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______.
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.

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>amplitude</td>
<td>speed of the wave</td>
</tr>
<tr>
<td>elasticity</td>
<td>determined by the frequency of the sound waves</td>
</tr>
<tr>
<td>frequency</td>
<td>density of the medium</td>
</tr>
<tr>
<td>longitudinal</td>
<td>height of the wave</td>
</tr>
<tr>
<td>medium</td>
<td>distance of one complete wave cycle</td>
</tr>
<tr>
<td>pitch</td>
<td>waves that travel up and down</td>
</tr>
<tr>
<td>transverse</td>
<td>disturbance of energy</td>
</tr>
<tr>
<td>velocity</td>
<td>waves created by the movement of molecules</td>
</tr>
<tr>
<td>wave</td>
<td>wave cycles in a given unit of time</td>
</tr>
<tr>
<td>wavelength</td>
<td>allows energy to pass through</td>
</tr>
</tbody>
</table>
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Connected/Not Connected

Directions: Place the following words in the proper sentences.

amplitude  echoes  height  reflected
atmosphere  electromagnetic  light  tranverse
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.
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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
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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_____.

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ELEMENTS OF PHYSICS
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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

1. The energy of sound, explosions, and earthquakes are all transported by __________ waves.

2. The energy of visible light is transported by electromagnetic waves, which are __________ waves.

3. Sound echoes are __________ waves.

4. 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.

5. _______ Wavelength is the number of wave cycles in a given unit of time.

6. _______ Sound waves need a medium to be propagated.

7. _______ Amplitude is the speed of the wave.

8. _______ Electromagnetic waves cannot travel through a medium.

9. _______ 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.

10. Why does sound travel more quickly in water than in air?

11. What are photons?

12. Explain the similarity between echoes of sound and images in a mirror.
WAVE DIAGRAM

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

Velocity = Wavelength x 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 $3.0 \times 10^8$ m/s. Red light has a wavelength of $7 \times 10^{-7}$ m. What is its frequency?

4. The frequency of violet light is $7.5 \times 10^{14}$ 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?