Teacher: Mr. Cox Subject: Physics

Options for credit this week *April 6 - 10, 2020*

Suggested online resources

- *If you have Google Classroom, please complete the assignment online, however here is a paper copy of the material.*
- *All online resources for this week will be through CK12.org. Please explore the different options below the adaptive practices, such as the PLIX, Simulations, and Real World Demonstrations.*
- *You may also make a video of you performing a demonstration in place of any assignment this week. Simply upload the video into the assignment and make sure I can access the video to watch.*

No-Tech/Low-Tech Activities

- *Notes have been provided for Wave Amplitude, Wave Interactions, and Sound Waves.*
- *Complete the 30 Question Practices to show understanding of the work. The answers to the odd number problems have been provided for Wave Amplitude and Wave Frequency.*
- *Alternative Assignments - If you are able to watch videos regarding Waves - Amplitude, Interactions, or Sound, you may summarize the videos and/or demonstration.*
- *You may also make a video of you performing a demonstration in place of any assignment this week.*

Instructions for Attached Assignments

- *Read the provided notes on Wave Amplitude, Wave Interactions, and Sound Waves. Check your understanding by answering the Practice Questions for each section and turn those in for credit. You may answer them on CK-12 directly by going to our Google Classroom and clicking the link, OR google docs, OR on a separate sheet of paper, then take a picture and email it to me at scox@rice-isd.org, or send it to the office and they will forward the work to me.*

- *There are Real World and fun Interactive Simulations on CK-12 for Sound Waves. Pick one and investigate how sound waves behave. Summarize your finding in 4-5 sentences and turn this in with your review questions.*

- *COVID-19 journal - Write 3-5 sentences on what Science you have seen this week in regards to COVID-19. Be specific and remember to document where you received your information.*

CHAPTER 1 Wave Amplitude

Learning Objectives

- Define wave amplitude.
- State how to measure the amplitude of transverse and longitudinal waves.
- Explain what determines the amplitude of a wave.

On a windy day, moving air particles strike these flags and transfer their energy of motion to particles of fabric. The energy travels through the fabric in waves. You can see the waves rippling through the brightly colored cloth. The windier the day is, the more vigorously the flags wave.

What's the Matter?

Waves that travel through matter—such as the fabric of a flag—are called mechanical waves. The matter they travel through is called the medium. When the energy of a wave passes through the medium, particles of the medium move. The more energy the wave has, the farther the particles of the medium move. The distance the particles move is measured by the wave's amplitude.

What Is Wave Amplitude?

Wave amplitude is the maximum distance the particles of the medium move from their resting positions when a wave passes through. The resting position of a particle of the medium is where the particle would be in the absence of a wave. The **Figure** 1.1 show the amplitudes of two different types of waves: transverse and longitudinal waves.

- In a transverse wave, particles of the medium move up and down at right angles to the direction of the wave. Wave amplitude of a transverse wave is the difference in height between the crest and the resting position. The crest is the highest point particles of the medium reach. The higher the crests are, the greater the amplitude of the wave.

- In a longitudinal wave, particles of the medium move back and forth in the same direction as the wave. Wave amplitude of a longitudinal wave is the distance between particles of the medium where it is compressed by the wave. The closer together the particles are, the greater the amplitude of the wave.

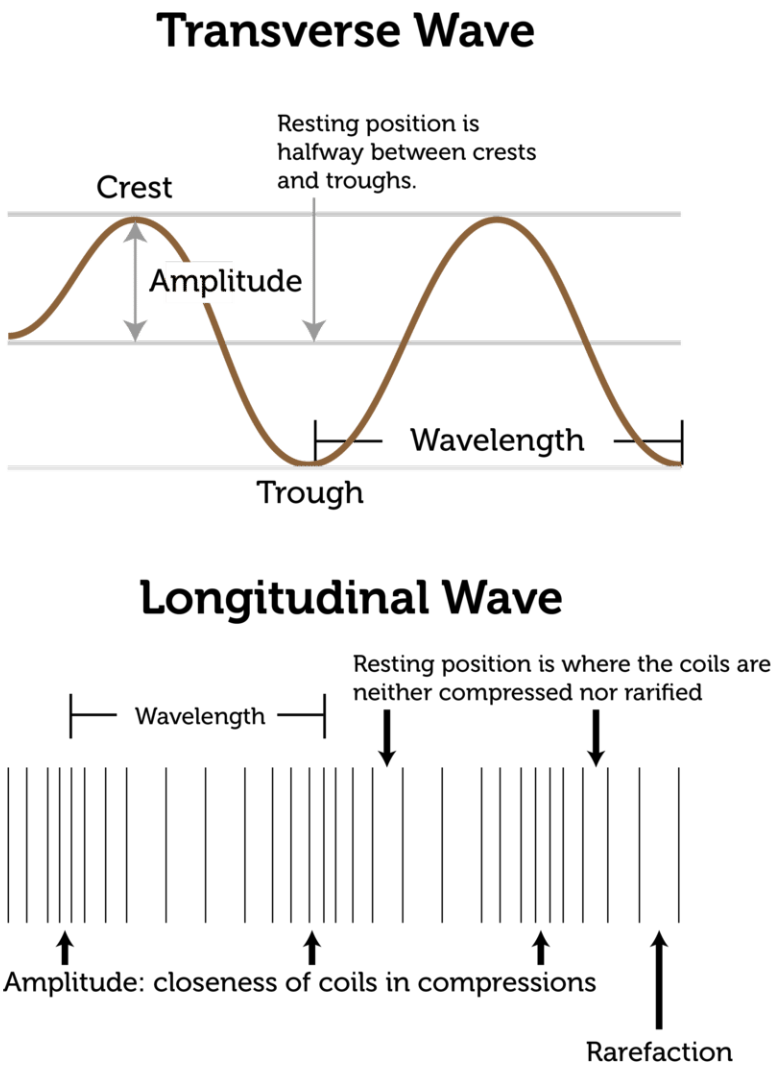
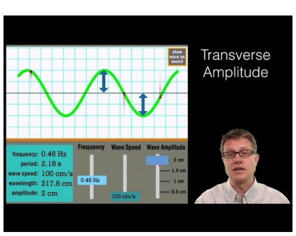


FIGURE 1.1

Q: What do you think determines a wave's amplitude?

A: Wave amplitude is determined by the energy of the disturbance that causes the wave.



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Energy and Amplitude

A wave caused by a disturbance with more energy has greater amplitude. Imagine dropping a small pebble into a pond of still water. Tiny ripples will move out from the disturbance in concentric circles. The ripples are low-amplitude waves with very little energy. Now imagine throwing a big boulder into the pond. Very large waves will be generated by the disturbance. These waves are high-amplitude waves and have a great deal of energy.

Summary

- Wave amplitude is the maximum distance the particles of the medium move from their resting positions when a wave passes through.
- Wave amplitude of a transverse wave is the difference in height between a crest and the resting position. Wave amplitude of a longitudinal wave is the distance between particles of the medium where it is compressed by the wave.
- Wave amplitude is determined by the energy of the disturbance that causes the wave. A wave caused by a disturbance with more energy has greater amplitude.

Review

1. Define wave amplitude.
2. What is the amplitude of the transverse wave modeled in the **Figure** 1.2 if the height of a crest is 3 cm above the resting position of the medium?

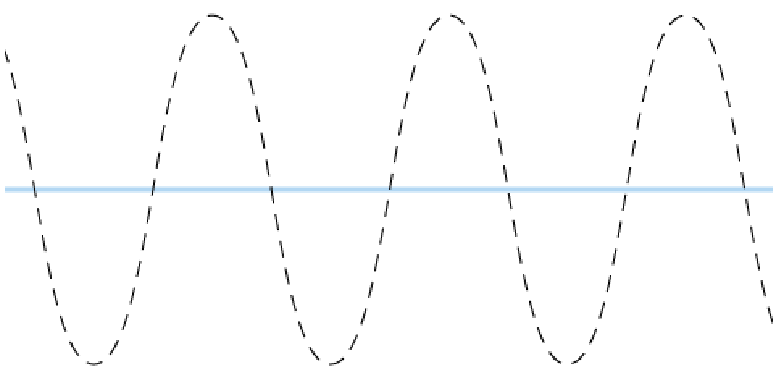

FIGURE 1.2

3. Which of these two longitudinal waves in the **Figure** 1.3 has greater amplitude?

4. Relate wave amplitude to wave energy.

References

1. . . CC BY-NC
2. Christopher Auyeung. CK-12 Foundation . CC BY-NC 3.0
3. Zachary Wilson. CK-12 Foundation . CC BY-NC 3.0
4. CK-12 Foundation. CK-12 Foundation . CC BY-NC 3.0

CHAPTER 1 Wave Interactions

Learning Objectives

- Identify ways that waves can interact with matter.
- Define and give examples of wave reflection, refraction, and diffraction.

Did you ever hear an echo of your own voice? An echo occurs when sound waves bounce back from a surface that they can't pass through. The woman pictured here is trying to create an echo by shouting toward a large building. When the sound waves strike the wall of the building, most of them bounce back toward the woman, and she hears an echo of her voice. An echo is just one example of how waves interact with matter.

How Waves Interact with Matter

Waves interact with matter in several ways. The interactions occur when waves pass from one medium to another. The types of interactions are reflection, refraction, and diffraction. Each type of interaction is described in detail below.

Reflection

An echo is an example of wave reflection. **Reflection** occurs when waves bounce back from a surface they cannot pass through. Reflection can happen with any type of waves, not just sound waves. For example, light waves can also be reflected. In fact, that's how we see most objects. Light from a light source, such as the sun or a light bulb, shines on the object and some of the light is reflected. When the reflected light enters our eyes, we can see the object.

Reflected waves have the same speed and frequency as the original waves before they were reflected. However, the direction of the reflected waves is different. When waves strike an obstacle head on, the reflected waves bounce straight back in the direction they came from. When waves strike an obstacle at any other angle, they bounce back at the same angle but in a different direction. This is illustrated in the **Figure** 1.1. In this diagram, waves strike a wall at an angle, called the angle of incidence. The waves are reflected at the same angle, called the angle of reflection, but in a different direction. Notice that both angles are measured relative to a line that is perpendicular to the wall.

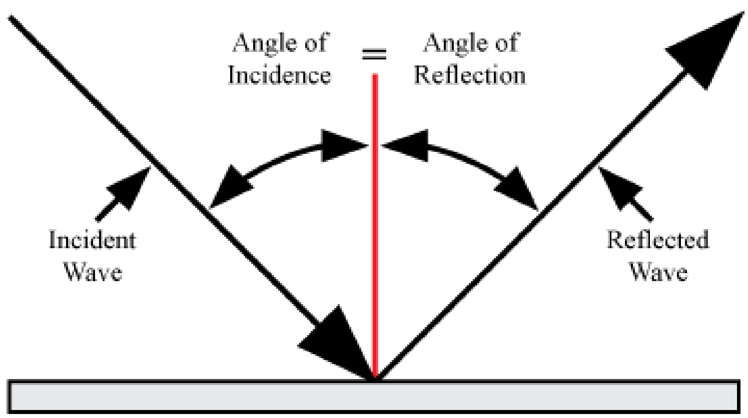

FIGURE 1.1

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Refraction

Refraction is another way that waves interact with matter. **Refraction** occurs when waves bend as they enter a new medium at an angle. You can see an example of refraction in the **Figure** 1.2. Light bends when it passes from air to water or from water to air. The bending of the light traveling from the fish to the man's eyes causes the fish to appear to be in a different place from where it actually is.

Waves bend as they enter a new medium because they start traveling at a different speed in the new medium. For example, light travels more slowly in water than in air. This causes it to refract when it passes from air to water or from water to air.

Q: Where would the fish appear to be if the man looked down at it from straight above its actual location?

A: The fish would appear to be where it actually is because refraction occurs only when waves (in this case light waves from the fish) enter a new medium at an angle other than 90°.

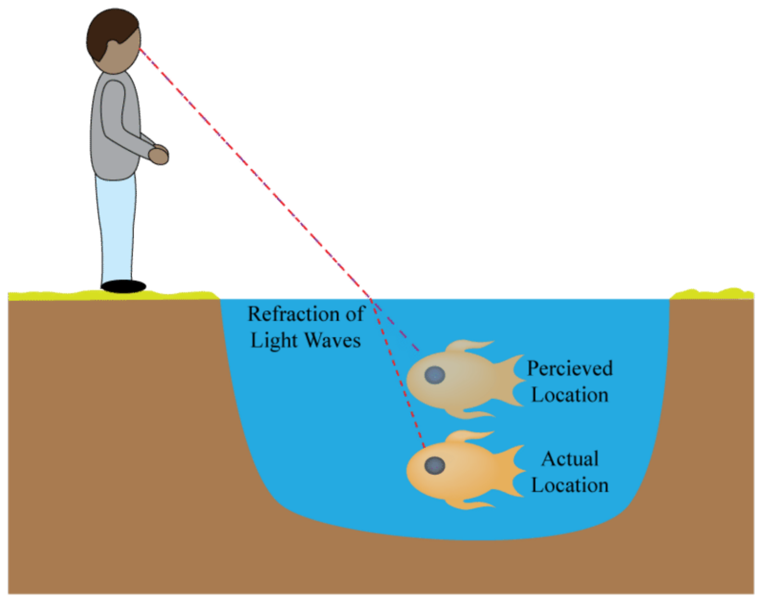


FIGURE 1.2

Diffraction

Did you ever notice that you can hear sounds around the corners of buildings even though you can't see around them? The **Figure** 1.3 shows why this happens. As you can see from the figure, sound waves spread out and travel around obstacles. This is called **diffraction**. It also occurs when waves pass through an opening in an obstacle. All waves may be diffracted, but it is more pronounced in some types of waves than others. For example, sound waves bend around corners much more than light does. That's why you can hear but not see around corners.

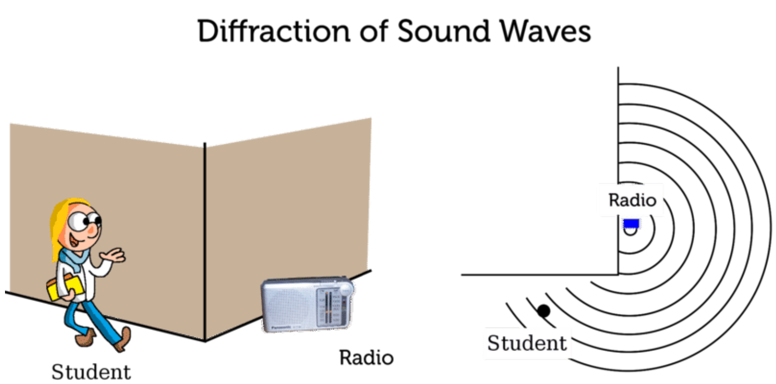


FIGURE 1.3

For a given type of waves, such as sound waves, how much the waves diffract depends on the size of the obstacle (or opening in the obstacle) and the wavelength of the waves.

The **Figure** above shows how the amount of diffraction is affected by the size of the opening in a barrier. Note that the wavelength of the wave is the distance between the vertical lines.

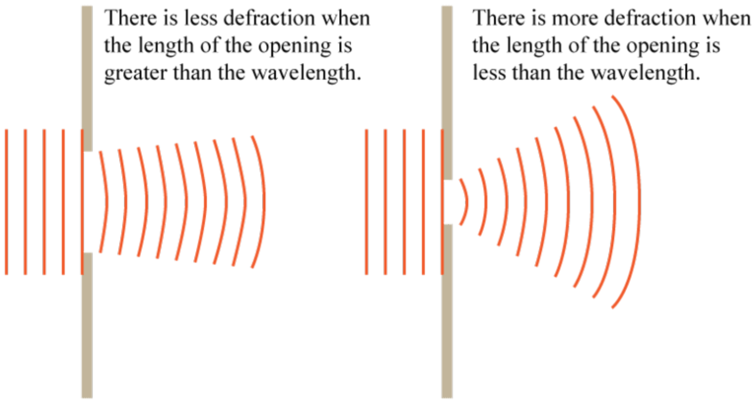
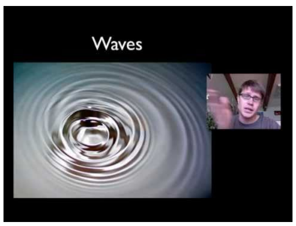


FIGURE 1.4



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Summary

- Three ways that waves may interact with matter are reflection, refraction, and diffraction.
- Reflection occurs when waves bounce back from a surface that they cannot pass through.
- Refraction occurs when waves bend as they enter a new medium at an angle and start traveling at a different speed.
- Diffraction occurs when waves spread out as they travel around obstacles or through openings in obstacles.

Review

1. What is reflection? What happens if waves strike a reflective surface at an angle other than 90°?
2. Define refraction. Why does refraction occur?
3. When does diffraction occur? How is wavelength related to diffraction?

References

1. Pixabay - waxflowers;Zachary Wilson. https://pixabay.com/p-1629027/?no_redirect;CK-12 Foundation . CC BY-NC 3.0
2. Zachary Wilson. CK-12 Foundation . CC BY-NC 3.0
3. Zachary Wilson. CK-12 Foundation . CC BY-NC 3.0
4. Student: Flickr:MaxTorrt; Radio: Flickr:Kansir. Student: http://www.flickr.com/photos/16953895@N05/8299424201/; Radio: http://www.flickr.com/photos/kansirnet/231639326/ . CC BY 2.0
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CHAPTER 1 Sound Wave

Learning Objectives

- Define sound.
- Describe sound waves and how they are generated.
- Identify media through which sound waves can travel.

Crack! Crash! Thud! That's what you'd hear if you were in the forest when this old tree cracked and came crashing down to the ground. But what if there was nobody there to hear the tree fall? Would it still make these sounds? This is an old riddle. To answer the riddle correctly, you need to know the scientific definition of sound.

Defining Sound

In science, **sound** is defined as the transfer of energy from a vibrating object in waves that travel through matter. Most people commonly use the term sound to mean what they hear when sound waves enter their ears. The tree above generated sound waves when it fell to the ground, so it made sound according to the scientific definition. But the sound wasn't detected by a person's ears if there was nobody in the forest. So the answer to the riddle is both yes and no!

How Sound Waves Begin

All sound waves begin with vibrating matter. Look at the first guitar string on the left in the **Figure** 1.1. Plucking the string makes it vibrate. The diagram below the figure shows the wave generated by the vibrating string. The moving string repeatedly pushes against the air particles next to it, which causes the air particles to vibrate. The vibrations spread through the air in all directions away from the guitar string as longitudinal waves. In longitudinal waves, particles of the medium vibrate back and forth parallel to the direction that the waves travel.

Q: If there were no air particles to carry the vibrations away from the guitar string, how would sound reach the ear?

A: It wouldn't unless the vibrations were carried by another medium. Sound waves are mechanical waves, so they can travel only though matter and not through empty space.

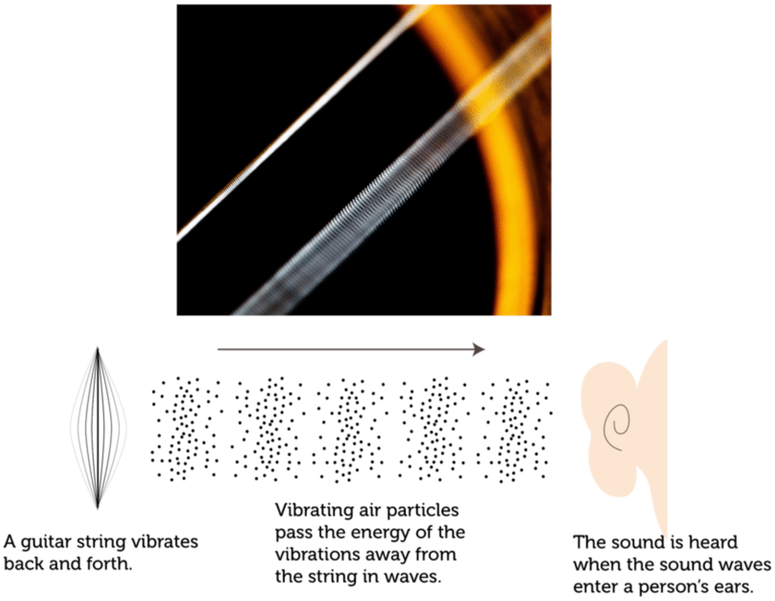

FIGURE 1.1

What about the sound waves created by other instruments? Why does the same musical note on different instruments, such as a guitar and violin, sound different? Begin your exploration of sound by exploring the different types of sound waves produced by string instruments in the Violin SIM below:

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A pan flute is another example of a musical instrument that depends on the vibration of air particles. Use the simulation below to visualize how the movement of invisible air molecules inside the tubes produces musical notes:

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A Ticking Clock

The fact that sound cannot travel through empty space was first demonstrated in the 1600s by a scientist named Robert Boyle. Boyle placed a ticking clock in a sealed glass jar. The clock could be heard ticking through the air and glass of the jar. Then Boyle pumped the air out of the jar. The clock was still ticking, but the ticking sound could no longer be heard. That's because the sound couldn't travel away from the clock without air particles to pass the sound energy along.

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Sound Waves and Matter

Most of the sounds we hear reach our ears through the air, but sounds can also travel through liquids and solids. If you swim underwater—or even submerge your ears in bathwater—any sounds you hear have traveled to your ears through the water. Some solids, including glass and metals, are very good at transmitting sounds. Foam rubber and heavy fabrics, on the other hand, tend to muffle sounds. They absorb rather than pass on the sound energy.

Q: How can you tell that sounds travel through solids?

A: One way is that you can hear loud outdoor sounds such as sirens through closed windows and doors. You can also hear sounds through the inside walls of a house. For example, if you put your ear against a wall, you may be able to eavesdrop on a conversation in the next room—not that you would, of course.

Summary

- In science, sound is defined as the transfer of energy from a vibrating object in waves that travel through matter.
- All sound waves begin with vibrating matter. The vibrations generate longitudinal waves that travel through matter in all directions.
- Most sounds we hear travel through air, but sounds can also travel through liquids and solids.

Review

1. How is sound defined in science? How does this definition differ from the common meaning of the word?
2. Hitting a drum, as shown in the **Figure** 1.2, generates sound waves. Create a diagram to show how the sound waves begin and how they reach a person's ears.

FIGURE 1.2

3. How do you think earplugs work?