

## Photo Description



Large waves crash against dark rocks near the shore, creating white foam and spray. The powerful water hits the rocks and splashes high into the air. You can see how the ocean's energy moves the water against the solid rocks on the beach.

## Scientific Phenomena

This image shows the Anchoring Phenomenon of wave energy transfer and collision forces. When ocean waves move toward shore, they carry energy from wind across the water. As waves hit the rocks, the water's kinetic energy transfers into the rocks and changes direction, creating the dramatic splash and spray. The force of moving water demonstrates how energy can be transferred from one object to another through collisions.

## Core Science Concepts

1. Energy Transfer: Moving water carries energy that transfers to rocks when they collide
2. Forces and Motion: Waves demonstrate how forces can change the direction and speed of moving objects
3. Cause and Effect: Wind energy creates waves, which then create splashing when they hit barriers
4. Properties of Water: Water can exist as liquid droplets in spray and foam during wave action

### Pedagogical Tip:

Use slow-motion videos of waves crashing to help students observe the energy transfer that happens too quickly to see in real time. This helps make the invisible phenomenon of energy transfer visible.

### UDL Suggestions:

Provide multiple ways for students to demonstrate wave energy: kinetic learners can create waves in water tables, visual learners can draw energy transfer diagrams, and auditory learners can describe the sounds of crashing waves.

## Zoom In / Zoom Out

1. Zoom In: At the molecular level, water molecules are constantly moving and bouncing off each other. When waves crash, millions of water molecules suddenly change direction and speed, creating the kinetic energy we see as splashing.
2. Zoom Out: This wave action is part of Earth's water cycle system. Ocean waves help move water into the atmosphere through evaporation from spray, transport energy across ocean basins, and gradually shape coastlines through erosion over thousands of years.

## Discussion Questions

1. What do you think would happen if these waves hit sand instead of rocks? (Bloom's: Analyze | DOK: 2)
2. Where do you think the energy in these waves originally came from? (Bloom's: Evaluate | DOK: 3)
3. How might the size of the splash change if the waves were moving faster or slower? (Bloom's: Apply | DOK: 2)
4. What evidence can you see in the photo that shows energy is being transferred? (Bloom's: Analyze | DOK: 2)

## Potential Student Misconceptions

1. Misconception: "The water in waves moves forward toward the shore."  
Reality: Water molecules mostly move up and down in circles; it's the energy that moves forward through the water.
2. Misconception: "Bigger rocks always stop waves completely."  
Reality: Wave energy can go around, over, and through rock barriers, though rocks do absorb and redirect much of the energy.
3. Misconception: "Waves only happen in oceans."  
Reality: Any moving liquid can create waves when energy is added, including lakes, rivers, and even water in bathtubs.

## 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: PS3.A Energy and Matter, PS3.B Conservation of Energy and Energy Transfer
- Crosscutting Concepts: Energy and Matter, Cause and Effect
- Science and Engineering Practice: Constructing Explanations and Designing Solutions

## Science Vocabulary

- \* Energy: The ability to cause motion or change in matter
- \* Transfer: When energy moves from one object to another object
- \* Kinetic energy: The energy that moving objects have
- \* Force: A push or pull that can change how objects move
- \* Collision: When two objects hit each other and energy moves between them

## External Resources

Children's Books:

- Waves by Patricia J. Murphy
- The Magic School Bus Ups and Downs: A Book About Floating and Sinking by Joanna Cole
- National Geographic Readers: Waves by Anne Schreiber

YouTube Videos:

- "How do Ocean Waves Work?" by SciShow Kids - Simple explanation of wave energy and motion for elementary students ([https://www.youtube.com/watch?v=XiGzudM1\\_IU](https://www.youtube.com/watch?v=XiGzudM1_IU))
- "Wave Energy for Kids" by Generation Genius - Interactive lesson about how waves carry energy and create motion ([https://www.youtube.com/watch?v=qjuzfE\\_6nQs](https://www.youtube.com/watch?v=qjuzfE_6nQs))