# Waves: Energy in Motion

## Introduction to the AIMS Teaching Module (ATM)

- Rationale .......................................................... 4
- Organization and Management ............................... 5
- Features ............................................................. 6

## Introducing Waves: Energy in Motion

- Themes ..................................................................... 11
- Overview ............................................................... 11
- Objectives ............................................................. 11

## Preparation for Viewing

- Introduction to the Program .................................. 13
- Introduction to Vocabulary ................................... 13
- Discussion Ideas .................................................. 13
- Focus ...................................................................... 13
- Jump Right In ....................................................... 14

## After Viewing the Program

- Suggested Activities ............................................. 15
- Vocabulary ........................................................... 18
- Checking Comprehension .................................... 19
- Wave Match-Up .................................................... 20
- True or False ........................................................ 21
- Word Scramble ...................................................... 22
- Types of Waves .................................................... 23
- Word Search ......................................................... 24
- Test ................................................................. 25

## Additional AIMS Multimedia Programs ................. 27

## Answer Keys ......................................................... 28
Congratulations!

You have chosen a learning program that will actively motivate your students AND provide you with easily accessible and easily manageable instructional guidelines designed to make your teaching role efficient and rewarding.

The AIMS Teaching Module provides you with a video program keyed to your classroom curriculum, instructions and guidelines for use, plus a comprehensive teaching program containing a wide range of activities and ideas for interaction between all content areas. Our authors, educators, and consultants have written and reviewed the AIMS Teaching Modules to align with the Educate America Act: Goals 2000.

This ATM, with its clear definition of manageability, both in the classroom and beyond, allows you to tailor specific activities to meet all of your classroom needs.
RATIONALE

In today's classrooms, educational pedagogy is often founded on Benjamin S. Bloom's "Six Levels of Cognitive Complexity." The practical application of Bloom's Taxonomy is to evaluate students' thinking skills on these levels, from the simple to the complex: Knowledge (rote memory skills), Comprehension (the ability to relate or retell), Application (the ability to apply knowledge outside its origin), Analysis (relating and differentiating parts of a whole), Synthesis (relating parts to a whole), and Evaluation (making a judgment or formulating an opinion).

The AIMS Teaching Module is designed to facilitate these intellectual capabilities, AND to integrate classroom experiences and assimilation of learning with the students' life experiences, realities, and expectations. AIMS' learner verification studies prove that our AIMS Teaching Modules help students to absorb, retain, and to demonstrate ability to use new knowledge in their world. Our educational materials are written and designed for today's classroom, which incorporates a wide range of intellectual, cultural, physical, and emotional diversities.
ORGANIZATION AND MANAGEMENT

To facilitate ease in classroom manageability, the AIMS Teaching Module is organized in four sections. You are reading Section 1, Introduction to the Aims Teaching Module (ATM).

SECTION 2, INTRODUCING THIS ATM will give you the specific information you need to integrate the program into your classroom curriculum.

SECTION 3, PREPARATION FOR VIEWING provides suggestions and strategies for motivation, language preparedness, readiness, and focus prior to viewing the program with your students.

SECTION 4, AFTER VIEWING THE PROGRAM provides suggestions for additional activities plus an assortment of consumable assessment and extended activities, designed to broaden comprehension of the topic and to make connections to other curriculum content areas.
FEATURES

INTRODUCING EACH ATM

SECTION 2

Your AIMS Teaching Module is designed to accompany a video program written and produced by some of the world’s most credible and creative writers and producers of educational programming. To facilitate diversity and flexibility in your classroom, your AIMS Teaching Module features these components:

Themes

The Major Theme tells how this AIMS Teaching Module is keyed into the curriculum. Related Themes offer suggestions for interaction with other curriculum content areas, enabling teachers to use the teaching module to incorporate the topic into a variety of learning areas.

Overview

The Overview provides a synopsis of content covered in the video program. Its purpose is to give you a summary of the subject matter and to enhance your introductory preparation.

Objectives

The ATM learning objectives provide guidelines for teachers to assess what learners can be expected to gain from each program. After completion of the AIMS Teaching Module, your students will be able to demonstrate dynamic and applied comprehension of the topic.
PREPARATION FOR VIEWING

SECTION 3

In preparation for viewing the video program, the AIMS Teaching Module offers activity and/or discussion ideas that you may use in any order or combination.

Introduction To The Program

Introduction to the Program is designed to enable students to recall or relate prior knowledge about the topic and to prepare them for what they are about to learn.

Introduction To Vocabulary

Introduction to Vocabulary is a review of language used in the program: words, phrases, usage. This vocabulary introduction is designed to ensure that all learners, including limited English proficiency learners, will have full understanding of the language usage in the content of the program.

Discussion Ideas

Discussion Ideas are designed to help you assess students’ prior knowledge about the topic and to give students a preview of what they will learn. Active discussion stimulates interest in a subject and can motivate even the most reluctant learner. Listening, as well as speaking, is active participation. Encourage your students to participate at the rate they feel comfortable. Model sharing personal experiences when applicable, and model listening to students’ ideas and opinions.

Focus

Help learners set a purpose for watching the program with Focus, designed to give students a focal point for comprehension continuity.

Jump Right In

Jump Right In provides abbreviated instructions for quick management of the program.

AFTER VIEWING THE PROGRAM

SECTION 4

After your students have viewed the program, you may introduce any or all of these activities to interact with other curriculum content areas, provide reinforcement, assess comprehension skills, or provide hands-on and in-depth extended study of the topic.
**SUGGESTED ACTIVITIES**

The Suggested Activities offer ideas for activities you can direct in the classroom or have your students complete independently, in pairs, or in small work groups after they have viewed the program. To accommodate your range of classroom needs, the activities are organized into skills categories. Their labels will tell you how to identify each activity and help you correlate it into your classroom curriculum. To help you schedule your classroom lesson time, the AIMS hourglass gives you an estimate of the time each activity should require. Some of the activities fall into these categories:

- **Meeting Individual Needs**
  These activities are designed to aid in classroom continuity. Reluctant learners and learners acquiring English will benefit from these activities geared to enhance comprehension of language in order to fully grasp content meaning.

- **Curriculum Connections**
  Many of the suggested activities are intended to integrate the content of the ATM program into other content areas of the classroom curriculum. These cross-connections turn the classroom teaching experience into a whole learning experience.

- **Critical Thinking**
  Critical Thinking activities are designed to stimulate learners’ own opinions and ideas. These activities require students to use the thinking process to discern fact from opinion, consider their own problems and formulate possible solutions, draw conclusions, discuss cause and effect, or combine what they already know with what they have learned to make inferences.

- **Cultural Diversity**
  Each AIMS Teaching Module has an activity called Cultural Awareness, Cultural Diversity, or Cultural Exchange that encourages students to share their backgrounds, cultures, heritage, or knowledge of other countries, customs, and language.

- **Hands On**
  These are experimental or tactile activities that relate directly to the material taught in the program. Your students will have opportunities to make discoveries and formulate ideas on their own, based on what they learn in this unit.

- **Writing**
  Every AIMS Teaching Module will contain an activity designed for students to use the writing process to express their ideas about what they have learned. The writing activity may also help them to make the connection between what they are learning in this unit and how it applies to other content areas.

- **In The Newsroom**
  Each AIMS Teaching Module contains a newsroom activity designed to help students make the relationship between what they learn in the classroom and how it applies in their world. The purpose of In The Newsroom is to actively involve each class member in a whole learning experience. Each student will have an opportunity to perform all of the tasks involved in production: writing, researching, producing, directing, and interviewing as they create their own classroom news program.

- **Extended Activities**
  These activities provide opportunities for students to work separately or together to conduct further research, explore answers to their own questions, or apply what they have learned to other media or content areas.

- **Link to the World**
  These activities offer ideas for connecting learners’ classroom activities to their community and the rest of the world.

- **Culminating Activity**
  To wrap up the unit, AIMS Teaching Modules offer suggestions for ways to reinforce what students have learned and how they can use their new knowledge to enhance their world view.
VOCABULARY

Every ATM contains an activity that reinforces the meaning and usage of the vocabulary words introduced in the program content. Students will either read or find the definition of each vocabulary word, then use the word in a written sentence.

CHECKING COMPREHENSION

Checking Comprehension is designed to help you evaluate how well your students understand, retain, and recall the information presented in the AIMS Teaching Module. Depending on your students' needs, you may direct this activity to the whole group yourself, or you may want to have students work on the activity page independently, in pairs, or in small groups. Students can verify their written answers through discussion or by viewing the video a second time. If you choose, you can reproduce the answers from your Answer Key or write the answer choices in a Word Bank for students to use. Students can use this completed activity as a study guide to prepare for the test.

CONSUMABLE ACTIVITIES

The AIMS Teaching Module provides a selection of consumable activities, designed to specifically reinforce the content of this learning unit. Whenever applicable, they are arranged in order from low to high difficulty level, to allow a seamless facilitation of the learning process. You may choose to have students take these activities home or to work on them in the classroom independently, in pairs or in small groups.

CHECKING VOCABULARY

The Checking Vocabulary activity provides the opportunity for students to assess their knowledge of new vocabulary with this word game or puzzle. The format of this vocabulary activity allows students to use the related words and phrases in a different context.

TEST

The AIMS Teaching Module Test permits you to assess students' understanding of what they have learned. The test is formatted in one of several standard test formats to give your students a range of experiences in test-taking techniques. Be sure to read, or remind students to read, the directions carefully and to read each answer choice before making a selection. Use the Answer Key to check their answers.
ADDITIONAL
AIMS MULTIMEDIA
PROGRAMS

After you have completed this AIMS Teaching Module you may be interested in more of the programs that AIMS offers. This list includes several related AIMS programs.

ADDITIONAL READING
SUGGESTIONS

AIMS offers a carefully researched list of other resources that you and your students may find rewarding.

ANSWER KEY

Reproduces tests and work pages with answers marked.
Waves: Energy in Motion

THEMES

Waves: Energy in Motion explores the characteristics of different waves, including transverse, longitudinal and standing waves. Behavioral aspects of waves are also discussed, such as reflection, refraction, diffraction and interference. Sound intensity and the mechanisms of human hearing are also explored.

OVERVIEW

Waves carry energy, but not matter, from one place to another. The low point of a wave is called the trough, while the high point is known as the crest. The difference in height between the crest and the trough of a wave is called amplitude. The distance between the crests is referred to as wavelength. In a transverse wave, the particles of the medium move perpendicular to the direction of the energy flow. In a longitudinal wave, particles of the medium move back and forth. Sound waves are measured by the frequency of the vibration that produces them. This frequency is measured in hertz.

OBJECTIVES

- To learn more about the characteristics of different waves, including transverse and longitudinal waves.
- To discuss wave behavior patterns such as reflection, refraction, diffraction and interference.
- To examine how sounds are produced by musical instruments.
- To explore the human ear and its ability to perceive sound.
- To discuss how sound intensity, amplitude and frequency are measured.
Use this page for your individual notes about planning and/or effective ways to manage this AIMS Teaching Module in your classroom.

Our AIMS Multimedia Educational Department welcomes your observations and comments. Please feel free to address your correspondence to:

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Chatsworth, California 91311-4409
INTRODUCTION TO THE PROGRAM

Sound is produced when a moving object vibrates. The vibrations move through the air and are picked up by animals and humans, whose brains interpret the vibrations as various noises.

Light is a form of energy that produces heat and allows us to see. Light keeps us warm. It is also helps plants make food through the process of photosynthesis. This is the basis of all life on Earth. Without light, nothing in the world could survive.

INTRODUCTION TO VOCABULARY

Ask students to look up the word "wave" in the dictionary. What are some of its meanings? What is the origin of the word "wave"? (The word “wave” has many meanings, both as a noun and a verb. As a verb, it means to shake an air current; motion with the hands; or move an object to and fro. As a noun, it refers to a moving ridge or swell; a shape with a curve; a surge of feeling; a line of attack during war; or a period of hot or cold weather. The word originates from the Middle English word waveren which comes from the Old English word waefre, meaning restless.

DISCUSSION IDEAS

Ask students to think about the different types of waves that are surrounding them at any given moment. What are some ways to prove that these waves exist, even though we cannot see them? (Shadows prove that light waves can be blocked. Echoes prove that sound waves can bounce off of objects. Plucking the string of a musical instrument proves that vibrations create waves that can be heard.)

FOCUS

Ask the class to think about how light and sound affect their world. What would life be like without these things? How must people with vision and hearing impairments adapt? How often do we consider the benefits of sight and sound?
JUMP RIGHT IN

HOW TO USE THE WAVES: ENERGY IN MOTION AIMS TEACHING MODULE

**Preparation**

- Read *Waves: Energy in Motion Themes, Overview, and Objectives* to become familiar with program content and expectations.

- Use *Preparation for Viewing* suggestions to introduce the topic to students.

**Viewing WAVES: ENERGY IN MOTION**

- Set up viewing monitor so that all students have a clear view.

- Depending on your classroom size and learning range, you may choose to have students view *Waves: Energy in Motion* together or in small groups.

- Some students may benefit from viewing the video more than one time.

**After Viewing WAVES: ENERGY IN MOTION**

- Select *Suggested Activities* that integrate into your classroom curriculum. If applicable, gather materials or resources.

- Choose the best way for students to work on each activity. Some activities work best for the whole group. Other activities are designed for students to work independently, in pairs, or in small groups. Whenever possible, encourage students to share their work with the rest of the group.

- Duplicate the appropriate number of *Vocabulary, Checking Comprehension*, and consumable activity pages for your students.

- You may choose to have students take consumable activities home, or complete them in the classroom, independently, or in groups.

- Administer the Test to assess students' comprehension of what they have learned, and to provide them with practice in test-taking procedures.

- Use the *Culminating Activity* as a forum for students to display, summarize, extend, or share what they have learned with each other, the rest of the school, or a local community organization.
SUGGESTED ACTIVITIES

Writing

During the 1800s, scientists began to understand how to record and transmit sound waves. Some of the most important contributors to our understanding of sound are listed below. Ask students to choose one of the people and investigate the work that person did with sound waves. Have each student prepare a one-page report on the person using library texts and encyclopedias.

Alexander Graham Bell
Emile Berliner
Thomas A. Edison
Hermann Helmholtz
Ernst Mach
Heinrich Hertz

Meeting Individual Needs

Ask students to make sentences using the following words. Encourage them to use a dictionary if they are confused about the meanings. Make sure that their sentences display an understanding of the words as they relate to the program.

- amplitude - the strength of a sound wave
- pitch - the highness or lowness of a sound wave, based on frequency or wavelength
- wavelength - the distance between the crests of two waves
- frequency - the rate of vibration of a sound wave

Connection to Nature Studies

Many animals, such as owls and cats, hunt at night instead of during the day. Some people believe that these animals can see in the dark. Is this possible? (No. A small bit of light must be present for all creatures to see. Without light, the eye cannot process images.)

Some animals, such as dogs and rabbits, cannot see colors like we do. They see things only in black or white. However, animals that are brightly colored, like butterflies and birds, almost always see in color. What could be the reason? (Some animals are brightly colored so they can recognize each other and attract mates. Being able to see colors is important for their survival.)
Critical Thinking

Ask students if they have ever placed a seashell against their ears to hear the “ocean.” What could be the explanation for this phenomenon? Why do we hear sounds better when we cup a hand behind our ears? (The inside of a seashell is like a cone. The wide opening collects sounds and directs them inside the shell. As the shell narrows, the sound waves bounce around and become louder. This makes ordinary room noises, which we usually don’t notice, seem louder. When we cup a hand around our ear, our hand collects more sound waves and directs them into our ear. More sound waves hitting our eardrum makes a sound seem louder.)

Hands On

In times past, warriors placed their ears near the ground to hear approaching enemy horses. To find out how this works, assist students in doing the following experiment. They will need a pencil, an aquarium or other large glass container filled with water, and a wooden or metal table.

Allow students to take turns performing the following steps. 1) Strike the pencil against the metal table. Listen carefully to the sound. 2) Submerge the pencil in the container of water and strike it against the side of the container. With an ear against the container, listen for changes in the sound. 3) Pressing an ear to the table, strike the pencil against the table top.

Which of the sounds was loudest? Which was softest? What could be the reason for the changes? (The sound is louder when heard through the table [a solid] and softest when heard through the air [a gas]. The sound of the pencil in water [a liquid] is somewhere in between. The denser a material is, the quicker sound waves travel through it. This is because dense matter is more elastic and can carry sound waves more efficiently.)

Connection to History

Since ancient times, humans have used the sun to tell time. As a class exercise, help students construct a sundial. Take the class to a quiet location outside. Place a stick or ruler in the ground. It might help to tape a small note to the ruler asking others not to disturb it. Assign each hour of the school day to a pair of students. Have them mark the end of the ruler’s shadow at the beginning of each hour. After each hour of the school day has been recorded, ask students the following questions.

At what hour of the day was the longest shadow seen? At what hour of the day was the shortest shadow seen? The ancient Egyptians had sundials so precise, each minute of the day was recorded. How could the class sundial be modified for better accuracy? (The longest shadows of the day will be seen early in the morning and late in the day. The shortest shadow will be seen at midday. When the sun is directly overhead, there will be no shadow. The sundial can be improved for accuracy by making the dial very thin and tall. The circle used to record minutes and hours would correspondingly be much larger.)
Extended Activity

Using the spectrum of seven basic colors, scientists have devised the color wheel. Each color on the color wheel has an opposite color.

Draw a red square on a white sheet of paper. Look at the square while counting to 60, then look away from the square at a blank piece of paper. What do you see? (Students should see a green-blue square.)

Red and green are opposites on the color wheel. When you stare at a red square, cells in your eyes that respond to red get tired. When you look away from the red square, these cells take a short break. During this break, you see green. Green is the opposite of red on the color wheel.

Link to the World

Even though we cannot hear ultrasound waves, they have many uses in the modern world. Just as a laser is a focused beam of light, an ultrasound or ultrasonic wave is a very focused form of sound. Ask students if they know some uses for ultrasound waves. (Ultrasound waves are used by submarines and ships to detect obstacles. The ultrasound waves bounce off of objects and tell navigators how close the objects are. Ultrasound waves are also used to detect cracks and flaws in airplanes, train tracks and manufactured products. Dentists and doctors use ultrasonic instruments, such as drills and scalpels, to perform medical procedures. Ultrasound waves also allow us to see inside the body. In addition, ultrasound waves are used to kill insects, disinfect surgical instruments and make foods safer to eat.)

Culminating Activity

Ask students to write down an example of each of the following types of waves. Encourage them to use examples from their daily lives.

- compression wave
- sound wave
- standing wave
- refracted wave
- seismic waves
- electromagnetic wave
- transverse wave
- ultrasound wave
- longitudinal wave
VOCABULARY

The following terms are from Waves: Energy in Motion. Fill in the number of each term next to its closest definition.

1. acoustics
2. amplitude
3. crest
4. decibel
5. diffraction
6. frequency
7. hertz
8. interference
9. light
10. reflection
11. refraction
12. reverberation
13. spectrum
14. trough
15. wave

___ to cast back light, heat, sound, etc. from a surface
___ number of vibrations of cycles per unit of time
___ mutual action of two waves of the same frequency reinforcing or neutralizing each other
___ low point of a wave
___ study of how sounds are created, transmitted and received
___ electromagnetic waves that can travel through the vacuum of space
___ high point of a wave
___ bending of a ray or wave of light, heat or sound as it passes from one medium to another medium of different density
___ unit for measuring the volume of sound
___ multiple reflection of sound waves
___ transforming of a straight wave front into a curved wave front
___ series of colored bands diffracted and arranged in order of wavelengths
___ a disturbance that carries energy but not matter from one place to another
___ difference in height between the crest and the trough of a wave
___ international unit of measurement for a frequency, equal to one cycle per second
CHECKING COMPREHENSION

Read the following sentences and circle the letter of the word that best fills each blank.

Waves carry ___1___ , but not matter, from one place to another. The low point of a wave is called the ___2___ , while the high point is known as the ___3___ . The difference in height between the crest and the trough of a wave is called ___4___ . The distance between the crests is referred to as ___5___ . In a ___6___ wave, the particles of the medium move perpendicular to the direction of the energy flow. In a ___7___ wave, particles of the medium move back and forth. When a wave is passed from one substance to another at an angle, it changes direction. This is known as the law of ___8___ . Waves also bend as they pass the edges of objects in their path. This phenomenon is known as ___9___ . Sound waves are measured by the frequency of the vibration that produces them. This frequency is measured in ___10___ .

1. A. heat  
   B. energy  
   C. stations  
   D. elements  

2. A. crest  
   B. hertz  
   C. compression  
   D. trough  

3. A. wavelength  
   B. crest  
   C. amp  
   D. prism  

4. A. amplitude  
   B. the seismic gap  
   C. frequency  
   D. diffraction  

5. A. spectrum  
   B. reflection  
   C. amplitude  
   D. wavelength  

6. A. transverse  
   B. longitudinal  
   C. parallel  
   D. trough  

7. A. transmission  
   B. longitudinal  
   C. deflection  
   D. formulation  

8. A. reflection  
   B. diffusion  
   C. refraction  
   D. vibration  

9. A. diffraction  
   B. interference  
   C. electromagnetism  
   D. compression  

10. A. amps  
    B. crests  
    C. wavelengths  
    D. hertz
### WAVE MATCH-UP

Match each term on the left with the best group of words on the right.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Doppler effect</td>
<td>wave that is created when force is applied to one end of a metal spring</td>
</tr>
<tr>
<td>2. electromagnetic wave</td>
<td>comprised of sounds that are above 20,000 hertz</td>
</tr>
<tr>
<td>3. longitudinal wave</td>
<td>compression waves that can be heard</td>
</tr>
<tr>
<td>4. seismic wave</td>
<td>distance between the crests of two waves</td>
</tr>
<tr>
<td>5. sound</td>
<td>waves that occur in mediums which are fixed at both ends, such as guitar strings</td>
</tr>
<tr>
<td>6. standing wave</td>
<td>phenomenon whereby sound waves have a higher frequency when they are approaching than when they are moving away</td>
</tr>
<tr>
<td>7. transverse wave</td>
<td>ocean waves are an example of this wave type</td>
</tr>
<tr>
<td>8. ultrasound</td>
<td>compression and transverse waves that travel through the earth</td>
</tr>
<tr>
<td>9. vibration</td>
<td>phenomenon that occurs when waves move back and forth on a violin string</td>
</tr>
<tr>
<td>10. wavelength</td>
<td>related patterns of electric and magnetic force, such as light waves</td>
</tr>
</tbody>
</table>
TRUE OR FALSE

Place a T next to statements that are true and an F next to statements that are false.

1. ___ The action of an ocean wave is perpendicular to the direction of the energy flow.
2. ___ The difference in height between the crest and trough of a wave is called wavelength.
3. ___ In a longitudinal wave, the areas where particles are farther apart are called rarefactions.
4. ___ Sound waves are an example of compression waves.
5. ___ A wave travels at the same velocity in different substances.
6. ___ Waves that are in phase strengthen one another.
7. ___ The frequency of a sound wave is the same as the frequency of the source's vibration.
8. ___ Humans can hear sounds between 10,000 and 50,000 hertz.
9. ___ Deep base sounds have shorter wavelengths than high sounds.
10. ___ Hair cells of the inner ear will eventually heal if they become damaged.
WORD SCRAMBLE

To read these facts about waves, unscramble the bold word in each sentence.

1. An **ohce** is a sound wave bouncing off of a large object such as a building or mountain.
   
   ______________________________________.

2. Bats emit high-pitched squeaks that bounce off of objects and help them **geniveta** in the dark.
   
   ______________________________________.

3. A **galitdi** recording stores sounds in the form of numbers that measure each sound wave.
   
   ______________________________________.

4. Sound waves travel faster in **semlta** than they do in liquids or air.
   
   ______________________________________.

5. A **sepmocric** uses a lens to bend light rays and make things appear larger.
   
   ______________________________________.

6. A rainbow forms when sunlight shines on water in the **porhetasem**.
   
   ______________________________________.

7. Objects that do not allow light to pass through them are described as **eqapuo**.
   
   ______________________________________.

8. Objects that scatter all light rays passing through them are described as **srectunInta**.
   
   ______________________________________.
TYPES OF WAVES

Each sentence below describes a type of wave. Use the terms below to fill in the blanks.

- compression waves
- sound waves
- standing waves
- refracted waves
- seismic waves
- electromagnetic waves
- transverse waves
- ultrasound waves
- longitudinal wave

1. Related patterns of electric and magnetic force, such as light waves, are known as ____________________.

2. In ____________________, particles of the medium move back and forth.

3. Compression and transverse waves that travel through the earth are known as ____________________.

4. Waves that occur in mediums which are fixed at both ends, such as guitar strings, are known as ____________________.

5. In ____________________, the particles of the medium move perpendicular to the direction of the energy flow.

6. ____________________ are carried by sounds that are above 20,000 hertz.

7. Compression waves that can be heard are ____________________.

8. ____________________ are bent as they pass from one medium to another medium of a different density.
WORD SEARCH

The following words can be found in the maze below. The letters may be arranged horizontally, vertically, diagonally or backward.

amplitude
crest
decibel
Doppler
frequency
hertz
seismic
spectrum
trough
wave
Circle the phrase which best answers each question.

1. All waves transfer:
   - matter.
   - ultrasound.
   - energy.
   - reflections.

2. The distance between crests of waves is known as:
   - compression.
   - rarefaction.
   - amplitude.
   - wavelength.

3. Which is these is not a type of wave?
   - transverse
   - longitudinal
   - electromagnetic
   - phase

4. A wave that changes direction as it passes from one substance to another at an angle is:
   - reflecting.
   - refracting.
   - phasing.
   - amplifying.

5. The change in pitch of an approaching train whistle is due to ___ .
   - the Velocity effect.
   - the Distortion factor.
   - the Doppler effect.
   - the Compression principle.
6. The intensity of sound is measured in:

   • amplitudes.
   • decibels.
   • frequencies.
   • hertz.

7. The greater the amount of energy carried by a wave, the greater its:

   • frequency.
   • compression.
   • amplitude.
   • refraction.

8. Waves in phase:

   • have different frequencies.
   • weaken one another.
   • pass given points at different times.
   • strengthen one another.

9. The only waves that can travel through the vacuum of space are:

   • seismic.
   • standing.
   • compression.
   • electromagnetic.

10. Guitar and violin strings produce _____ waves.

    • longitudinal.
    • standing.
    • seismic.
    • ultrasound.
ADDITIONAL AIMS MULTIMEDIA PROGRAMS

You and your students might also enjoy these other AIMS Multimedia programs:

Physics Essentials Series
   Electricity: The Invisible River of Energy
   Heat and the Changing States of Matter
   Motion: Newton’s Three Laws
   Light, Lenses, and Lasers
   Force and Work: Energy in Action
VOCABULARY

The following terms are from Waves: Energy in Motion. Fill in the number of each term next to its closest definition.


10 to cast back light, heat, sound, etc. from a surface
6 number of vibrations of cycles per unit of time
8 mutual action of two waves of the same frequency reinforcing or neutralizing each other
14 low point of a wave
1 study of how sounds are created, transmitted and received
9 electromagnetic waves that can travel through the vacuum of space
3 high point of a wave
11 bending of a ray or wave of light, heat or sound as it passes from one medium to another medium of different density
4 unit for measuring the volume of sound
12 multiple reflection of sound waves
5 transforming of a straight wave front into a curved wave front
13 series of colored bands diffracted and arranged in order of wavelengths
15 a disturbance that carries energy but not matter from one place to another
2 difference in height between the crest and the trough of a wave
7 international unit of measurement for a frequency, equal to one cycle per second
ANSWER KEY for page 19

CHECKING COMPREHENSION

Read the following sentences and circle the letter of the word that best fills each blank.

Waves carry ____1____, but not matter, from one place to another. The low point of a wave is called the ____2____, while the high point is known as the ____3____. The difference in height between the crest and the trough of a wave is called ____4____. The distance between the crests is referred to as ____5____. In a ____6____ wave, the particles of the medium move perpendicular to the direction of the energy flow. In a ____7____ wave, particles of the medium move back and forth. When a wave is passed from one substance to another at an angle, it changes direction. This is known as the law of ____8____. Waves also bend as they pass the edges of objects in their path. This phenomenon is known as ____9____. Sound waves are measured by the frequency of the vibration that produces them. This frequency is measured in ____10____.

1. A. heat
   B. energy
   C. stations
   D. elements

2. A. crest
   B. hertz
   C. compression
   D. trough

3. A. wavelength
   B. crest
   C. amp
   D. prism

4. A. amplitude
   B. the seismic gap
   C. frequency
   D. diffraction

5. A. spectrum
   B. reflection
   C. amplitude
   D. wavelength

6. A. transverse
   B. longitudinal
   C. parallel
   D. trough

7. A. transmission
   B. longitudinal
   C. deflection
   D. formulation

8. A. reflection
   B. diffusion
   C. refraction
   D. vibration

9. A. diffraction
   B. interference
   C. electromagnetism
   D. compression

10. A. amps
    B. crests
    C. wavelengths
    D. hertz
**WAVE MATCH-UP**

Match each term on the left with the best group of words on the right.

1. Doppler effect
   - wave that is created when force is applied to one end of a metal spring

2. electromagnetic wave
   - comprised of sounds that are above 20,000 hertz

3. longitudinal wave
   - compression waves that can be heard

4. seismic wave
   - distance between the crests of two waves

5. sound
   - waves that occur in mediums which are fixed at both ends, such as guitar strings

6. standing wave
   - phenomenon whereby sound waves have a higher frequency when they are approaching than when they are moving away

7. transverse wave
   - ocean waves are an example of this wave type

8. ultrasound
   - compression and transverse waves that travel through the earth

9. vibration
   - phenomenon that occurs when waves move back and forth on a violin string

10. wavelength
    - related patterns of electric and magnetic force, such as light waves
TRUE OR FALSE

Place a T next to statements that are true and an F next to statements that are false.

1. ___ The action of an ocean wave is perpendicular to the direction of the energy flow.
2. ___ The difference in height between the crest and trough of a wave is called wavelength.
3. ___ In a longitudinal wave, the areas where particles are farther apart are called rarefactions.
4. ___ Sound waves are an example of compression waves.
5. ___ A wave travels at the same velocity in different substances.
6. ___ Waves that are in phase strengthen one another.
7. ___ The frequency of a sound wave is the same as the frequency of the source’s vibration.
8. ___ Humans can hear sounds between 10,000 and 50,000 hertz.
9. ___ Deep base sounds have shorter wavelengths than high sounds.
10. ___ Hair cells of the inner ear will eventually heal if they become damaged.
WORD SCRAMBLE

To read these facts about waves, unscramble the bold word in each sentence.

1. An **ohce** is a sound wave bouncing off of a large object such as a building or mountain.
   
   **echo**

2. Bats emit high-pitched squeaks that bounce off of objects and help them **geniveta** in the dark.
   
   **navigate**

3. A **galitdi** recording stores sounds in the form of numbers that measure each sound wave.
   
   **digital**

4. Sound waves travel faster in **semlta** than they do in liquids or air.
   
   **metals**

5. A **sepomocric** uses a lens to bend light rays and make things appear larger.
   
   **microscope**

6. A rainbow forms when sunlight shines on water in the **porhetasem**.
   
   **atmosphere**

7. Objects that do not allow light to pass through them are described as **eqapuo**.
   
   **opaque**

8. Objects that scatter all light rays passing through them are described as **srectunInta**.
   
   **translucent**
TYPES OF WAVES

Each sentence below describes a type of wave. Use the terms below to fill in the blanks.

- compression waves
- sound waves
- standing waves
- refracted waves
- seismic waves
- electromagnetic waves
- transverse waves
- ultrasound waves
- longitudinal wave

1. Related patterns of electric and magnetic force, such as light waves, are known as ________
   electromagnetic waves.

2. In ________ longitudinal waves, particles of the medium move back and forth.

3. Compression and transverse waves that travel through the earth are known as ________
   seismic waves.

4. Waves that occur in mediums which are fixed at both ends, such as guitar strings, are
   known as ________ standing waves.

5. In ________ transverse waves, the particles of the medium move perpendicular to the direction
   of the energy flow.

6. ________ Ultrasound waves are carried by sounds that are above 20,000 hertz.

7. Compression waves that can be heard are ________ sound waves.

8. ________ Refracted waves are bent as they pass from one medium to another medium of a
   different density.
WORD SEARCH

The following words can be found in the maze below. The letters may be arranged horizontally, vertically, diagonally or backward.

amplitude
crest
decibel
Doppler
frequency
hertz
seismic
spectrum
trough
wave
TEST

1. All waves transfer:
   - matter.
   - ultrasound.
   - **energy.**
   - reflections.

2. The distance between crests of waves is known as:
   - compression.
   - rarefaction.
   - amplitude.
   - **wavelength.**

3. Which is not a type of wave?
   - transverse
   - longitudinal
   - electromagnetic
   - **phase**

4. A wave that changes direction as it passes from one substance to another at an angle is:
   - reflecting.
   - **refracting.**
   - phasing.
   - amplifying.

5. The change in pitch of an approaching train whistle is due to ____ .
   - the Velocity effect.
   - the Distortion factor.
   - **the Doppler effect.**
   - the Compression principle.
6. The intensity of sound is measured in:
   - amplitudes.
   - **decibels.**
   - frequencies.
   - hertz.

7. The greater the amount of energy carried by a wave, the greater its:
   - frequency.
   - compression.
   - **amplitude.**
   - refraction.

8. Waves in phase:
   - have different frequencies.
   - weaken one another.
   - **pass given points at different times.**
   - **strengthen one another.**

9. The only waves that can travel through the vacuum of space are:
   - seismic.
   - standing.
   - compression.
   - **electromagnetic.**

10. Guitar and violin strings produce ____ waves.
    - longitudinal.
    - **standing.**
    - seismic.
    - ultrasound.