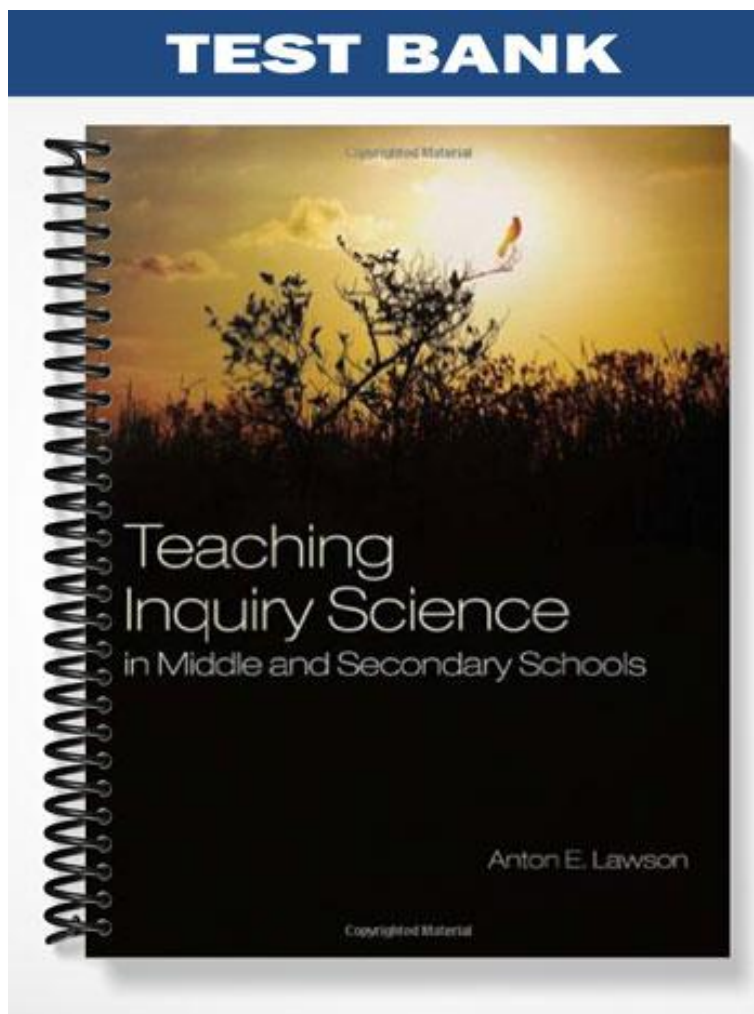


TEST BANK



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Teaching Inquiry Science

in Middle and Secondary Schools

Anton E. Lawson

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Part I: The Nature of Science

Chapter 2. The Nature of Scientific Theories

Short Answer Essay Questions

1. What is a scientific theory? Define and provide an example.
2. What is a scientific law? Define and provide an example.
3. In what ways are hypotheses and theories similar/different?
4. Why is it better to say that entities such as oxygen have been invented rather than discovered?
5. Can hypotheses become theories? Explain.
6. Can theories become laws? Explain.
7. Is there a scientific method? Explain.
8. Is a theory that has been rejected by the scientific community still a theory? Explain.
9. Is it possible to prove a hypothesis or a theory correct? Explain.
10. Is it possible to disprove a hypothesis or a theory? Explain.
11. What is wrong with telling students that gravity causes apples to fall to the ground?
12. How do science and religion differ in terms patterns of reasoning and certainty of conclusions?

True/False Questions

Use the following key to classify items 1-15.

KEY: a. true
b. false

1. A theory is an educated guess of what will be observed under certain conditions. b
2. Theories cannot be proved to be true beyond any doubt. a
3. Theories can be disproved beyond any doubt. b
4. To be scientific, a theory must be testable. a
5. To test a theory, you need one or more predictions. a
6. A hypothesis that gains support becomes a theory. b
7. A theory that gains support becomes a law. b
8. Truth is attainable via proof through repeated supporting observations. b

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9. Scientific statements that are "just a theory" are of little value. b
10. Theory generation involves creativity. a
11. To conclude that a theory has been supported or contradicted, one must compare observations with expectations. a
12. To this day scientists still do not know why objects such as rocks fall to the ground when released. a

Multiple-Choice Questions

(Please note: asterisk denotes correct answer)

1. Which is/are tested by the use of the *If/and/then* thinking pattern?
 - a. generalizations
 - b. hypotheses
 - c. theories
 - d. hypotheses and theories
 - e. generalizations, hypotheses and theories. *
2. Hypotheses differ from theories because
 - a. supported hypotheses become theories.
 - b. unsupported theories become hypotheses.
 - c. hypotheses are less general, less complex and less abstract than theories. *
 - d. hypotheses describe while theories explain.
 - e. only hypotheses can be contracted by evidence.
3. According to the ancient Greek Four Substance Theory, a burning candle in a bottle goes out because it
 - a. burns up the available oxygen.
 - b. fills the space with carbon dioxide.
 - c. runs out of phlogiston.
 - d. fills the space with dephlogisticated air.
 - e. fills the space with phlogiston. *
4. According to the ancient Greek Four Substance theory, a rock dropped in water sinks because
 - a. its natural place is below water. *
 - b. it is attracted to the bottom by gravity.
 - c. it is denser than water.
 - d. it lacks the vital force.
 - e. it is heavy.
5. Today scientists believe that oxygen exists primarily because
 - a. oxygen has been directly observed by many scientists.
 - b. oxygen's existence has been supported by numerous predicted observations. *
 - c. oxygen has been observed using powerful electron microscopes.
 - d. the oxygen concept makes sense.
 - e. respected scientists of the past believed that oxygen exists.
6. Which is *not* a good reason to respond to a causal question with several hypotheses/theories?
 - a. It helps one avoid becoming biased.
 - b. It makes it more likely that one or more explanation will be supported.
 - c. It makes it more likely that one or more explanation will be rejected.

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- d. It insures that you will find the right explanation. *
 - e. It makes more likely that interactions among explanations will be found.
7. Hypotheses and theories are initially assumed to be true
- a. so that predictions can be deduced. *
 - b. because they have been supported by considerable evidence..
 - c. because they are true.
 - d. so that they can be compared with observed results of experimental tests.
 - e. based primarily on what they expect to find.
8. What is wrong with the statement that apples fall *because* of the force of gravity?
- a. Nothing.
 - b. Nobody understands how/why gravity works so we still lack a satisfactory explanation for why apples fall. *
 - c. There may be several other reasons why apples fall.
 - d. Experiments cannot be completely controlled so we cannot know anything for certain.
 - e. Apples fall because their stems become weak and break off the tree branch.
9. Why can science not prove that any particular explanation is true?
- a. Experiments cannot be completely controlled.
 - b. Some clever person may come up with another satisfactory explanation in the future. *
 - c. Explanations are derived by the creative use of analogies.
 - d. The scientific method is only a guide to learning. It does not work all the time.
 - e. Scientists may be biased.
10. Why can science not disprove any particular explanation?
- a. Experiments cannot be completely controlled. *
 - b. Some clever person may come up with another satisfactory explanation in the future.
 - c. Explanations are derived by the creative use of analogies.
 - d. The scientific method is only a guide to learning. It does not work all the time.
 - e. Scientists may be biased.
11. Proposing the existence of a God that can do anything in any way (i.e., has limitless powers) may be correct, however, such a proposal is not part of doing science because
- a. God cannot be directly observed.
 - b. God does not exist.
 - c. God's existence cannot be proved.
 - d. testing the proposal requires knowing what happened before humans existed.
 - e. it cannot be contradicted by evidence. *
12. To test any two alternative theories, one needs a planned test that
- a. leads to a different prediction for each alternative.
 - b. is controlled.
 - c. can be contradicted.
 - d. can be conducted with the available technology.
 - e. generates a prediction that is consistent with what is actually found.

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Use the following key to classify items 13-22.

KEY: a. law
b. hypothesis or theory

13. Green apples are sour. a
14. This street is wet because it rained last night. b
15. No two people are identical in all respects. a
16. A gazelle stotts in order to signal the cheetah that it has been seen. b
17. Rising unemployment probably accounts for the recent drop in stock prices. b
18. Different sets of genes and different environments explain differences among organisms. b
19. Lightning caused the golfers to quickly leave the course. b
20. Organisms exhibit variable characteristics. a
21. Organisms have changed across time due to natural selection. b
22. Salmon spawn in their home streams. a

Use the following key for items 23- 30.

KEY: a. hypothesis
b. theory
c. law

23. An explanation for where all living things came from. b
24. An explanation for why the space shuttle crashed. a
25. The statement that matter can never be created or destroyed. c
26. The statement the force of gravity between two objects is directly proportional to their masses. c
27. An explanation for why the basketball team's leading scorer scored only one point in last night's game. a
28. A possible reason for my headache. a
29. An explanation for why burning plants emit light. b
30. The conclusion that the organisms within all natural populations exhibit variations. c

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Use the following key and information to classify items 31-36, which appear in italics.

- KEY:
- a. conclusion
 - b. test
 - c. expected result (prediction)
 - d. observed result
 - e. hypothesis/theory

It was known for some time that some metals burn when rays of sunlight are focused on them. According to the phlogistonists, (31) *phlogiston is released from the burning metal leaving behind the base (the ashes)*. Further, burning stops when the air is full of phlogiston. However, if (32) *phlogiston is a material that is released from a burning metal*, and (36) *the burned metal's ashes are collected and weighed*, then (33) *the ashes should weigh less than the original metal*. The ashes should weigh less because (34) *part of the original metal (the phlogiston) has escaped into the air*. But when several types of metals were burned and their ashes were weighed, (35) *the ashes weighed more, not less, than the original metals*. Therefore (36) *the theory was not supported*.

Answers: 31. e 32. e 33. c 34. e 35. d 36. a