

PRACTICE OF SCIENCE STUDY GUIDE

1. Study the following vocabulary terms:
 - Analyze - *To methodically examine data for the purpose of explanation or interpretation*
 - Bias - *Occurs when a scientist's expectations change how results are analyzed or how conclusions are made*
 - Confirmation - *The process of ensuring consistent and predictable results through repetition and replication*
 - Control Sample - *A standard by which test results can be compared, usually a sample where the independent variable is withheld (not given)*
 - Data - *Information gathered through observation or measurement*
 - Evidence - *Data that has been analyzed and used to support a scientific claim*
 - Hypothesis - *A possible explanation for a natural event based on what is known or observed*
 - Prediction - *To make a statement or claim about what will happen based on past experience or evidence*
 - Repetition - *The practice of repeating trials during a scientific investigation (multiple trials) to ensure consistent and predictable results*
 - Replication - *The practice of replicating, or copying, another scientist's investigation to ensure consistent and predictable results*
 - Science - *The systematic study of the physical and natural world through observation and experimentation*
 - Variable - *Any factor that can change which may affect the results of an investigation*
2. What is the format of an effective research question?
"How does (the independent variable) affect (the dependent variable)?"
3. What characterizes a controlled experiment?
The identification and control of variables.
4. How can you identify the independent variable (*test variable*) in an experiment?
It is the thing being tested (or manipulated) to see what effect it has on another variable.
How can you identify the dependent variable (*outcome variable*) in an experiment?
It is the thing being measured (or observed) to see how it is affected by the independent variable.
How can you identify controlled variables (*constants*) in an experiment?
These variables are kept constant (the same) so they do not affect the outcome.
5. Why is it important to control all variables except for the independent variable?
It is important to be able to link the outcome with the independent variable. If other factors are changing (ie – other variables are not kept constant), then it is impossible to say what caused a change in the outcome (if it was the independent variable or some other factor that was changing).
6. How do scientists use predictions?
Scientists use predictions to test their hypothesis.
7. How are a hypothesis and a prediction related?
If the hypothesis is correct, then the prediction will be observed. The prediction is a statement about the expected outcome assuming the hypothesis to be true.
8. What is the difference between "data" and "evidence"?
Data consists of any and all observations or measurements made during an investigation. Evidence, however, is data that has been analyzed and used to support a specific claim. Evidence is data that has been given meaning.
9. What are some ways to analyze data?
The important words are COMPARE and CALCULATE.
You compare data to discover patterns or relationships. A great way to do this is to organize data into tables, graphs, charts, or diagrams. You may need to calculate specific values using the data in order to accomplish this.

10. What is the purpose of repetition and replication in science?
Repetition and replication are both forms of scientific confirmation. Their purpose in science is to ensure that data is consistent and predictable, which affects its reliability.
11. How do you know if you've performed enough trials in your investigation?
You've performed enough trials when your data is consistent and predictable.
12. Identify the three parts of a scientific argument and briefly describe each one.
Claim – your answer to the guiding question
Evidence – analyzed data which supports the claim, highlighting the patterns and relationships that resulted in the claim
Justification – relevant scientific concepts that explain the results
13. Why is it improper to use words such as “prove”, “proof”, or “proven” in science?
What phrase(s) should we use instead of these words?
Using words such as “proven” suggest that there is no possibility that the explanation will change in the future. It suggests that nothing new will be learned about the topic that may cause us to change the way we think about it or understand it. These things violate the TENTATIVE nature of science, that science is always OPEN TO CHANGE in light of new information that doesn't fit with our current understanding.
Instead of “prove”, we can say “support”.
Instead of “proof”, we can use “evidence”.
Instead of “proven”, we can say “supported with evidence” or “the data suggests”.