Name: _____ **Date:** _____

Shatter the Myth: 12th Grade Advanced Inquiry and Experimental Design Challenge

Evaluate complex experimental protocols and identify subtle biases while analyzing how peer review rigorously validates modern scientific breakthroughs.

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1. In a study investigating the neuroplasticity of elderly musicians compared to non-musicians, researchers found a correlation between years of practice and cortical thickness. Which statement best reflects the analytical limitations of this finding?

A. The sample size is likely too small to be statistically significant.
B. Correlation does not inherently imply a causal relationship between practice and brain structure.
C. Cortical thickness cannot be measured accurately using current fMRI technology.
D. The researchers failed to use a control group in this specific study design.

2. True or False: In a double-blind study examining a new pharmaceutical's efficacy, both the technicians administering the treatment and the subjects are unaware of who belongs to the control group.

A. True
B. False

3. When a scientific theory is challenged by new, reproducible evidence that contradicts its predictions, the most rigorous scientific response is to _____ the existing framework.

A. discard
B. ignore
C. modify
D. conceal

4. Which of the following best describes the role of 'peer review' in the communication phase of the scientific method?

A. A public relations strategy to gain media attention for new discoveries.
B. A standard of proof where a hypothesis is automatically upgraded to a law.
C. An independent evaluation of methodology and logic by experts in the same field.
D. D

5. In the context of the Schrödinger's Cat thought experiment or quantum mechanics, the 'Observer Effect' suggests that the act of _____ a system necessarily alters its state.

A. measuring
B. hypothesizing
C. ignoring
D. simulating

6. True or False: A null hypothesis (H0) is a statement that there is no significant difference or relationship between specified populations or variables.

Name: _____ **Date:** _____

A. True
B. False

7. An environmental scientist examines the impact of microplastics on phytoplankton. If she uses a 'negative control,' what would that group consist of?

A. Phytoplankton exposed to a known toxin other than microplastics.
B. Phytoplankton in a sample of pure water with no microplastics.
C. A different species entirely that is not affected by microplastics.
D. Phytoplankton exposed to the maximum possible concentration of microplastics.

8. The concept of _____, popularized by Karl Popper, posits that for a hypothesis to be scientific, it must be possible to conceive of an observation that would prove it false.

A. verification
B. falsifiability
C. justification
D. probabilism

9. True or False: Inductive reasoning moves from general principles and laws to specific predictions about individual cases.

A. True
B. False

10. When analyzing a dataset with a high degree of 'noise' or variability, which statistical value is most useful for determining the precision of the mean?

A. The Mode
B. Standard Deviation
C. The Median
D. Total Range