

Name: _____ Date: _____

Wave Mechanics: Coherent Sources vs Dissipative Media Quiz for College Physics

Evaluate proficiency in wave interference and acoustic impedance through complex problem-solving and rigorous quantitative analysis of oscillatory systems.

1. In the context of the Thin Film Interference occurring in a soap bubble, why does the center of the film appear black just before it pops?

- A. Constructive interference occurs due to the $\lambda/4$ thickness.
- B. A 180-degree phase shift at the first interface and negligible path length lead to destructive interference.
- C. The refractive index of the soap becomes less than that of air.
- D. Total internal reflection prevents light from exiting the film.

2. In a dispersive medium, the phase velocity of a wave is always equal to its group velocity regardless of the frequency.

- A. True
- B. False

3. The phenomenon where the frequency of a wave detected by an observer changes because the source and observer are moving relative to each other is known as the _____.

- A. Mach Reflection
- B. Doppler Effect
- C. Lorentz Transformation
- D. Cherenkov Radiation

4. Consider an acoustic wave traveling from water into steel. Which property of the wave remains invariant during this transition?

- A. Wavelength
- B. Wave Velocity
- C. Frequency
- D. Amplitude

5. In quantum mechanics, the probability density of finding a particle is proportional to the square of the _____ of its wave function.

- A. Frequency
- B. Wavelength
- C. Amplitude
- D. Period

6. Transverse waves can be polarized, whereas longitudinal waves cannot.

- A. True

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B. False

7. What occurs when the driving frequency of an external force matches the natural frequency of a system, such as in an LCR circuit or a bridge?

- A. Total Internal Reflection
- B. Impedance Mismatch
- C. Resonance
- D. Diffraction Limit

8. The Rayleigh Criterion defines the minimum angular spread required to resolve two light sources, a limit primarily dictated by the phenomenon of _____.

- A. Refraction
- B. Dispersion
- C. Diffraction
- D. Absorption

9. In a vacuum, high-frequency gamma rays travel significantly faster than low-frequency radio waves.

- A. True
- B. False

10. Which mathematical principle allows us to decompose a complex, non-sinusoidal periodic wave into a sum of simple sine and cosine waves?

- A. Taylor Expansion
- B. Fourier Analysis
- C. Laplace Transformation
- D. Euler's Method