**Waves and Sound Unit Study Guide Answers**

**A proficient student can compare the properties of waves.**

1. What is a wave? – regular, rhythmic disturbances that carry energy but not matter
2. How does a wave begin?- by a vibration, caused by a force
3. What are transverse waves? Give some examples.-a wave whose energy moves at right angles to the medium’s movement; waves on a string, electromagnetic waves, seismic S waves and ocean waves
4. What are longitudinal waves? Give some examples-a waves whose energy moves parallel to the medium’s movement; sound waves, seismic P waves
5. What is the main difference between a transverse wave and longitudinal (or compressional) wave?-The matter and energy move at right angles in a transverse wave; they move parallel to each other in longitudinal waves.
6. What are wave crests?-the highest point on a tranverse wave
7. What are wave troughs?-the lowest point on a transverse wave
8. What is amplitude? How do we measure it? What sound property is affected by amplitude? – amplitude is the height of a wave measured from the rest position or line of origin to either the crest or the trough of the wave. It is a measure of how much energy a wave has. Volume of a sound wave is affected by amplitude. As amplitude increases, sound volume increases.
9. What is wavelength? How do we measure it?-the distance from one crest to the next crest, or from one trough to the next trough in a transverse wave. In a longitudinal wave, it is the distance from the center of a compression to the center of the next compression.
10. What is frequency? How do we measure it? What sound property is affected by frequency?-the number of waves that pass a given point in 1 second. We count the number of complete waves that pass a point in one second. The frequency of a sound wave determines its pitch. As frequency increases, the pitch of the sound increases.
11. What is energy?-the ability to do work
12. What is a medium?- the material a wave passes energy through (like the slinky in our slinky experiments, or air for sound waves, or the wall for sound waves)
13. What is a compression?- the part of a longitudinal wave where molecules are squeezed together
14. What is a rarefaction?- the part of a longitudinal wave where molecules are pulled apart
15. What causes seismic waves?-the sudden release of energy when rocks break free (from plate tectonic movement) of each other underground
16. Describe the differences between a P-wave, an S-wave, and a Surface wave. A P-wave, also known as a primary wave, is a longitudinal seismic or earthquake wave, and it is the first seismic wave to arrive to Earth’s surface from the earthquake’s focus. An S-wave, also known as a secondary wave, is a transverse seismic or earthquake wave, and it is the second seismic wave to arrive to Earth’s surface from the earthquake’s focus. A Surface wave is a combination of a longitudinal and a transverse seismic wave. It is the last wave to arrive at Earth’s surface from the focus, and it does the most damage to structures during an earthquake.
17. What are the 2 classes of waves?-mechanical and electromagnetic
18. What are mechanical waves? Give some examples-waves that need a medium to travel through; sound waves, water waves, slinky waves, seismic waves
19. What are electromagnetic waves? Give some examples-waves that can move through a medium, but do not need a medium to travel through; visible light, x-rays, microwaves, radiowaves,
20. What is the major difference between mechanical and electromagnetic waves?-mechanical waves need a medium to travel through, but electromagnetic waves could travel through a vacuum as well as a medium
21. What is wave reflection?-a wave that bounces off a surface
22. How are frequency and wavelength related?-the shorter the wavelength, the higher the frequency of a wave

**A proficient student can explain the relationship among the rate of vibration, the medium through which vibrations travel, and sound waves.**

1. What is sound?-energy moving through a substance in waves that can be heard when they reach a person’s or animal’s ears
2. What type of wave is a sound wave?- mechanical and longitudinal
3. What does the speed of sound depend on?-the elasticity, density, and temperature of the medium the sound wave travels through
4. How did Chuck Yeager’s team break the sound barrier?-he flew his jet at a higher altitude where he knew the temperature would be lower, which would slow the speed of sound
5. Explain the Doppler Effect.-A change in frequency of a wave as its source moves in relation to the observer; for example, as a police car with its siren on moves toward you, the pitch of the siren sounds higher than it would if the police car were stationary because the movement of the police car is adding to the motion of the sound waves. When the police car with its siren on moves away from you, the pitch of the siren sounds lower than it would if the police car were stationary because the movement of the police car is affecting the motion of the sound waves in the opposite way.
6. What is echolocation?-the use of sound waves and echoes to locate where an object is located
7. What units is the amplitude of sound measured in?-decibels (dB)
8. What units is the frequency of sound measured in?-hertz (Hz)
9. How do sound waves start? – with a vibration
10. How are pitch and frequency related?-as frequency increases, pitch increases
11. How are amplitude and volume related?-as amplitude increases, volume increases
12. How does the temperature of the medium affect the speed of a sound wave?-as the temperature of the medium increases, the speed of the sound wave increases
13. How does the state of matter affect the speed of a sound wave?-sound waves travel fastest in solids, next fastest in liquids, and slowest in gases
14. What is diffraction?-the bending of sound waves around corners
15. What is another name for a reflected sound wave?-echo
16. Why is it important to protect your ears in loud environments?-without that protection, your ears may be damaged and your hearing could be affected
17. Describe how we hear, being sure to mention: pinna, auditory canal, hammer, anvil, stirrup, eardrum, cochlea, semicircular canal, Eustachian tube, and auditory nerve. Sound waves start with a vibration that created a wave that moves through a medium, like air, to our ears. The pinna collects the sound waves and directs them into our ears. The sound waves travel through the auditory canal and then hit the eardrum, causing the eardrum to vibrate. The eardrum’s movement moves the hammer, then the anvil, then the stirrup. The vibration then travels to the cochlea, where the liquid and cilia move. When the cilia (hairs) move, they create electrical signals that travel through the auditory nerve to the brain. The brain then translates the electrical signals into sounds. The Eustachian helps us by keeping the pressure inside our ear equal to the air pressure outside our body. The semicircular canals don’t help us hear, but they do help us keep our balance.