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Neon Flux Expedition: 11th Grade Quantum & Relativistic Mechanics Quest

Calculate spacetime distortions and orbital probability densities that challenge the deterministic clockwork of classical physics.

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1. A Muon, a subatomic particle with a lifespan of 2.2 microseconds at rest, is detected reaching Earth's surface after traveling through the atmosphere at 0.994c. What relativistic phenomenon explains its survival over this distance?

A. Gravitational lensing
B. Time dilation
C. The Compton Effect
D. Quantum entanglement

2. In the context of the Copenhagen interpretation, the _____ principle asserts that certain pairs of physical properties, like position and momentum, cannot be simultaneously known with infinite precision.

A. Exclusion
B. Equivalence
C. Uncertainty
D. Photoelectric

3. According to General Relativity, a clock positioned at the base of a high-mass mountain will tick slightly slower than an identical clock at the mountain's peak.

A. True
B. False

4. If you double the intensity of monochromatic light hitting a metal surface in a photoelectric experiment without changing the frequency, what occurs?

A. The kinetic energy of ejected electrons doubles.
B. The stopping potential required doubles.
C. The number of electrons ejected per second doubles.
D. The threshold frequency decreases by half.

5. When a high-energy photon collides with a stationary electron and scatters at an angle, transferring some of its energy, the resulting increase in wavelength is known as the _____ Shift.

A. Doppler
B. Compton
C. Schwarzschild
D. Planck

6. In the standard model of cosmology, the 'Event Horizon' of a black hole represents:

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A. The point where density becomes zero.
B. The boundary where escape velocity exceeds the speed of light.
C. The region where quantum tunneling is impossible.
D. The physical surface of the collapsed star.

7. The de Broglie hypothesis suggests that a macroscopic object, like a flying baseball, does not have a measurable wavelength because its mass is too high.

A. True
B. False

8. Einstein's principle of _____ states that an observer in a sealed elevator cannot distinguish between being accelerated upwards and being in a uniform gravitational field.

A. Correspondence
B. Invariance
C. Equivalence
D. Superposition

9. What does the squared magnitude of the wave function ($|\psi|^2$) represent in the Schrödinger formulation of quantum mechanics?

A. The exact speed of the particle.
B. The probability density of finding a particle at a specific location.
C. The total energy of the vacuum state.
D. The number of dimensions in the Hilbert space.

10. The 'Twin Paradox' is resolved by recognizing that the twin who travels to space and returns is the one who undergoes non-inertial acceleration, breaking the symmetry of the frames.

A. True
B. False