

ELEMENTS OF PHYSICS
WAVES: SOUND AND ELECTROMAGNETISM**Pre-Test**

Directions: This will help you discover what you know about the subject of waves before you begin this lesson. Answer the following true or false.

1. All waves are traveling disturbances that carry energy from place to place. T_____ F_____.
2. Wave frequency is the distance of one complete wave. T_____ F_____.
3. Velocity is the speed of the wave. T_____ F_____.
4. Sound is a form of energy transmitted by longitudinal waves. T_____ F_____.
5. Sound waves do not need a medium to travel. T_____ F_____.
6. Sound cannot travel through solid material. T_____ F_____.
7. Explosions, earthquakes, and sound are similar in that they are all longitudinal waves. T_____ F_____.
8. Electromagnetic waves cannot be distorted. T_____ F_____.
9. A sound echo and an image in a mirror are both examples of reflected waves. T_____ F_____.
10. The Doppler effect is the same as a reflected wave. T_____ F_____.

ELEMENTS OF PHYSICS
WAVES: SOUND AND ELECTROMAGNETISM**Use the Right Word**

Directions: Find the right word from the physics vocabulary list that completes the following sentences.

1. A traveling disturbance of energy is called a _____.
2. The number of wave cycles in a unit of time is called the wave _____.
3. A _____ is an intervening substance that allows energy to pass.
4. The energy of sound, explosions, and earthquakes are all propagated by _____ waves.
5. Electromagnetism is propagated by _____ waves.
6. The density of the medium is called its _____.
7. _____ are sub-atomic particles of energy and matter propagated by electromagnetic waves.
8. Waves that change direction when they bounce off a barrier are _____ waves.
9. In music, the frequency of the sound waves determine its _____.
10. The theory that electromagnetism is made up of both energy and sub-atomic particles is called the _____.

ELEMENTS OF PHYSICS
WAVES: SOUND AND ELECTROMAGNETISM**Word Match**

Directions: Connect the word with the proper definition.

amplitude	speed of the wave
elasticity	determined by the frequency of the sound waves
frequency	density of the medium
longitudinal	height of the wave
medium	distance of one complete wave cycle
pitch	waves that travel up and down
transverse	disturbance of energy
velocity	waves created by the movement of molecules
wave	wave cycles in a given unit of time
wavelength	allows energy to pass through

ELEMENTS OF PHYSICS

WAVES: SOUND AND ELECTROMAGNETISM

Connected/Not Connected

Directions: Place the following words in the proper sentences.

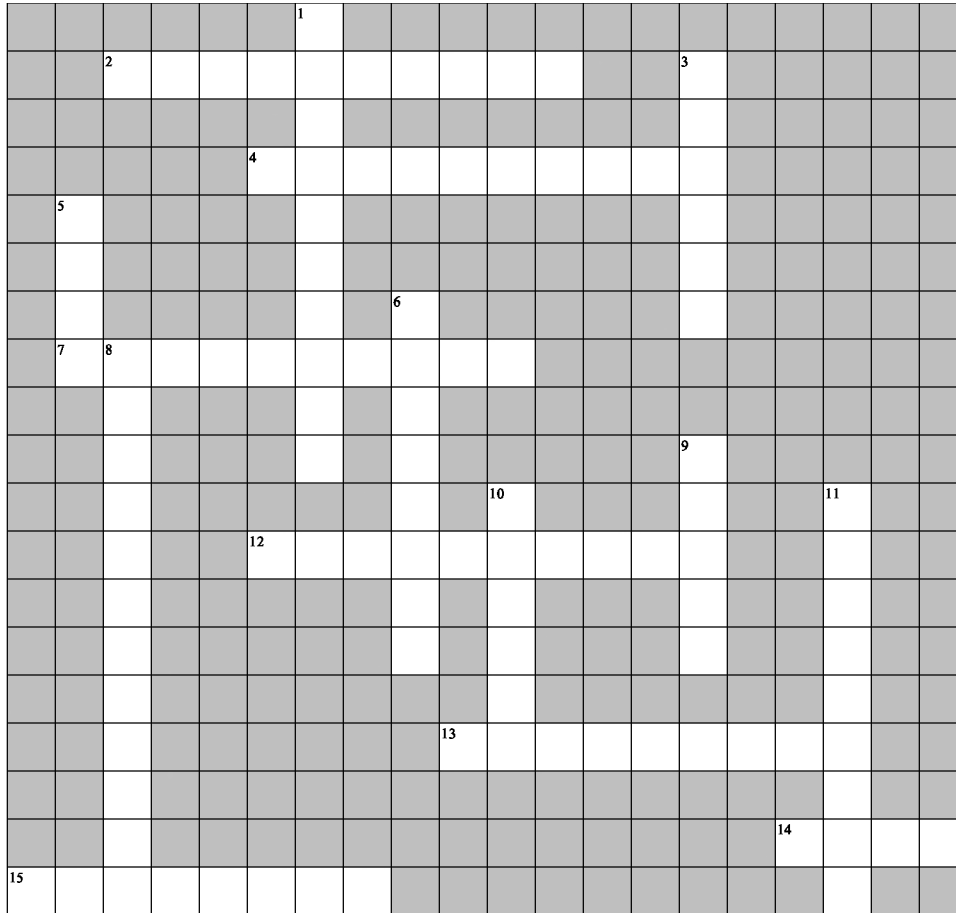
amplitude	echoes	height	reflected
atmosphere	electromagnetic	light	transverse
Doppler	energy	longitudinal	vacuum
Earth	explosions	medium	wavelength
earthquakes	frequency	pitch	waves

1. _____ are connected to _____ because they are the means by which disturbances are transported.
2. _____ is NOT connected to _____ because one is the distance of one complete wave and the other is the number of wave cycles in a given time.
3. _____ is connected to wave _____ because it is the maximum difference of the disturbance.
4. A _____ is NOT connected to a _____ because the complete absence of matter will not allow longitudinal waves to travel through its space.
5. _____ and _____ are connected because, like sound, they are propagated by longitudinal waves.
6. The _____ is NOT connected to _____ because solid material is a medium that allows longitudinal waves to travel much faster than the air.
7. _____ waves are connected to _____ because these waves transport electricity and magnetism, which allows us to see.
8. _____ waves are NOT connected to _____ waves because one type of wave needs a medium to transport the energy and the other type of wave does not.
9. _____ are connected to _____ waves because they are waves that bounce off a barrier.
10. The _____ effect is NOT connected to constant _____ because the sound changes as it moves towards the observer and then retreats away from the observer.

ELEMENTS OF PHYSICS

WAVES: SOUND AND ELECTROMAGNETISM

Crossword Puzzle



Across

2. waves bouncing off a barrier
4. electromagnetic waves are _____ waves
7. the density of the medium
12. distance of one complete wave
13. the height of the wave
14. reflected sound
15. speed of the wave

Down

1. distance of one complete wave
3. the capacity to do work
5. traveling disturbance of energy
6. German-American physicist 1879 - 1955
8. sound waves are _____ waves
9. space was once believed to be filled with this
10. intervening substance that allows waves to pass
11. number of wave cycles in a given unit of time

ELEMENTS OF PHYSICS
WAVES: SOUND AND ELECTROMAGNETISM**Video Quiz**

Directions: Answer the following true or false, or fill in the blank with the correct word to make it true.

1. Waves transport the energy of disturbances. T_____ F_____.
2. The number of wave cycles in a given unit of time is called the wave _____.
3. The speed of the wave is called its _____.
4. Sound waves are longitudinal waves. T_____ F_____.
5. Longitudinal waves never need a medium to transport the energy. T_____ F_____.
6. Sound travels faster in the air than in the ground. T_____ F_____.
7. Visible light is transported by _____ waves.
8. The Doppler effect only applies to sound waves. T_____ F_____.
9. Echoes of sound and mirror images are examples of refracted waves. T_____ F_____.
10. All waves can be distorted, deflected, or changed. T_____ F_____.

ELEMENTS OF PHYSICS

WAVES: SOUND AND ELECTROMAGNETISM

Post-Test

Vocabulary

Directions: Fill in the blank with the appropriate term from the list below.

amplitude	frequency	reflected	velocity
Doppler	height	refracted	vibrations
echo	longitudinal	standing wave	wave
electromagnetic	medium	tranverse	wave height
explosions	pitch	vacuum	wavelength

- The energy of sound, explosions, and earthquakes are all transported by _____ waves.
- The energy of visible light is transported by electromagnetic waves, which are _____ waves.
- Sound echoes are _____ waves.
- The _____ effect occurs when the pitch of the sound is higher as the source approaches the listener and is lower when it retreats away from the listener.

True or False

Directions: Fill in the blank with true or false. If the statement is false, change it to make the statement true. Rewrite the true statement on the lines provided.

- _____ Wavelength is the number of wave cycles in a given unit of time.
- _____ Sound waves need a medium to be propagated.
- _____ Amplitude is the speed of the wave.
- _____ Electromagnetic waves cannot travel through a medium.
- _____ Electromagnetic waves are only energy and have no matter.

Essay Section

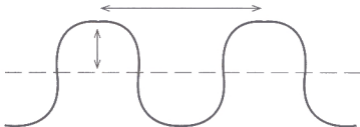
Directions: Answer the following questions in complete sentences. Use the back of this page or a separate sheet of paper if you need more space to complete your answer.

- Why does sound travel more quickly in water than in air?
- What are photons?
- Explain the similarity between echoes of sound and images in a mirror.

WAVE DIAGRAM

Name _____

On the following diagram, place the following terms in their correct places: amplitude, wavelength, crest, trough, rest position.



Define the terms below.

amplitude _____

wavelength _____

crest _____

trough _____

WAVE VELOCITY CALCULATIONS

Name _____

$$\text{Velocity} = \text{Wavelength} \times \text{Frequency}$$

Solve the following problems.

1. A tuning fork has a frequency of 280 hertz, and the wavelength of the sound produced is 1.5 meters. Calculate the velocity of the wave.

2. A wave is moving toward shore with a velocity of 5.0 m/s. If its frequency is 2.5 hertz, what is its wavelength?

3. The speed of light is 3.0×10^8 m/s. Red light has a wavelength of 7×10^{-7} m. What is its frequency?

4. The frequency of violet light is 7.5×10^{14} hertz. What is its wavelength?

5. A jump rope is shaken producing a wave with a wavelength of 0.5 m with the crest of the wave passing a certain point 4 times per second. What is the velocity of the wave?



EXPLORING SOUND

Pre-test

Name _____

A. Directions: Pick the definition in column B that best matches the word in column A. Write the letter of the definition on the blank line.

- | A | B |
|------------------------|---|
| 1. echo _____ | a. Sounds above the human range of hearing. |
| 2. decibel _____ | b. A unit used to measure the loudness of a sound. |
| 3. vacuum _____ | c. The emptiness of space. |
| 4. ultrasonic _____ | d. Sounds below the human range of hearing. |
| 5. infrasonic _____ | e. When a sound bounces off a smooth surface and is heard more than once. |
| 6. reverberation _____ | f. The unit used to measure the frequency of a sound. |
| 7. hertz _____ | g. Repeated reflections of sound waves against a smooth surface. |

B. Directions: The following questions need a short answer.

1. Sound travels at different speeds in different substances. Why does it travel faster in metals than in air?

2. How do bats and dolphins find their food or navigate in darkness?

3. In outer space there is no sound. Why?



EXPLORING SOUND Program Quiz

Name _____

1. Which travels faster, sound or light?
2. Sound travels at different speeds in different substances. Why does it travel faster in metal than in air?
3. How do animals, like bats and porpoises, use ultrasonic sounds to find their way or to catch food?
4. In outer space, there are no sounds. Why?
5. The hertz is used to measure the frequency of sound. If something is rated at 150 hertz, what does that mean?
6. What is an echo?
7. What are the three primary types of musical instruments?
8. What is a decibel?



EXPLORING SOUND Vocabulary

Name _____

Directions: Match the term in column A with its definition in column B.

Column A

1. decibel _____
2. compression _____
3. rarefaction _____
4. Doppler effect _____
5. vacuum _____
6. frequency _____
7. hertz _____
8. ultrasonic _____
9. infrasonic _____
10. echo _____
11. interference _____
12. reverberation _____
13. pitch _____
14. rhythm _____
15. oscilloscope _____
16. wavelength _____
17. crest _____
18. trough _____
19. kilohertz _____
20. megahertz _____

Column B

- A. A device used to electronically show the crest and trough of sounds.
- B. The unit used to measure the frequency of sound.
- C. Sounds that are above 20,000 vibrations per second.
- D. The emptiness of space.
- E. A unit used to measure the loudness of a sound.
- F. Repeated reflection of sound waves against a smooth surfaces.
- G. When sound bounces off a smooth surface and is heard more than once.
- H. F.M. radio stations broadcast at these frequencies.
- I. One thousand hertz.
- J. Sounds that are below the human range of hearing.
- K. The part of a sound wave where molecules are pushed together.
- L. How high or low a sound is.
- M. The lowest point of a wave.
- N. A regular pattern of tones.
- O. The change in frequency of a sound due to the source or listener moving.
- P. The high point of a wave.
- Q. When two sounds come together or overlap.
- R. The part of a sound wave where molecules spread out.
- S. The number of waves produced in a certain time.
- T. The distance between one crest and the next crest or one trough and the next trough.



EXPLORING SOUND Post Test

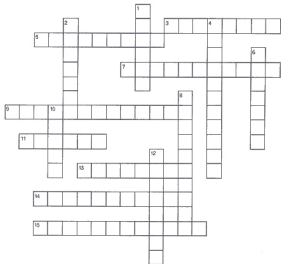
Name _____

Directions: Answer the following questions in the space provided.

1. Which is faster light or sound? Give an example that proves your idea.
2. Bats and dolphins use special techniques for locating their food. Describe this process.
3. What are the three primary types of musical instruments?
4. What are decibels?
5. What is an echo?
6. Why are there no sounds in outer space?
7. What is the Doppler effect?
8. What does an oscilloscope do?
9. Sound travels faster in liquids and metals than in air. Why?
10. Radio signals are broadcast at units in kilohertz or megahertz. What does that mean?

SOUND AND MUSIC CROSSWORD

Name _____



Across

- Has a higher frequency than the fundamental frequency
- The control of noise and the vibrations that cause noise
- The lowest frequency in a musical sound
- Type of wave in which matter vibrates in the same direction that the wave travels
- Eight notes on the musical scale
- As the amplitude of sound waves increases, the _____ of the sound increases.
- Area where sound waves are pushed together
- The combination of two or more sound waves can cause _____.

Down

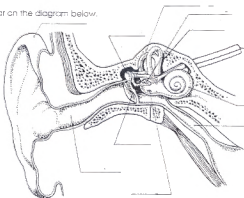
- Sound does not travel through a _____.
- This effect is a change in wave frequency caused by the motion of the source of the wave.
- Area where sound waves are pushed apart
- Produced when overtones have frequencies that are whole number multiples of the fundamental
- Sounds that cannot be heard by human beings
- This depends on the frequency of the sound waves.
- The intensity of sounds are measured in units called _____.

STRUCTURE OF THE HUMAN EAR

Name _____

Label the parts of the ear on the diagram below.

- auditory canal
- eardrum
- hammer
- anvil
- semicircular canals
- cochlea
- auditory nerve
- Eustachian tube
- stirrup
- earlobe
- oval window



Fill in the blanks with the correct answers.

Sound waves beat against a large membrane of the outer ear called the eardrum or _____ . In the _____ these vibrations are transferred by the three small bones, _____ and _____ which increase the force of the vibration. The _____ presses against the _____ which is smaller than the tympanic membrane. The _____ connects the throat to the middle ear and serve to equalize air pressure. Hearing actually takes place on the other side of the oval window, in the _____. The fluid-filled chamber of the inner ear is called the _____. It accepts the wave motion that then travels through the vestibular and tympanic canals. Where the sound waves beat against the sides of the canals, _____ bend and _____ transmit impulses. The _____ carries this information to the brain where it is interpreted.

The upper part of the inner ear contains three _____. These are positioned at _____ angles to each other and are filled with _____. The semicircular canals help to maintain _____.