



# Chapter 4



## Teacher Notes

The best answer is E. Sound travels through water, air, and metal; light travels through water and air. Sound, unlike light, requires a medium through which to travel. Sound can travel through all three states of matter, although the ease, speed, and distance of transmission differ. Light differs from sound in that it does not require a medium through which to travel. Light can travel through a medium like air and water; however, as it passes through water, the water particles affect its speed and direction of movement. Light does not pass through opaque materials and objects such as metal. If the metal is shiny, light is reflected off the metal. Some metals also absorb light.


The big idea is that sound can travel through any type of matter, but it can't travel through a vacuum. Light can travel through a vacuum as well as through transparent and translucent materials, but opaque materials block the transmission of light.

Research on learning indicates that students have different ideas about the types of materials sound and light can travel through. Students' answer choices and explanations will alert you to the need to make sure instruction builds a bridge between students' initial ideas about how sound and light waves travel and the scientific ideas that explain the transmission of sound and light.

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

**Chapter 4**

**Waves and Matter**



Sound and light both travel by waves. Circle the statement that best describes how their waves travel through matter.

- A. Sound travels through air; light travels through air.
- B. Sound travels through air; light travels through water and air.
- C. Sound travels through water and air; light travels through air.
- D. Sound travels through water and air; light travels through water and air.
- E. Sound travels through water, air, and metal; light travels through water and air.
- F. Sound travels through water, air, and metal; light travels through water, air, and metal.

Explain your thinking. Describe your ideas about how sound and light waves travel through matter.

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Note-taking

Study Guide

Chapter Review

Standards Practice

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Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

**Note-taking Chapter 4**



**How do waves transfer energy through matter and through empty space?**

**Before You Read**

Before you read the chapter, think about what you know about waves, light, and sound. Record your ideas in the first column. Pair with a partner, and discuss his or her thoughts. Write those ideas in the second column. Then record what you both would like to share with the class in the third column.

Think	Pair	Share

**Chapter Vocabulary**

Lesson 1	Lesson 2	Lesson 3
<p><b>NEW</b>                      mechanical wave                      electromagnetic wave                      transverse wave                      longitudinal wave                      frequency                      amplitude                      refraction</p> <p><b>REVIEW</b>                      perpendicular</p>	<p><b>NEW</b>                      radio wave                      infrared wave                      ultraviolet wave                      transparent                      translucent                      opaque                      intensity</p> <p><b>ACADEMIC</b>                      range</p>	<p><b>NEW</b>                      compression                      rarefaction                      pitch                      decibel</p>

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A Lesson Content Vocabulary page for each lesson is provided in the Chapter Resources Files.

- Note-taking
- Study Guide
- Chapter Review
- Standards Practice

- Note-taking
- Study Guide
- Chapter Review
- Standards Practice

# Note-taking continued

## Lesson 1 Waves

**7.NS.2, 7.NS.4, 7.NS.6, 7.NS.7, 7.NS.8, 7.NS.9, 7.NS.10, 7.NS.11, 7.1.4**

*Skim or scan the heading, boldfaced words, and pictures in the lesson. Identify or predict three facts you will learn from the lesson. Discuss your thoughts with a classmate.*

### Main Idea

**What are waves?**

I found this on page 119.

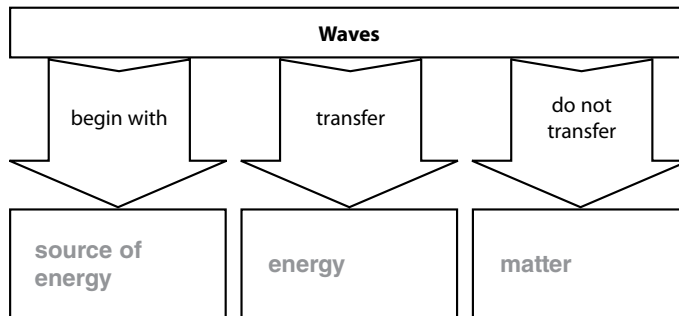
I found this on page 120.

I found this on page 121.

I found this on page 121.

### Details

**Organize** information about waves.



**Differentiate** two main types of waves.

Mechanical Waves	Electromagnetic Waves
a type of wave that can travel only through matter	a type of wave that can travel through empty space and through matter

**Classify** wave motion. Circle the type of motion that occurs in electromagnetic waves.

Type of Wave Motion	Description of Disturbance	Examples
Transverse	perpendicular to the direction the wave travels	flag waving in a breeze; light waves
Longitudinal	parallel to the direction the wave travels	sound waves
Combination	both parallel and perpendicular to the direction the wave travels	water waves

Lesson 1 | Waves (continued)

Main Idea

I found this on page 122.

Details

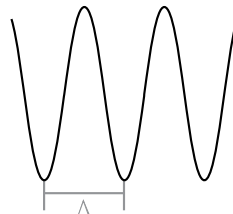
Contrast the motion of water waves and seismic waves.

Water Waves	Seismic Waves
combination of transverse and longitudinal waves; particles move in circles	<ul style="list-style-type: none"> <li>• Surface waves are a combination of transverse and longitudinal waves.</li> <li>• P waves are longitudinal.</li> <li>• S waves are transverse.</li> </ul>

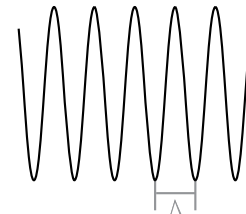
Properties of Waves

I found this on page 123.

Interpret wavelength in the two transverse wave diagrams. Mark and label with descriptions one wavelength in each wave.



Longer wavelength, lower frequency



Shorter wavelength, higher frequency

I found this on page 123.

Relate wavelength to frequency.

**Wavelength**  
the difference between a point on one wave and the same point on the next wave

**Frequency**  
the number of wavelengths that pass a point each second

# Note-taking continued

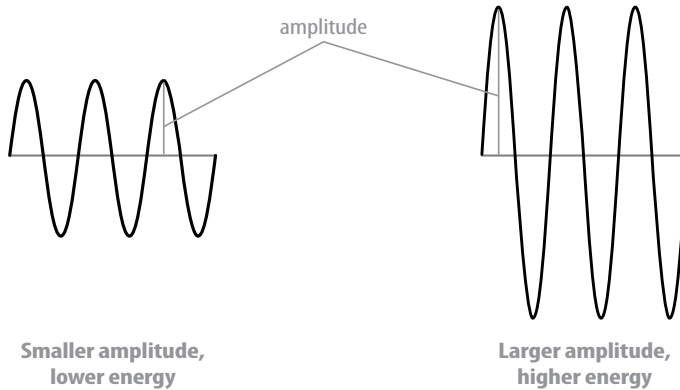
## Lesson 1 | Waves (continued)

### Main Idea

I found this on page 124.

### Details

**Interpret** amplitude and energy in the two transverse wave diagrams. Mark and label the amplitude in each wave, and identify it as having higher or lower energy than the other.



### Wave Interaction with Matter

I found this on page 125.

**Describe** ways that waves interact with matter.

Interaction	Description
Transmission	Wave energy is carried all the way through the matter.
Absorption	Wave energy changes to thermal energy and remains in matter; less energy is transmitted.
Reflection	Wave energy bounces back off matter.
Refraction	the change in direction of a wave that changes speed when it moves from one medium into another at an angle
Diffraction	the change in direction of a wave when it travels past the edge of an object or through an opening

I found this on page 126.

**Analyze It** Explain why you see rings form and grow outward when you drop a pebble through the surface of still water.

Accept all reasonable responses. Sample answer: The pebble causes a disturbance and transfers energy from its motion to the water. The energy travels away from the source point in all directions with both parallel and perpendicular wave motion.

**Lesson 2** Light

**7.NS.4, 7.NS.7, 7.NS.11, 7.DP.5, 7.DP.7, 7.DP.11, 7.1.4**  
**Skim or scan** the heading, boldfaced words, and pictures in the lesson. Identify or predict three facts you will learn from the lesson. Discuss your thoughts with a classmate.

**Main Idea**

**What are light waves?**

I found this on page 130.

**The Electromagnetic Spectrum**

I found this on page 131.

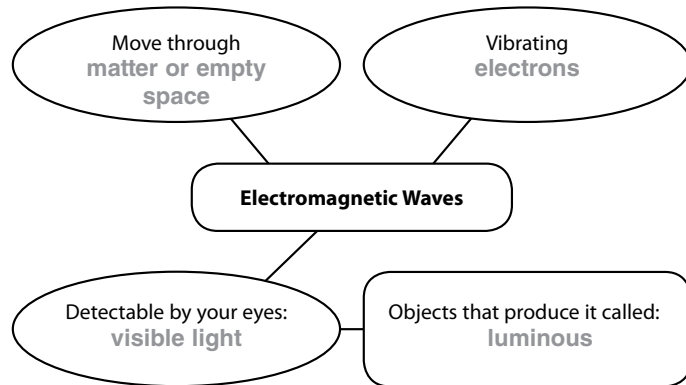
I found this on page 132.

I found this on page 133.

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**Details**

**Characterize** electromagnetic waves.



**Differentiate** types of electromagnetic waves.

Type	Characteristics
Radio wave	longer than about 30 cm; used in radio and television transmission
Microwave	1 mm to 30 cm; used in cooking appliances
Infrared wave	shorter than a microwave, but longer than light; produced by space heaters
Light	shorter than infrared but longer than ultraviolet; what we see from the Sun and lamps
Ultraviolet waves	slightly shorter than visible light; carry enough energy to damage skin
X-rays	high energy wave that can pass through skin and muscle
Gamma rays	highest energy waves; can penetrate lead

# Note-taking continued

## Lesson 2 | Light (continued)

### Main Idea

I found this on page 133.

### Speed, Wavelength, and Frequency

I found this on page 134.

### Interaction of Light and Matter

I found this on page 134.

### Color

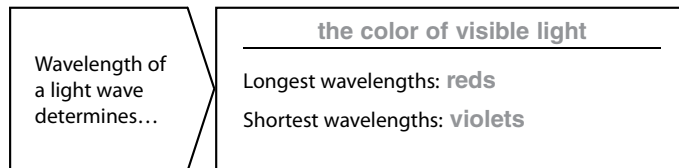
I found this on page 135.

### Details

**Classify** waves that carry energy from the Sun.

Waves Carrying Energy from the Sun		
7%	44%	49%
ultraviolet	light	infrared

**Relate** wavelength to color.



**Describe** materials that affect light.

Material	Description
Transparent	allows almost all the light that strikes it to pass through
Translucent	allows most of the light that strikes it to pass through
Opaque	material through which light does not pass

**Generalize** ways that objects interact with light to produce colors. Use the terms absorb, reflect, and transmit each at least one time in your explanations.

Opaque Blue Objects	Transparent and Translucent Red Objects
absorb all the wavelengths except those in the blue part of the spectrum; reflect blue light	absorb all the wavelengths except those in the red part of the spectrum; transmit red light

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Lesson 2 | Light (continued)

Main Idea

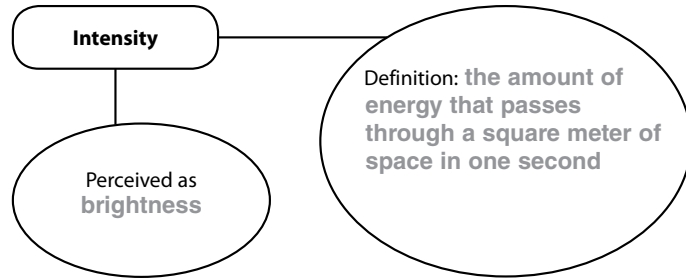
**Intensity of Light**  
I found this on page 136.

**Interactions of Sunlight and Matter**  
I found this on page 137.

**Vision and the Eye**  
I found this on page 138.

Details

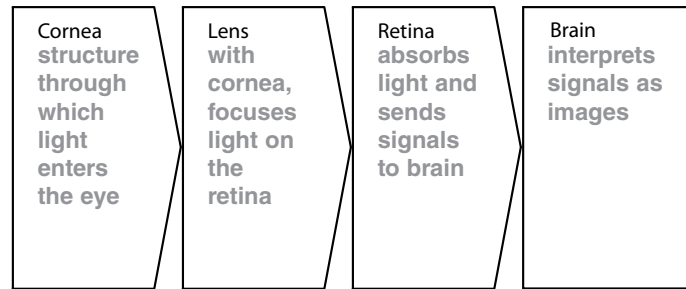
**Characterize** intensity of light.



**Express** the effects of scattering and refraction of sunlight.

Scattering	Refraction
The sky appears blue and the Sun appears yellow.	seeing the Sun above the horizon after it has set below the horizon

**Sequence** the process of vision. Explain the function of each structure.



**Connect It** Describe how light waves interact with the clothes you are wearing and your eyes.

Accept all reasonable responses. Sample answer: My jeans absorb all of the wavelengths of light except the wavelengths in the blue spectrum; they reflect the blue light. The reflected light enters my eyes and is perceived by my brain as the color blue.

**Lesson 3 Sound**

**7.NS.2, 7.NS.5, 7.NS.7, 7.NS.9, 7.NS.11, 7.DP.1, 7.DP.3, 7.DP.5, 7.DP.6, 7.DP.7, 7.DP.10, 7.DP.11, 7.1.4**  
**Skim or scan** the heading, boldfaced words, and pictures in the lesson. Identify or predict three facts you will learn from the lesson. Discuss your thoughts with a classmate.

**Main Idea**

**What are sound waves?**  
 I found this on page 142.

I found this on page 142.

I found this on page 143.

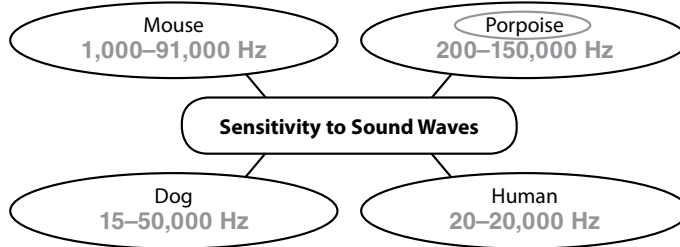
**Properties of Sound Waves**  
 I found this on page 143.

**Details**

**Identify** three ways in which light waves and sound waves are different from each other.

1. Light waves are electromagnetic; sound waves are mechanical.
2. We perceive light waves by seeing; we perceive sound waves by hearing.
3. Light waves are transverse; sound waves are longitudinal.

**Detail** sensitivity to sound waves. Write the range in Hz, and circle the animal with the most sensitive hearing.



**Differentiate** regions of a longitudinal wave.

Compression	Rarefaction
where the particles of the medium are closest together	where the particles are farthest apart

**Relate** frequency and pitch.

The higher the frequency of the waves, the higher the pitch sounds.

The lower the frequency of the waves, the lower the pitch sounds.

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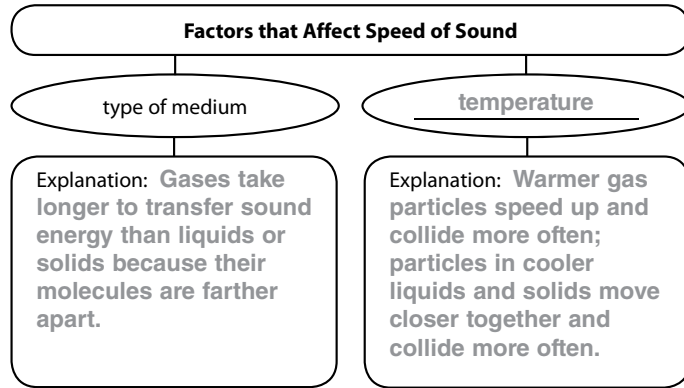
**Lesson 3 | Sound (continued)**

**Main Idea**

I found this on page 144.

**Details**

**Identify** two factors that affect the speed of sound.



I found this on page 145.

**Explain** the change in decibel level of a sound as you move farther away from the source.

Sound waves spread out as they travel away from the source; the farther from the source, the less energy in the same space. This means lower intensity and a lower decibel level.

**Describe** how structures contribute to hearing.

Structures for Hearing Sound		
Outer Ear	Middle Ear	Inner Ear
collects sound waves	hammer, anvil, stirrup, eardrum; amplify sound waves	cochlea; change sound waves to nerve signals to the brain

**Hearing and the Ear**  
I found this on page 146.

**Synthesize It** Suppose your dog is barking at the door as if he hears something there, but you hear nothing. Hypothesize what is happening in your outer and middle ears at that time.

Accept all reasonable responses. Sample answer: The dog's more sensitive ears can hear sounds that I cannot. Since I am in the same room with the dog, the same sound waves are entering my outer ear. However, either the frequency is too high or the intensity is too low to be amplified in my middle ear.

## Review Waves, Light, and Sound

### Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned.

#### Use this checklist to help you study.

- Complete your Foldables® Chapter Project.
- Study this chapter in your Notebook.
- Study the definitions of vocabulary words.
- Reread the chapter, and review the charts, graphs, and illustrations.
- Review the Understanding Key Concepts at the end of each lesson.
- Look over the Chapter Review at the end of the chapter.



**Summarize It** Reread the chapter Big Idea and the lesson Key Concepts. Summarize all the types of waves in the room around you and how they are behaving.

Accept all reasonable responses. Sample answer: The room is filled with light, which is the visible range of electromagnetic wavelengths. The transverse waves passed through the transparent window, which transmitted them. The light waves are reflecting off the many opaque objects in the room, and I see many colors as the different pigments in objects absorb and reflect the different wavelengths of light. I also hear sounds, which are the audible vibrations of longitudinal mechanical waves. Sounds from outside the window are softer; sounds from inside the room are louder, or more intense. The sound that I hear from the radio comes from radio waves, which are very low frequency electromagnetic waves. The sunlight around me is accompanied by other electromagnetic wave energy from the Sun at wavelengths I cannot see. These are infrared waves and ultraviolet waves.

**Challenge** Find out more about electronic devices that can detect or receive types of waves. Make a chart that shows the devices and explains how they function and what they are used for. Display the chart in your classroom.

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## Study Guide

**Use Vocabulary**  
Use the vocabulary terms from the chapter to complete the sentences below.

- The property of waves that is measured in hertz (Hz) is \_\_\_\_\_.
- A change in direction, or \_\_\_\_\_, can occur as a wave moves into a medium.
- A material that transmits light but through which objects appear blurry is \_\_\_\_\_.
- An object that does not allow light to pass through it is \_\_\_\_\_.
- The portion of a sound wave with higher-than-normal pressure is called a(n) \_\_\_\_\_.
- A unit that describes the intensity or loudness of sound is the \_\_\_\_\_.

**Link Vocabulary and Key Concepts**  
Use vocabulary terms from the chapter to complete the concept map below.

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## Use Vocabulary

- frequency
- refraction
- translucent
- opaque
- compression
- decibel

## Link Vocabulary and Key Concepts

- 7–8.** mechanical wave, electromagnetic wave (in any order)
- 9–10.** frequency, amplitude (in any order)
- 11–12.** transparent, opaque (in any order)
- 13.** compressions
- 14.** rarefactions

# Chapter 4 Review

## Understand Key Concepts

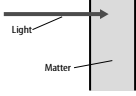
1. B. in circles around the same point.
2. C. speed.
3. A. microwave
4. B. hertz.
5. A. absorption
6. D. wavelength.
7. B. reflection, refraction, and transmission
8. A. red
9. A. amplitude
10. A. low frequency and high amplitude

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

### Chapter 4 Review

**Understand Key Concepts**  
Circle the correct answer below.

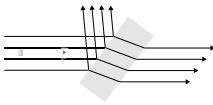
1. As a water wave passes, the particles that make up the water move
  - A. back and forth, parallel to the wave.
  - B. in circles around the same point.
  - C. up and down at right angles to the wave.
  - D. whichever direction the wave moves.
2. The refraction of a wave is caused by a change in
  - A. amplitude.
  - B. frequency.
  - C. speed.
  - D. wavelength.
3. Which is always a transverse wave?
  - A. microwave
  - B. seismic wave
  - C. sound wave
  - D. water wave
4. Wave frequency is measured in
  - A. decibels.
  - B. hertz.
  - C. meters.
  - D. seconds.
5. The arrow in the diagram below shows a point on a light wave that stops as it interacts with matter. Which type of interaction does the arrow represent?
 



Light

Matter

  - A. absorption
  - B. reflection
  - C. refraction
  - D. transmission
6. The distance between one point on a wave and the nearest point just like it is the
  - A. amplitude.
  - B. frequency.
  - C. pitch.
  - D. wavelength.
7. Which interactions of light with matter are taking place in the picture below?
 



  - A. diffraction, reflection, and absorption
  - B. reflection, refraction, and transmission
  - C. reflection, scattering, and diffraction
  - D. translucent, transparent, and opaque
8. Which of the following colors of light has the longest wavelength?
  - A. red
  - B. green
  - C. violet
  - D. yellow
9. You turn up the volume on the car radio. Which of the following properties of the sound changes?
  - A. amplitude
  - B. frequency
  - C. speed
  - D. wavelength
10. If a sound is loud and low-pitched, the sound wave also has which of the following properties?
  - A. low frequency and high amplitude
  - B. low frequency and low amplitude
  - C. high frequency and high amplitude
  - D. high frequency and low amplitude

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**Chapter 4 Review continued**

**Critical Thinking**  
Use the lines below to respond to the following questions.

**11. Construct** Make a diagram that shows how interactions of light waves with matter cause a flower to appear orange.

**12. Synthesize** An MP3 player at maximum volume produces sound at 110 dB. The table shows the time exposure before a risk of hearing damage. How many hours a day could you listen to your MP3 player at full volume before a hearing loss risk? Explain.

Recommended Noise Exposure Limits	
Sound Level (dB)	Time Permitted (h)
90	8
95	4
100	2
105	1

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**13. Summarize** What is the process by which an object can be seen and recognized? Be sure to include the interactions of light waves and matter in your summary.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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 Standards Practice

## Critical Thinking

- Diagrams should indicate white light approaching the flower. All colors but orange enter the flower and are absorbed. Orange light is reflected from the flower.
- You could listen to the player a maximum amount of 30 minutes. Each 5 dB of sound cuts the safe listening time in half. Because 110 dB is 5 dB higher than 105 dB, an hour time limit would be cut to 30 minutes.
- When light strikes an object, some of the light reflects back to your eyes. When the light waves enter your eyes, they are focused by the cornea and the lens onto the retina. Cells on the retina absorb the light and produce a signal the brain can interpret.





# Chapter 4 Review continued

## Review the Big Idea

- 18. Mechanical and electromagnetic waves can both transfer energy through matter, but only electromagnetic waves can transfer energy through empty space. Matter can transmit, absorb, refract, reflect, or diffract energy.
- 19. Weather satellites that orbit above Earth use microwaves that transfer information through space to weather stations. There, computer programs enable meteorologists to interpret the data and make weather predictions.

## Math Skills

- 20.  $\frac{1}{25}$
- 21.  $\frac{1}{16}$
- 22.  $\frac{1}{64}$

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

**Chapter 4 Review continued**

**Review the Big Idea**


18. Explain various ways in which waves transfer energy through matter and empty space. Include correct terms to describe the various interactions of waves with matter.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

19. Using the picture below, describe how the transfer of energy through matter and empty space helps a meteorologist predict the weather.



\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Math Skills**

**Use a Fraction**

20. By what fraction does the sound intensity change if you move from 2 m away from a source to 10 m away from the source?

21. You are standing 3 m from someone who is using a lawn mower. How will the sound intensity change if the person moves the mower to a distance 12 m from you?

22. A car 5 m away from you beeps its horn. How would the intensity of the beep change if you moved to a distance 40 m from the car?

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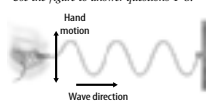
Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

**Standardized Test Practice**

Mark your answer in the answer bubbles below each question.

**Multiple Choice**

Use the figure to answer questions 1–3.



1 The figure above shows waves generated on a rope. Which type of waves are shown in the figure?

(A) combination  
(B) electromagnetic  
(C) longitudinal  
(D) mechanical

2 Which statement best describes the correct relationship for the wave shown in the figure?

(A) The disturbance is parallel to the direction the wave travels.  
(B) The disturbance is perpendicular to the direction the wave travels.  
(C) The disturbance carries matter and energy in the same direction along the wave.  
(D) The disturbance has both back-and-forth and up-and-down motion.

3 Which describes how the wave would change if the person's hand moved at a faster rate?

(A) The amplitude would decrease.  
(B) The amplitude would increase.  
(C) The frequency would decrease.  
(D) The frequency would increase.

4 If two waves are traveling at the same speed, which description is most accurate?

(A) The wave with the longer wavelength has the higher frequency.  
(B) The wave with the shorter wavelength has the higher frequency.  
(C) Both waves must have equal wavelengths.  
(D) Both waves must have equal frequencies.

5 Wood is opaque. Which describes how light waves can interact with wood?

(A) absorption and reflection  
(B) diffraction and transmission  
(C) reflection and refraction  
(D) transmission and refraction

6 Which property is unique to electromagnetic waves?

(A) the ability to interact with matter  
(B) the ability to travel through matter  
(C) the ability to have different intensities  
(D) the ability to travel through empty space

Use the table to answer question 7.

Incoming Light	Color of Filter	Outgoing Light
white	red	red
red	blue	none
white	blue	blue
green	green	?

7 The table above shows the interactions of different colors of light with different colors of filters. Which is the correct color to complete the table?

(A) green  
(B) none  
(C) red  
(D) white

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## Multiple Choice

- D—Correct. A, B, C—Combination describes water waves and some types of seismic waves. Electromagnetic describes light and other waves that travel through matter and empty space. Longitudinal describes sound waves and some types of seismic waves.
- B—Correct. A—Incorrect. This statement describes transverse waves. C—Incorrect. This statement is not accurate for any kind of wave. D—Incorrect. This statement describes combination waves (surface waves).
- D—Correct. A, B—Incorrect. The amplitude of the wave does not change with a change in speed. C—Incorrect. When wave speed increases, the number of wavelengths that pass a point each second increases.
- B—Correct. A—Incorrect. When speed is equal, the wave with the longer wavelength must have a lower frequency. C, D—Incorrect. Waves traveling at the same speed do not need to have equal wavelengths and frequencies.

- A—Correct. B, C, D—Refraction and transmission occur only with transparent and translucent materials.
- D—Correct. A, B, C—All describe properties common to both electromagnetic waves and mechanical waves.
- A—Correct. B, C, D—The color of a transparent or translucent object is the color of light that it transmits.

# Standardized Test Practice

- 8 D—Correct. A, C—Incorrect. Light that is reflected or absorbed would not enter the eye. B—Incorrect. If blocked, light could not reach the retina.
- 9 C—Correct. A—Incorrect. The table shows the slowest speeds for air. B—Incorrect. For the materials shown, the speeds for sound through the liquids are slower than the speeds of sound through the solids. D—Incorrect. The speed of sound is faster in cold materials.
- 10 B—Correct. A, C, D—Green, white, and yellow light all contain green light that would reflect off the object, making it appear green.

## Constructed Response

- 11 Sound travels more slowly than light. Your eyes detect the jet image at its true location, but the sound takes more time to reach your ears.
- 12 The incoming light for the diagram would stay the same. The reflected light lines would be shown at a variety of angles because the reflecting surface is rough. Each ray, however, would obey the law of reflection, with the angle the outgoing ray makes with the normal is equal to the angle the incoming ray makes with the normal.
- 13 Pitch is determined by the frequency of the wave. A high-frequency sound wave is heard as a sound with a high pitch. Sound intensity is the amount of energy that passes through a square meter of space each second. You perceive a high intensity as a louder sound.
- 14 The outer ear collects sound waves. The middle ear amplifies the intensity of sound waves. The inner ear changes the sound waves to nerve signals.

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### Standardized Test Practice continued

- 8 Which must be true of the cornea for the eye to work properly in sending a message to the brain?
- (A) It must absorb light.  
 (B) It must block out light.  
 (C) It must reflect light.  
 (D) It must transmit light.

Use the table to answer question 9.

Material	Speed of Sound (m/s)
Air (0°C)	331
Air (20°C)	343
Water (0°C)	1,500
Water (20°C)	1,481
Ice (0°C)	3,500
Iron	5,130

- 9 Based on the data in the table, which of the following statements is most likely true?

- (A) Sound travels fastest through gases because they are less dense.  
 (B) Sound travels fastest through liquids because they are most fluid.  
 (C) Sound travels fastest through solids because they are most dense.  
 (D) Sound travels fastest through materials that have higher temperatures.

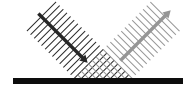
- 10 Which color of light could you shine on a green object to make it appear black?

- (A) green  
 (B) red  
 (C) white  
 (D) yellow

### Constructed Response

- 11 You are standing outside and hear a jet flying overhead. You look up toward the direction of the sound, but you notice that the jet is far ahead of where the sound seems to come from. Explain why you can hear a jet only after it passes overhead.

Use the figure to answer question 12.



- 12 The figure above shows light rays striking a flat surface. Describe how the figure would change if the surface the light rays hit against were bumpy instead of flat.

- 13 People sometimes confuse the pitch of a sound with the sound's intensity. How would you explain the difference between these two properties to a classmate?

- 14 What roles do the outer ear, the middle ear, and the inner ear play in hearing?



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## Chapter 4 | Lesson 1

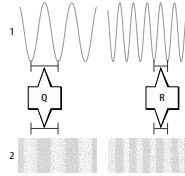
**Multiple Choice** Bubble the correct answer.

Use the table below to answer questions 1 and 2.

Type of Wave Motion	Electromagnetic Waves	Mechanical Waves
Longitudinal	F	J
Transverse	G	K
Combination	H	L

- If you listed examples of each type of wave in the table above, which cells would be empty? 7.1.4
  - A F and H
  - B G and H
  - C J and L
  - D K and L
- Which example would you list in cell J? 7.1.4
  - A light waves
  - B sound waves
  - C water waves
  - D waving flag

Use the figure below to answer questions 3 and 4.



- Based on the figure, which statement correctly describes frequency and wavelength? 7.1.4
  - A Frequency increases as wavelength decreases.
  - B Frequency is determined by amplitude, not wavelength.
  - C Higher frequency waves have longer wavelengths.
  - D Wavelength affects the frequency of transverse waves only.
- Which part of the figure shows a higher frequency longitudinal wave? 7.1.4
  - A 1-Q
  - B 1-R
  - C 2-Q
  - D 2-R

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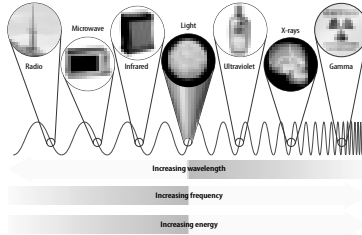


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## Chapter 4 | Lesson 2

**Multiple Choice** Bubble the correct answer.

Use the figure below to answer questions 1 through 4.



- Which type of electromagnetic wave is most energetic? 7.1.4
  - A infrared
  - B radio
  - C ultraviolet
  - D X-rays
2. Which wave has the longest wavelength? 7.1.4
  - A gamma
  - B infrared
  - C visible light
  - D X-rays
3. Which correctly relates the frequency of electromagnetic waves? 7.1.4
  - A radio < gamma < visible light
  - B radio < microwave < visible light
  - C visible light < ultraviolet < infrared
  - D X-rays < ultraviolet < microwaves
4. Based on the figure, which statement is true? 7.1.4
  - A Frequency increases as wavelength increases.
  - B Waves that have high energy have low frequency.
  - C Waves that have longer wavelengths have higher frequency.
  - D Waves that have shorter wavelengths have more energy.

**Extend Your Learning**  
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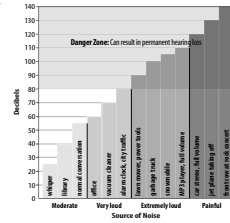
## Chapter 4 | Lesson 3

**Multiple Choice** Bubble the correct answer.

Use the table below to answer questions 1 and 2.

### Speed of Sound

Material	Speed (m/s)
Air (0°C)	331
Air (20°C)	343
Water (20°C)	1,481
Water (10°C)	1,491
Seawater (25°C)	1,533
Ice (0°C)	3,500
Iron	5,130
Glass	5,640



1. Which would sound travel through the fastest? 7.1.4

- A air
- B glass
- C ice
- D water

2. Based on the table, which statement is true? 7.1.4

- A Sound travels fastest in gases.
- B Sound travels fastest in liquids.
- C Sound travels fastest in metals.
- D Sound travels fastest in solids.

3. To protect your hearing, you should wear earplugs when 7.1.4

- A mowing the lawn.
- B studying at the library.
- C talking to friends.
- D vacuuming a room.

4. Which allows the ear to hear sound as high or low? 7.1.4

- A amplitude
- B decibel
- C pitch
- D rarefaction

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1. B
2. D
3. A
4. C

