

Name _____

The Dance of Waves: Understanding the Relationship between Wave Speed, Frequency, and Wavelength

Open-Ended Response Answer Key

1. As a scientist studying waves in a laboratory, I could conduct an experiment using a ripple tank. By varying the frequency of the wave generator and measuring the resulting wavelengths and wave speeds on the water's surface, I could investigate the relationship between these factors. The equipment would include a ripple tank, wave generator, ruler, and stopwatch. I hope to discover how changes in frequency directly impact the wavelength and wave speed, allowing for a better understanding of wave behavior.
2. The importance of the relationship between wave speed, frequency, and wavelength in telecommunications lies in the ability to allocate specific frequency bands for different purposes. This enables clear and interference-free communication over long distances. Without this understanding, there would be a risk of signal overlap, leading to garbled or disrupted communications. For example, radio stations use distinct frequencies to avoid interfering with one another, ensuring that listeners receive clear broadcasts.
3. In medical imaging technologies like ultrasound, the ability to adjust frequency and wavelength settings is crucial for optimizing image quality. Lower-frequency ultrasound waves penetrate deeper into the body, making them suitable for imaging organs but with less detail. Higher-frequency waves are used for superficial imaging with finer detail. Healthcare professionals benefit from this knowledge by selecting the appropriate frequency settings to obtain the required diagnostic information, leading to accurate diagnoses and better patient care.
4. When designing a Wi-Fi network for a large public space, understanding the relationship between wave speed, frequency, and wavelength is essential. Higher-frequency signals provide faster data rates but have limited coverage. To ensure a reliable network, a balance must be struck. Understanding this relationship would influence decisions on the placement of access points, signal strength, and interference reduction techniques, ensuring that users receive strong and stable Wi-Fi connectivity throughout the public area.

