Name: _____ **Date:** _____

Why Aging in Space Isn't Science Fiction: 11th Grade Physics

Students calculate relativistic shifts and analyze quantum behaviors to synthesize how microscopic events reshape our macroscopic reality.

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1. A muon is an unstable subatomic particle that decays very quickly. Even though its lifespan should be too short to reach the Earth's surface from the upper atmosphere, we detect them at sea level. Which concept explains this?

A. The Doppler Effect
B. Time dilation due to high-velocity travel
C. The Pauli Exclusion Principle
D. Gravitational lensing

2. According to General Relativity, a clock positioned at the top of a skyscraper will tick slightly faster than a clock located in the basement.

A. True
B. False

3. To satisfy the conservation laws in modern physics, if a particle of matter meets its corresponding antimatter particle, they undergo _____.

A. Nuclear combustion
B. Total annihilation into energy
C. Spontaneous fission
D. Quantum entanglement

4. The scanning tunneling microscope (STM) allows scientists to see individual atoms. This technology relies on which quantum phenomenon?

A. The Photoelectric Effect
B. Nuclear Fusion
C. Quantum Tunneling
D. Blackbody Radiation

5. If an object moves at 99% the speed of light, its mass remains exactly the same as its rest mass regardless of the observer's frame.

A. True
B. False

6. Louis de Broglie proposed that if light waves can behave like particles, then matter (like electrons) can behave like _____.

A. Waves
B. Neutrinos

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C. Solid spheres
D. Static charges

7. Which of these provides the most direct evidence that energy is quantized rather than continuous?

A. The refraction of light through a prism
B. The discrete emission spectra of gases
C. The acceleration of a car
D. The curvature of a rainbow

8. The Heisenberg Uncertainty Principle suggests that measuring the velocity of an electron with extreme precision inherently makes its position less certain.

A. True
B. False

9. In the context of General Relativity, the region around a massive object where even light cannot escape is bounded by the _____.

A. Photon Sphere
B. Singularity Point
C. Event Horizon
D. Galactic Bulge

10. If you observe a 100-meter long spaceship flying past you at 0.8c, what will you measure its length to be?

A. Exactly 100 meters
B. Greater than 100 meters
C. Less than 100 meters
D. 0 meters