

## Photo Description



Big waves crash into dark rocks by the ocean. Water sprays high into the air when it hits the rocks. The rocks are wet and shiny from all the splashing water.

## Scientific Phenomena

This image shows the Anchoring Phenomenon of wave energy transfer and erosion. Ocean waves carry energy from wind across the water's surface. When waves hit solid objects like rocks, the water's kinetic energy is transferred on impact, causing dramatic splashing and spray. Over long periods, this constant force gradually breaks down and reshapes the rocky coastline through mechanical weathering and erosion.

## Core Science Concepts

1. Energy Transfer: Moving water carries energy that gets released when it hits something solid
2. Forces and Motion: Waves push against rocks with great force, demonstrating how motion can cause change
3. Weathering and Erosion: Water slowly breaks down rocks over time through repeated impacts
4. States of Matter: Water exists as liquid in waves and tiny droplets in spray

### Pedagogical Tip:

Use kinesthetic learning by having students clap their hands together repeatedly to simulate how waves hitting rocks over and over can cause changes - start gently, then increase force to show how energy affects impact.

### UDL Suggestions:

Provide multiple ways for students to experience wave energy: show video clips with sound, use hand motions to mimic waves, and let students feel the vibration of a drum to represent wave energy moving through water.

## Zoom In / Zoom Out

1. Zoom In: At the molecular level, water molecules are constantly moving and bouncing off each other. When waves crash, these tiny particles slam into the rock surface, and some water molecules break apart rock minerals bit by bit.
2. Zoom Out: This coastline is part of Earth's water cycle system. Waves are created by wind patterns across entire ocean basins, and the erosion happening here helps create sand that travels to beaches hundreds of miles away.

## Discussion Questions

1. What do you think happens to the rocks after many years of waves hitting them? (Bloom's: Predict | DOK: 2)
2. How is the energy of ocean waves similar to the energy of a bouncing ball? (Bloom's: Compare | DOK: 2)
3. Why do you think the water sprays so high when it hits the rocks? (Bloom's: Analyze | DOK: 2)
4. What other things in nature show the same kind of pattern as these waves? (Bloom's: Apply | DOK: 1)

## Potential Student Misconceptions

1. Misconception: "Rocks are too hard for water to break them."  
Reality: Water can break rocks, but it takes a very long time - thousands of years of waves hitting rocks can wear them down.
2. Misconception: "Waves only move up and down."  
Reality: Wave energy moves forward through the water, carrying power from one place to another.
3. Misconception: "The splashing water disappears."  
Reality: The water falls back down into the ocean and becomes part of the next wave.

## Cross-Curricular Ideas

1. Math - Measurement & Patterns: Have students measure how high the water splashes using a simple ruler or string. Create a chart to record splashes from different sized rocks. Students can look for patterns: "Do bigger rocks make bigger splashes?"
2. ELA - Descriptive Writing & Onomatopoeia: Ask students to write or draw pictures using words that sound like the actions they see: "splash," "crash," "whoosh," and "spray." Create a class poem together using these sound words to describe the waves hitting the rocks.
3. Social Studies - Coastal Communities: Discuss how people who live near the ocean experience waves and rocky beaches. Talk about lighthouses, harbors, and how communities protect their shorelines from erosion. Students can locate oceans and beaches on a map.
4. Art - Movement & Color: Have students create mixed-media artwork showing wave motion using blue paint, white spray bottles, and dark paper for rocks. Students can also draw before-and-after pictures showing how rocks change over thousands of years from wave erosion.

## STEM Career Connection

1. Geologist: A geologist studies rocks and how they change over time. This scientist might visit rocky coastlines like the one in the photo to measure erosion, collect rock samples, and understand how waves reshape our Earth. Average Salary: \$90,000-\$95,000
2. Oceanographer: An oceanographer studies the ocean and its waves. They learn about how waves form, how strong they are, and how they affect the land and animals living nearby. Some oceanographers work on boats to study real waves! Average Salary: \$85,000-\$100,000

3. Coastal Engineer: A coastal engineer designs structures like seawalls and breakwaters to protect beaches and towns from wave damage and erosion. They use science to understand wave energy and create solutions that keep communities safe. Average Salary: \$80,000-\$105,000

### 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: 2-PS1.A - Different materials can be described by their observable properties
- Crosscutting Concepts: Patterns - Patterns in the natural world can be observed and used as evidence

### Science Vocabulary

- \* Wave: Moving water that carries energy from one place to another
- \* Energy: The power to make things move or change
- \* Erosion: When rocks and soil get worn away by water, wind, or ice
- \* Force: A push or pull that can make objects move or change shape
- \* Impact: When one thing hits another thing with force

### External Resources

Children's Books:

- Waves by Kimberly Brubaker Bradley
- The Magic School Bus at the Waterworks by Joanna Cole
- What Is the Water Cycle? by Robin Johnson