

Name _____

Albert Einstein: Unraveling the Mysteries of the Universe

Open-Ended Response Answer Key

1. Albert Einstein's early experiences played a significant role in shaping his later scientific contributions. He displayed an early curiosity and fascination with mathematics and science, but his unconventional thinking often clashed with his teachers. This led to a somewhat challenging educational journey. However, his determination to pursue his passion for physics and mathematics eventually led him to the Swiss Federal Polytechnic, where he graduated in 1900. His ability to think outside the box and question established ideas became a hallmark of his scientific approach, ultimately leading to groundbreaking discoveries.
2. In Einstein's theory of special relativity, he introduced two key concepts that challenged classical mechanics. First, he stated that the laws of physics are the same for all observers, regardless of their motion, as long as they are not accelerating. This meant that there is no absolute frame of reference, and the classical notion of absolute space and time was replaced. Second, he introduced the equation $E=mc^2$, which demonstrated the equivalence of energy and mass with the speed of light as the constant of proportionality. This equation showed that mass and energy are interchangeable, and it had profound implications for the relationship between energy and matter, leading to advancements in nuclear physics and energy production.
3. Einstein's equation $E=mc^2$ is significant in its mathematical representation and its implications for the relationship between energy and matter. Mathematically, the equation shows that energy (E) is equal to mass (m) multiplied by the square of the speed of light (c). This demonstrates the tremendous amount of energy contained within even a small amount of mass. The equation has practical implications, as it led to advancements in nuclear physics and the development of nuclear energy. It laid the foundation for nuclear reactors and nuclear weapons, highlighting both the potential for peaceful and destructive applications of scientific discoveries.
4. Einstein's theory of general relativity introduced the concept that gravity is the curvature of space and time caused by the presence of mass and energy. This theory fundamentally changed the way we understand gravity, moving away from the classical idea of gravity as a force. In Einstein's view, massive objects, such as planets or stars, create a curvature in the fabric of space-time, and objects follow curved paths in this curved space-time. Experimental evidence supporting general relativity was observed during the 1919 solar eclipse when starlight was observed to bend as it passed near the sun, confirming Einstein's predictions. This evidence validated his theory and demonstrated the accuracy of his new framework for understanding gravity.

