshes with other gears to transfer motion
- \* Potential Energy: Stored energy that can be released to do work
- \* Kinetic Energy: The energy of motion or movement
- \* Complex Machine: A device made of two or more simple machines working together

### External Resources

- Children's Books:
- The Clock Struck One: A Time-Telling Tale by Trudy Harris
  - Clocks and More Clocks by Pat Hutchins

- What Makes a Clock Tick? by Franklin Branley

YouTube Videos:

- "How Do Clocks Work? | Simple Machines for Kids" - Educational overview of clock mechanisms and energy transfer suitable for elementary students

<https://www.youtube.com/watch?v=example1>

- "Gears and Simple Machines | Science for Kids" - Demonstrates how gears work together in machines like clocks

<https://www.youtube.com/watch?v=example2>