

# TRANSMISSION, ABSORPTION, AND REFLECTION: How Waves Interact With Materials

Read the text, and then answer the questions that follow.

Recall that **waves** are patterns of motion that carry energy from one place to another. A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. The energy of a wave is directly related to its amplitude and its frequency.

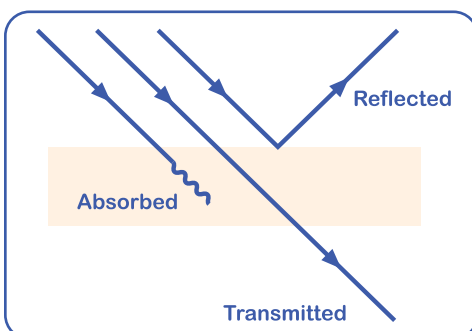
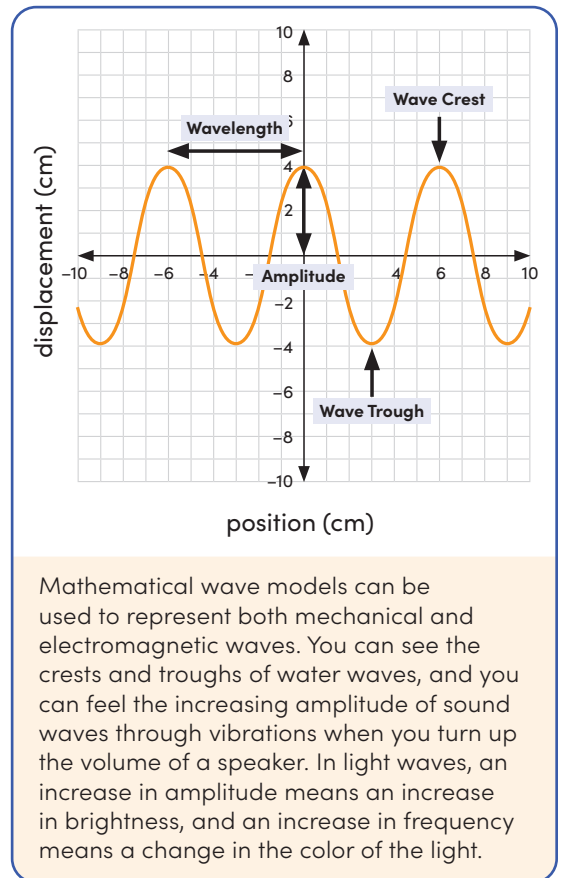
There are many different types of waves. **Mechanical waves**, such as water waves or sound waves, travel through matter. **Electromagnetic waves**, such as light waves, do not need to travel through matter. So, in outer space, you would be able to see light, but you would not be able to hear sound because there's no air in space for sound waves to travel through.

Both mechanical and electromagnetic waves interact with matter in a number of ways. They can be **transmitted** through, **absorbed** by, or **reflected** off matter.

When a wave is transmitted, it passes through the matter. For example, water waves are transmitted through the ocean toward the shore. Sound waves are transmitted through the air to your ear. Light waves are transmitted through transparent objects, such as windows.

When a wave is absorbed, energy is transferred from the wave to the matter. This causes the wave's amplitude to decrease. For example, when a water wave crashes on the shore, energy is absorbed by the sand. Recording studio walls are often covered in foam padding, which absorbs sound waves and minimizes echoes. Black objects absorb all wavelengths of light and convert them into heat energy, so the objects become warm.

When a wave is reflected, it bounces off matter and moves in a different direction. This can happen when the density of matter is too high for the wave to be transmitted or absorbed. For example, when a water wave crashes into a hard surface, such as a cliff, the wave is reflected and changes direction. When you hear an echo, you are hearing a sound wave reflecting off a surface. When you look at the surface of a smooth pool of water and see an image of the surrounding scenery, you are seeing reflected light.



Often, these interactions occur at the same time. For example, we see different colors due to the reflection and absorption of different frequencies of light. White light is actually a mixture of all the different colors in the rainbow. In other words, it is a mixture of all the different frequencies of visible light. When white light from the sun shines on a strawberry, the strawberry appears red because the strawberry reflects red light into your eye. At the same time, it absorbs all of the other colors of light.

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Show what you know! Answer the questions below.

1. Explain why sound waves are mechanical waves rather than electromagnetic waves.  
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2. Cathy yells in a tunnel and hears her voice echo. Is this an example of transmission, absorption, or reflection? Explain.  
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3. When Gordon jumps into the pool, he creates waves that travel from one end of the pool to the other. Is this an example of transmission, absorption, or reflection? Explain.  
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4. Justin has a brother named Nick. Nick's bedroom is directly above Justin's bedroom. Before Nick had carpet installed in his bedroom, Justin could hear the sound of Nick singing as he practiced for chorus class each night. Once Nick's room was carpeted, Justin could no longer hear Nick singing. Why?  
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5. Justin also shares a bedroom wall with his sister Jennifer. From his bedroom, he can hear that Jennifer is playing the guitar, but the sound is muffled. Describe the interactions occurring between the sound waves and the wall.  
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6. There is a giant oak tree in Justin's backyard. On a sunny day, the leaves of the tree look green. Describe the interactions occurring between the light waves and the leaves of the tree.  
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7. Justin's bedroom window is divided into four parts. In the afternoon, he notices that the sunlight creates a pattern of light and dark areas on the wall. Describe the interactions occurring between the light waves and the window.  
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