Name: _____ **Date:** _____

Nail the Lab: Advanced Inquiry and Design Strategies for Sophomores

Design controlled simulations and critiques of experimental variables to prepare for university-level research and peer review challenges.

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1. An environmental scientist observes that coral bleaching is more prevalent in areas with high agricultural runoff. To establish a causal relationship rather than a mere correlation, which action is most critical during the 'Experiment' phase?

A. Measuring the pH levels of the ocean water daily over six months.
B. Isolating nitrogen levels as the independent variable while holding temperature and light constant.
C. Interviewing local farmers about their fertilizer usage patterns.
D. Publishing the initial observation in a peer-reviewed ecology journal.

2. In a study investigating the Haber-Bosch process, a chemist predicts that increasing pressure will shift the equilibrium toward ammonia production. This predictive statement, which must be falsifiable and grounded in Le Chatelier's Principle, is known as a(n) _____.

A. Scientific Law
B. Observation
C. Hypothesis
D. Analysis

3. True or False: In advanced scientific inquiry, a 'null hypothesis' (H0) assumes that there is no significant statistical difference or relationship between the variables being tested.

A. True
B. False

4. A team of researchers fails to replicate the results of a famous 2010 study on 'social priming.' According to the scientific method, what is the most appropriate next step for the scientific community?

A. Immediately delete the original 2010 study from all databases.
B. Ignore the new data and continue using the 2010 study as a fact.
C. Engage in peer review and further experimentation to determine variables that caused the discrepancy.
D. Assume the second team made a mistake because the first study was older.

5. When analyzing the results of a double-blind medical trial, the _____ group receives a sugar pill to ensure that observed effects are actually due to the medication and not participant expectation.

A. Experimental
B. Control
C. Dependent
D. Quantitative

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6. While investigating the Photoelectric Effect, Albert Einstein used 'thought experiments' to challenge existing Newtonian physics. This stage of the scientific method primarily involves which of the following?

A. Gathering raw data through physical measurements.
B. Synthesizing theoretical frameworks to formulate new questions.
C. Creating a graph of light intensity versus kinetic energy.
D. Writing a lab manual for university freshmen.

7. True or False: A scientific theory is a 'best guess' that becomes a scientific law once it has been proven true by enough experiments.

A. True
B. False

8. If a biologist is studying the rate of enzyme activity at different temperatures, the measured reaction time is considered the _____ variable.

A. Independent
B. Static
C. Controlled
D. Dependent

9. In the 'Communication' phase, why is it mandatory for scientists to describe their methodology in extreme detail?

A. To prevent other scientists from stealing their ideas.
B. To ensure the experiment can be replicated by independent parties to verify results.
C. To meet the word count requirements for scientific journals.
D. To hide the data analysis behind complex terminology.

10. True or False: If an experiment's data refutes the original hypothesis, the experiment is considered a failure and the data should be discarded.

A. True
B. False