Name: _____ **Date:** _____

Answer Key: Stretching Time and Shrinking Atoms: 4th Grade Modern Physics Quiz

Learners apply synthesis skills across 10 challenging items to explain how the very fast and very small change our view of reality.

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1. Imagine you are an astronaut traveling on a super-fast rocket at 90% the speed of light. If you looked at your watch and then compared it to a clock on Earth, what would you notice?

Answer: B) Your watch ticked slower than the clock back on Earth.

According to Special Relativity, time slows down for objects moving at very high speeds, a concept known as time dilation.

2. True or False: In quantum physics, a tiny particle like an electron can be in two different places at the exact same time until we look at it.

Answer: A) True

Quantum superposition suggests that particles exist in many states or locations at once until a measurement is made.

3. Albert Einstein's famous equation $E=mc^2$ proves that ___ and energy are actually two different forms of the same thing.

Answer: C) Mass

The 'm' in the equation stands for mass, showing that matter can be converted into a massive amount of energy.

4. If you stood near a massive object like a star, General Relativity says that space isn't just empty—it actually behaves like which of these?

Answer: B) A stretched trampoline that curves under weight.

General Relativity describes gravity as the curvature of spacetime, similar to how a heavy ball curves a stretchy fabric.

5. When scientists say light has a 'Dual Nature,' they mean it can act as both a wave and a tiny packet of energy called a ___.

Answer: C) Photon

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Photons are the particles of light that demonstrate light's particle-like behavior in quantum mechanics.

6. True or False: Because of gravity's effect on time, the clocks on GPS satellites must be adjusted because they tick slightly differently than clocks on the ground.

Answer: A) True

This is a real-world application of Relativity; without adjusting for time differences caused by gravity, GPS would be inaccurate.

7. The 'Uncertainty Principle' is a rule in modern physics that says you can never perfectly know an electron's position and its ___ at the same time.

Answer: D) Speed

Heisenberg's Uncertainty Principle states that the more precisely you know a particle's position, the less precisely you can know its momentum (speed/direction).

8. Black holes are regions in space where gravity is so strong that even ___ cannot move fast enough to escape its pull.

Answer: B) Light

Because nothing travels faster than light, and light cannot escape a black hole, black holes appear invisible or 'black'.

9. Which of these everyday inventions relies on our understanding of quantum physics to work?

Answer: C) A smartphone

Smartphones use transistors and microchips that only work because of the way electrons behave at the quantum level.

10. True or False: According to Special Relativity, if an object could travel at the speed of light, it would appear to have no length (it would be flat).

Answer: A) True

Length contraction is a concept where objects moving close to the speed of light appear shorter in the direction they are traveling.