Name: _____ **Date:** _____

Answer Key: Blast Through the Wavefront: 10th Grade Wave Physics Gauntlet

Quantify the energy of the electromagnetic spectrum and analyze sonic interference patterns through rigorous mathematical application and conceptual synthesis.

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1. A fiber optic cable utilizes total internal reflection to transmit data. Which condition must be met for this phenomenon to occur as light moves from the core to the cladding?

Answer: B) The core must have a higher refractive index than the cladding.

Total internal reflection only occurs when light travels from a medium with a higher refractive index to one with a lower refractive index at an angle greater than the critical angle.

2. In the context of the Doppler Effect, if an observer moves toward a stationary sound source, the perceived _____ of the sound increases.

Answer: C) Frequency

As the observer moves toward the source, they encounter wave fronts more frequently, leading to a higher perceived frequency (pitch), though the actual source frequency remains constant.

3. Light waves are considered longitudinal waves because the oscillations of the electric and magnetic fields are parallel to the direction of energy transfer.

Answer: B) False

Electromagnetic waves, including light, are transverse waves; the field oscillations are perpendicular (90 degrees) to the direction of propagation.

4. Two coherent sound sources produce waves that arrive at a point in space out of phase by exactly 180 degrees. What is the observable result at that specific point?

Answer: C) Destructive interference resulting in a localized point of silence.

When waves are 180 degrees out of phase, the compression of one meets the rarefaction of the other, canceling each other out through destructive interference.

5. The bending of light as it passes through a narrow aperture or around the edge of an obstacle is known as _____.

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Answer: B) Diffraction

Diffraction describes the spreading or bending of waves when they encounter an opening or edge that is comparable in size to their wavelength.

6. The speed of sound generally increases as it moves from a gas into a solid material like steel.

Answer: A) True

Sound is a mechanical wave that relies on particle interaction; solids are more rigid and denser than gases, allowing the vibration to transfer more quickly.

7. Which of the following occurs when the frequency of an external force matches the natural frequency of an object?

Answer: C) Resonance

Resonance occurs when a system is driven at its natural frequency, leading to a dramatic increase in the amplitude of the vibrations.

8. In the electromagnetic spectrum, as the wavelength of a wave decreases, the _____ of that wave must increase.

Answer: D) Frequency

Because the speed of light is constant in a vacuum ($c = \lambda f$), wavelength and frequency are inversely proportional.

9. A student notices that a straw appears 'broken' when submerged in a glass of water. Which wave property explains this visual distortion?

Answer: B) Refraction

Refraction is the change in direction of a wave as it changes speed when moving from one medium (air) into another (water).

10. According to the wave model of light, brightness is directly related to the frequency of the light wave.

Answer: B) False

In the wave model, brightness is determined by the amplitude (intensity) of the wave, while frequency determines the color or energy of the photons.