

Properties of Sound

Sound waves are very different from electro-magnetic (EM) radiation.

Sound waves	X-rays
Mechanical energy	EM radiation
Requires a medium	Can travel in a vacuum
Longitudinal wave: particles in the medium move back and forth parallel to the direction the wave is travelling	Transverse wave: electric and magnetic component oscillating at right angles to each other, and to the direction of propagation
Variable velocity	Constant velocity

apart (rarefaction). A sound wave can also be represented sinusoidally with the peaks and troughs of the wave corresponding to the areas of maximum compression and rarefaction.

1) Frequency

The audible range of sound waves for humans is 20 to 20,000 Hz. 1 Hz is 1 wavelength per second. Medical ultrasound uses frequencies of **2-18 MHz** (1 MHz = 1 million Hz) i.e. above the range of human hearing..

Anatomy of a Sound Wave

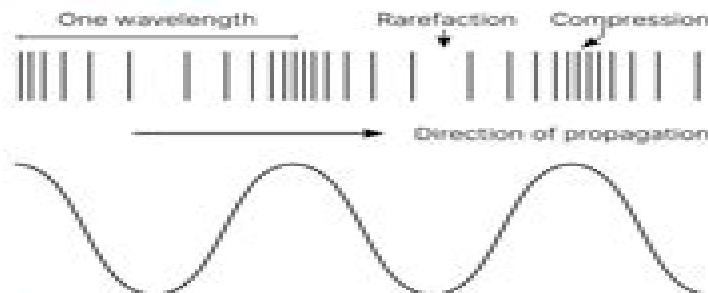


Figure 91. Anatomy of a sound wave

As the sound wave passes through material the particles vibrate back and forth. In some areas the particles are close together (compression) and in others they are further

2) Velocity

The velocity of a sound wave is dependent on, and constant for, the material through which the wave is passing.

$$c = \sqrt{k / \rho}$$

Where: c = speed

k = rigidity

ρ = density

From the above equation, the speed of the sound wave increases with increasing rigidity and decreasing density. It travels the slowest in air as the material is so compressible that a lot of energy is lost between the particles. The important number to learn is that for soft tissues the speed is around 1540 m/s. Ultra-

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1. Understanding the eBook Study Guide Properties Of Sound
 - The Rise of Digital Reading Study Guide Properties Of Sound
 - Advantages of eBooks Over Traditional Books
2. Identifying Study Guide Properties Of Sound
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Study Guide Properties Of Sound
 - User-Friendly Interface
4. Exploring eBook Recommendations from Study Guide Properties Of Sound
 - Personalized Recommendations
 - Study Guide Properties Of Sound User Reviews and Ratings
 - Study Guide Properties Of Sound and Bestseller Lists
5. Accessing Study Guide Properties Of Sound Free and Paid eBooks
 - Study Guide Properties Of Sound Public Domain eBooks
 - Study Guide Properties Of Sound eBook Subscription Services

- Study Guide Properties Of Sound Budget-Friendly Options
- 6. Navigating Study Guide Properties Of Sound eBook Formats
 - ePub, PDF, MOBI, and More
 - Study Guide Properties Of Sound Compatibility with Devices
 - Study Guide Properties Of Sound Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Study Guide Properties Of Sound
 - Highlighting and Note-Taking Study Guide Properties Of Sound
 - Interactive Elements Study Guide Properties Of Sound
- 8. Staying Engaged with Study Guide Properties Of Sound
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Study Guide Properties Of Sound
- 9. Balancing eBooks and Physical Books Study Guide Properties Of Sound
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Study Guide Properties Of Sound
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Study Guide Properties Of Sound
 - Setting Reading Goals Study Guide Properties Of Sound
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Study Guide Properties Of Sound
 - Fact-Checking eBook Content of Study Guide Properties Of Sound
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends

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