STUDY GUIDE - *Ch. 1.3 - In Studying Nature, Scientists Make Observations and Form and Test Hypothesis*

NAME: _____

- **Please PHYSICALLY PRINT OUT these pages and HANDWRITE the answers directly on the printouts.** *Typed work or digitally-produced answers will not be accepted.*
- **Importantly, guided readings are NOT GROUP PROJECTS!!!** *You, and you alone, are to answer the questions as you read. You are **not** to share them with another students or work together on filling it out. You are **not** to copy any answers from any other source including the internet. Please report any dishonest behavior to your instructor to be dealt with accordingly.*
- **Get in the habit of writing legibly, neatly, and in a NORMAL, MEDIUM-SIZED FONT.** *AP essay readers and I will skip grading anything that cannot be easily and quickly read so start perfect your handwriting.*
- **Please SCAN documents properly and upload them to Archie.** *Avoid taking photographs of or uploading dark, washed out, side ways, or upside down homework. Please use the scanner in the school's media lab if one is not at your disposal and keep completed guides organized in your binder to use as study and review tools.*
- **READ FOR UNDERSTANDING and not merely to complete an assignment.** *Though all the answers are in your textbook, you should try to put answers in your own words, maintaining accuracy and the proper use of terminology, rather than blindly copying the textbook whenever possible.*

1. **Inquiry** in science refers to the search for information and explanations of natural phenomena. Scientists use a process of inquiry, one we often call the **scientific method**, that includes _____, _____ (also called ***hypotheses***), and _____.

2. Why is it important that the process of inquiry and the scientific method is **repetitive**?

3. a. What is **data**?

   b. What is the difference between **quantitative vs qualitative data**?

4. a. Explain the process of inductive reasoning.

   b. Your book gives you two examples of inductive reasoning, one of which is that "All organisms are made of cells". How is this an example of inductive reasoning?

5. What is a **hypothesis** exactly and what does it lead to specifically?

6. What is an **experiment**?

7. a. Though explaining the natural world makes use of inductive logic. Scientists also readily use deductive logic, especially when designing experiments to test hypotheses. What is **deductive reasoning**?

   b. What form does this deductive reasoning take in the scientific process (a.k.a. the scientific method)?

8. In the example given of the broken desk lamp, the authors highlight that **two possible logical and informed explanations (hypotheses)** for why your desk lamp does not work are that 1. the bulb is improperly screwed in or 2. the bulb is burnt out. Each **hypothesis leads to a prediction**: 1. **If** the bulb is improperly screwed in, **then** re-screwing in the bulb correctly will fix the problem or 2. **If** the bulb is burnt out, **then** replacing the bulb will fix the problem. The prediction will help guide the creation of an experiment or a scientific test to help determine whether the explanation you came up with is valid or not. Of course, your book says that these two hypothesis are not the only explanations that can be used to explain the reason for the nonworking desk lamp. As a matter of fact, **there are always additional explanations for a phenomenon we see**, if you can't think of them all. For example, the electrical socket could be broken and that may be the reason the desk lamp is failing to turn on. Can you come up with a fourth possible hypothesis for why the desk lamp doesn't work *not* mentioned in your textbook?

9. a. Besides the fact that many hypothesis (explanations) may exist for a phenomenon observed in nature, we also say that a hypothesis can never be "proved." Why is that?

   b. Why is testing a hypothesis still a very useful endeavor then even if we cannot prove that particular explanation to be true beyond a shadow of doubt?

10. In order for it to be considered a **scientific hypothesis, the hypothesis (educated explanation for a phenomenon we observe in nature) must TESTABLE**. What does this mean?

11. Let's understand the process of experimental design a little better. It is important to designed a Controlled Experiment when testing hypotheses. What is a **controlled experiment**?

12. a What are **variables**?

b. What is the **independent variable** in scientific investigations?

c. What is the **dependent variable** in scientific investigations?

d. When designing a controlled scientific experiment, **how many variables should be allowed to vary between the control group of subjects and the experimental group of subjects**?

13. a. In the study on the coat coloration seen in Florida mice populations, what was the **observation** made that initially intrigued scientists and made them want to investigate the mice further?

b. Was this observation **qualitative or quantitative**?

c. What was the **hypothesis** they designed to help explain the reason for what they observed in the mouse population?

d. Read Figure 1.25 and study the two bar graphs carefully. Describe the **experiment** that was conducted to test the hypothesis and its resulting prediction?

d. What was the **type of data** collected in the experiment?

e. Was this data that was collected **qualitative or quantitative**?

e. Did the data collected (the **results**) in the experiment falsify or fail to falsify their hypothesis? Why?

14. What are three ways in which a scientific theory (such as the theory of natural selection) differs from the unscientific use of the word "theory" often used in everyday speech and a hypothesis? Remember, a hypothesis is an educated explanation for a phenomenon. Unscientifically, the word "theory" refers to mere untested and unsupported speculation. **Scientific Theories**, however, ...

    1.

    2.

    3.

15. Why do we say that science polices itself?