# Waves: Energy Moving Through Space and Matter

KS3 Ages 11-14 ⏰ 4 min read

## What Is a Wave?

A **wave** is a way that **energy** travels from one place to another. Imagine you drop a stone in a pond—the energy from the splash creates ripples that spread outward across the water. That's a wave! Waves don't move the water itself very far, but they do move the energy through it.

Waves are all around us. When you hear music, **sound waves** are traveling through the air to your ears. When you see a rainbow, **light waves** are entering your eyes. Even the ground shakes during an earthquake because of **seismic waves**.

Think of it like a stadium "wave": people stand up and sit down in a pattern, but no one actually moves to a different seat. The motion travels around the stadium, even though each person stays in roughly the same place.

## How Do Waves Work?

All waves need three things to exist: **energy** (something to start them), a **medium** (something for them to travel through), and **movement** (the way the energy spreads).

Two key features describe every wave. The **wavelength** is the distance between one peak and the next peak. The **frequency** is how many waves pass a point in one second. Fast waves have high frequency; slow waves have low frequency.

## Types of Waves

**Mechanical waves** need a material to travel through—like sound waves moving through air or water ripples moving through water. Without a medium, mechanical waves cannot exist.

**Electromagnetic waves** are completely different. They don't need anything to travel through; they can move through empty space! **Light waves**, **radio waves**, and **microwaves** are all electromagnetic waves.

Think of it like this: sound is like passing a message by whispering from person to person in a line. Light is like a message that travels all by itself, even through a completely empty room.

**Transverse waves** move up and down or side to side, like a jump rope wiggling. **Longitudinal waves** move back and forth in the direction they're traveling, like a Slinky being pushed and pulled. **Sound waves** are longitudinal waves.

## Real-World Examples

**Water waves** at the beach are mechanical transverse waves. **Radio waves** that carry broadcasts to your radio are electromagnetic waves. **Earthquake waves** travel through rock and soil to shake buildings. **Ultraviolet waves** from the Sun can give you a sunburn.

Understanding waves helps scientists and engineers design everything from safer buildings to better communications technology. Every time you listen to music, see a movie, or use your mobile phone, waves are doing the work!