Name: Date:

Scientific Theories, Laws, and Understandings

Instructions: Read the article and answer the questions below.

Science is the process of accumulating knowledge, or understandings, about the world through observation and experimentation. Scientific experiments begin with a hypothesis—an educated guess about how something might work. The experiment then supports or does not support the hypothesis. An unsupported hypothesis is discarded. A supported hypothesis typically leads to more experiments, to retest the hypothesis under new conditions or to explore related hypotheses. Scientific understandings develop over time as ideas are tested, retested, and revised.

Scientific Theories

A theory is based on numerous observations and correct hypotheses. In everyday speech, the word *theory* refers to an idea that might not be true or that hasn't yet been proved true. In science the word *theory* means almost the opposite. A scientific theory is an explanation that is supported by extensive evidence. A scientific theory has been tested many times and has been repeatedly proved accurate.

Scientific theories provide broad explanations for how parts of the world work. For example, the theory of plate tectonics explains earthquakes, volcanoes, the locations and heights of mountains, the locations of fossils, and the shapes of continents. It is supported by evidence from thousands of scientific experiments.

When a new theory is introduced, it is validated, or tested, by other scientists. These scientists may redo the same experiments that support the theory. They check that the conclusions are not based on errors or fluke occurrences. Scientists also test a theory by doing related experiments, testing whether the theory can be used to make new, accurate predictions.

Scientific Laws

A scientific law is slightly different from a scientific theory. Because both are scientific, they are both based on evidence. The key difference between the two is that a scientific law explains what something does, while a scientific theory explains how something works. For example, the law of gravity states that objects are attracted to each other. This means that if a person releases an object, that object will be pulled toward Earth by the gravitational force between the objects. The law of gravity does not explain how gravity works or how it pulls an object to the ground.

A scientific law, useful as it is, is limited to the event it describes. It offers no explanation as to why an event happens. The why—the explanation behind the phenomenon—is presented by a scientific theory. Why do two bodies with mass exert a force on each other? To answer this question, scientists propose theories. A scientific theory is based on, and supported by, a large body of evidence that has been gathered from repeated experiments. For example, the current accepted theory for why gravity occurs is Einstein's general theory of relativity.

Scientific laws and scientific theories are based on tested hypotheses and supported by solid evidence. Science needs them both: laws to describe what happens and theories to explain why.

1. What is a similarity between scientific laws and scientific theories?
   - **a.** Both describe what happens and why it happens.
   - **b.** Both are based on evidence and tested many times.
   - **c.** Both can be used to explain why something happens.
   - **d.** Both offer untested ideas and concepts for others to explore.

2. In the following sentence from the article, what is the meaning of the term *broad explanations*?
   Scientific theories provide *broad explanations* for how parts of the world work.
   - **a.** focused ideas
   - **b.** limited statements
   - **c.** evidence-based ideas
   - **d.** wide-ranging descriptions

3. Which statement best summarizes the information in the second paragraph of the article?
   - **a.** Scientific theories are ideas developed without evidence.
   - **b.** Scientific theories explain how and why something works.
   - **c.** The word *theory* has multiple uses with varied meanings.
   - **d.** Scientific laws are different from scientific theories in several ways.

4. What claim is supported by information in the article?
   - **a.** Scientific understandings develop quickly with little effort.
   - **b.** Scientific understandings are supported by large amounts of evidence.
   - **c.** Scientific understandings usually do not relate to real-world observations.
   - **d.** Scientific understandings cannot be changed, even if new evidence is found.

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Answer Key

1. **b.** *Both are based on evidence and tested many times.*
2. **d.** *wide-ranging descriptions*
3. **c.** *The word* theory *has multiple uses with varied meanings.*
4. **b.** *Scientific understandings are supported by large amounts of evidence.*