

1. Which of the following is considered to be in the realm of science?

- a) astrology
- b) astronomy
- c) creationism
- d) extrasensory perception (ESP)
- e) crystal power

Ans: b

Difficulty: Easy

Response:

Other Ways of Knowing 1.3

2. In science, every theory must be tested by using it to make

- a) a hypothesis.
- b) laws of nature.
- c) experiments.
- d) predictions.
- e) a mathematical formula.

Ans: d

Difficulty: Easy

Response:

The Scientific Method 1.2

3. Which of the following statements would be true of the scientific method?
- a) The scientific method is a linear process starting with observation and following several other rigidly defined steps.
 - b) The scientific method is a continuous process by which people learn about the physical universe and share their knowledge with others.
 - c) Scientists may report findings in such a way that experiments and observations remain known only to the original experimenters.
 - d) When the results of an experiment do not fit the hypothesis, a scientist may ethically discard the results and repeat the experiment.
 - e) The scientific method has no connection to the way people conduct their lives every day.

Ans: b

Difficulty: Medium

Response:

The Scientific Method 1.2

4. At the time Dimitri Mendeleev produced the first periodic table of the elements, which of the following was not true?
- a) There were a little more than 60 known chemical elements.
 - b) Chemists used the concept of atomic mass.
 - c) Chemists knew that each element had distinct chemical behaviors.
 - d) It was the mid-18th century.
 - e) There were one or two new discoveries of chemical elements each year.

Ans: d

Difficulty: Easy

Response:

Science in the Making

5. Basic research scientists

- a) are interested in inquiry for the sake of acquiring fundamental knowledge.
- b) believe in the healing power of meditation.
- c) want their research to have practical application to industry or technology.
- d) often have their discoveries translated into practical uses.
- e) would be likely to have a patent on a discovery.

Ans: a

Difficulty: Easy

Response:

The Organization of Science 1.4

6. What is SETI?

- a) a pseudoscience
- b) the theory of intelligent life
- c) the search for intelligent life
- d) the application of science to astrology
- e) short-wave interference in radio signals

Ans: c

Difficulty: Easy

Response:

The Organization of Science 1.4

7. Laws of nature can be characterized by saying that they

- a) arise from repeated observation but no testing.
- b) represent our best understanding of how the universe works in certain circumstances.
- c) are not subject to change based upon additional observations.
- d) always have exceptions and other defects.
- e) are the same as absolute truths.

Ans: b

Difficulty: Medium

Response:

The Scientific Method 1.2

8. The scientific method depends on
- a) reproducible results.
 - b) clearly stated laws of nature.
 - c) accurate initial predictions.
 - d) fact-based hypotheses.
 - e) communication of findings.

Ans: a

Difficulty: Easy

Response:

The Scientific Method 1.2

9. A theory is
- a) an educated guess based on data collected.
 - b) a statement that describes how a system will behave.
 - c) a precise mathematical equation.
 - d) based on many observations and experiments or tests.
 - e) a proven hypothesis.

Ans: d

Difficulty: Easy

Response:

The Scientific Method 1.2

10. Which pair are both examples of pseudoscience?
- a) UFO studies and astronomy
 - b) reincarnation and evolution
 - c) geology and crystal power
 - d) astrology and extrasensory perception
 - e) extrasensory perception and physics

Ans: d

Difficulty: Easy

Response:

Other Ways of Knowing 1.3

11. Peer review in science

- a) demoralizes most young scientists before they can become established.
- b) is accomplished in the editorial offices of major scientific journals.
- c) causes delays between the conclusion of an experiment and the communication of the results.
- d) is conducted in confidence by a panel of experts in the field.
- e) has become outdated since the advent of computers.

Ans: d

Difficulty: Easy

Response:

The Organization of Science 1.4

12. In the mid-nineteenth century, natural philosophers

- a) advised the government on policy issues.
- b) recommended allocation of funds for research.
- c) argued for the natural coalition of church and state.
- d) were the landed gentry with little interest in science.
- e) understood the workings of all the physical universe.

Ans: e

Difficulty: Easy

Response:

The Organization of Science 1.4

13. Which of the following would be funded by a typical federal grant for scientific research?

- a) computer time to run analyses
- b) salaries of investigators
- c) equipment to conduct the research
- d) travel to field sites
- e) all of the above

Ans: e

Difficulty: Easy

Response:

The Organization of Science 1.4

14. What percent of research grants submitted are federally funded?

- a) 10% to 40%
- b) 20% to 60%
- c) 30% to 70%
- d) 40% to 80%
- e) 50% to 90%

Ans: a

Difficulty: Easy

Response:

The Organization of Science 1.4

15. How does science differ from pseudoscience?

- a) Scientific hypotheses are always testable.
- b) Science requires a lower standard of proof than pseudoscience.
- c) Scientific statements are based on anecdotes.
- d) Science is just one person's opinion.
- e) Science is the quest for absolute truth.

Ans: e

Difficulty: Medium

Response:

Other Ways of Knowing 1.3

16. When scientists have finished research and wish to communicate the results, they are most likely to do which of the following?

- a) immediately repeat the research
- b) call a press conference and announce pre-publication findings
- c) sell their findings to a research and development company
- d) write a concise paper and submit it to a scientific journal
- e) submit an abstract to a popular science magazine

Ans: d

Difficulty: Medium

Response:

The Organization of Science 1.4

17. Which statement is true about the discipline of science?
- a) Science is a set of facts about the physical world.
 - b) Science provides answers to all questions about our environment.
 - c) Science is a tool for understanding our physical and biological environment.
 - d) Science and intuition are mutually exclusive.
 - e) Science encompasses all of pseudoscience and more.

Ans: c

Difficulty: Medium

Response:

The Role of Science 1.1

18. Which statement does not describe a falling object?
- a) $D = a \text{ constant multiplied by } (\text{time})^2$.
 - b) The distance traveled is proportional to time traveled multiplied by time traveled.
 - c) Distance equals a constant multiplied by time.
 - d) Time multiplied by a constant squared equals distance.
 - e) If an object falls three times as long as another, it will travel nine times as far as another.

Ans: c

Difficulty: Medium

Response:

The Scientific Method 1.2

19. How did Mendeleev organize the periodic table of elements?
- a) date of first discovery
 - b) alphabetically
 - c) atomic weight of the element
 - d) total number of electrons
 - e) ionization energy

Ans: c

Difficulty: Medium

Response:

The Scientific Method 1.2

20. Determine which of these questions could be researchable using the scientific method.

- a) Under what conditions could bass live in a lake?
- b) What was the artist thinking when he painted Mona Lisa?
- c) Are UFOs related to crop circles?
- d) Is there a supreme deity?
- e) What is the meaning of life?

Ans: a

Difficulty: Medium

Response:

The Scientific Method 1.2

21. Which of the following statements is a prediction?

- a) Mealworms prefer dark environments.
- b) High quality balloons filled with atmospheric air will float higher than low quality balloons filled with atmospheric air.
- c) Spearmint candies taste better than peppermint candies.
- d) Data show that a decrease in food lowers the rate of mealworm reproduction. Therefore, if there is an increase the amount of food available to mealworms, their reproduction rate will increase.
- e) Most scientists never communicate their work.

Ans: d

Difficulty: Medium

Response:

The Scientific Method 1.2

22. Why do scientists reject astrology?

- a) Planets do not exert a gravitational force on a newborn baby.
- b) Stars do not exert any force on a newborn baby.
- c) The Babylonians developed astrology.
- d) The Moon is too far away to influence a person's life.
- e) There is no evidence that stars can predict the future.

Ans: e

Difficulty: Difficult

Response:

Other Ways of Knowing 1.3

23. Why is mathematics the language of science?

- a) Use of mathematics ensures international cooperation among scientists.
- b) Mathematics separates scientists from non-scientists.
- c) Mathematics allows scientists to be more accurate in describing an observation of nature.
- d) Because scientists are more analytical than creative, mathematics is a way to analyze.
- e) Mathematics is like Latin in that it is a way to communicate that few understand.

Ans: c

Difficulty: Difficult

Response:

The Scientific Method 1.2

24. How is an hypothesis tested?

- 1) by using the hypothesis to make predictions about a system
 - 2) by comparing observations in nature with predictions
 - 3) by making a new hypothesis
- a) 1
 - b) 2
 - c) 3
 - d) By 1 and 2, but not 3
 - e) By 1, 2, and 3

Ans: d

Difficulty: Difficult

Response:

The Scientific Method 1.2

25. Which of the following scientists would study forces of motion in the universe?

- a) biologists and chemists
- b) physicists and astronomers
- c) chemists and geologists
- d) geologists and biologists
- e) chemists alone

Ans: b

Difficulty: Difficult

Response:

Other Ways of Knowing 1.3

26. What is the main difference between observations and experiments?

Ans: Observations look at nature without manipulating it, while experiments involve manipulating nature and then observing the result.

Difficulty: Easy

Response:

The Scientific Method 1.2

27. As described in this chapter, what were the independent and dependent variables in the Cedar Creek Natural History Area experiment?

Ans: The amounts of nitrogen and other nutrients are the independent variables and the biodiversity of vegetation in each plot is the dependent variable.

Difficulty: Medium

Response:

Scientific Method 1.2

28. What are two of the ways that statements describing relationships between measurements can be stated?

Ans: They can be presented as a mathematical equation and in symbolic form.

Difficulty: Easy

Response:

The Scientific Method 1.2

29. Name at least one major source of funding for American scientific research.

Ans: Major source of funding for American scientific research include: Department of Agriculture, Department of Defense, Department of Energy, Department of the Interior, Department of Transportation, Environmental Protection Agency, National Aeronautics and Space Administration, National Institutes of Health, National Institutes of Standards and Technology, National Oceanographic and Atmospheric Administration, National Science Foundation, etc.

Difficulty: Easy

Response:

The Organization of Science 1.4

30. Explain the difference between basic research and applied research.

Ans: Basic research is pursuit of knowledge for its own sake, while applied research is aimed at specific problems.

Difficulty: Easy

Response:

The Organization of Science 1.4

31. Name the three essential parts of every experiment. Give an example of a simple experiment that you might perform and identify these three parts in your experiment.

Ans: There are three parts associated with a typical experiment: designing the experiment, conducting it while making observations, and interpreting the results. Experiments should be logical and reasonable and carefully designed with the fewest steps in order to yield interpretable results.

Difficulty: Medium

Response:

Scientific Method 1.2

32. What are some of the ways scientists communicate with each other?

Ans: Answers could include informal discussions, email, professional papers, conferences, collegial work, and so forth.

Difficulty: Easy

Response:

The Organization of Science 1.4

33. Describe the SETI project.

Ans: Since the 1960s some astronomers have used radio telescopes to attempt to detect radio signals from other civilizations in space in a project known as Search for Extraterrestrial Intelligence (SETI). In their search, the SETI astronomers analyze the broad range of radio frequencies in each section of the sky. The volume of data collected by this project is now being analyzed during idle times on the personal computers of more than a million global participants.

Difficulty: Medium

Response:

The Organization of Science 1.4

34. Results of scientific experiments must be reproducible. Give an example of how you have reproduced the results of someone else's experiment in everyday life.

Ans: Answers will vary greatly. Examples might include that a student followed someone else's recipe, method for painting a window frame without getting paint on the glass, or innovative way to build a sandcastle that can withstand a direct hit by a wave. The student might mention using the same techniques and materials, making observations, and testing a hypothesis.

Difficulty: Medium

Response:

Scientific Method 1.2

35. What is the difference between a hypothesis and a theory?

Ans: While a hypothesis is an idea, a theory is a set of ideas that has met many observational and experimental tests.

Difficulty: Medium

Response:

The Scientific Method 1.2

36. Describe what is meant by peer review. Do you think this system is a good idea? Explain your answer.

Ans: Peer review occurs when a paper or grant proposal of some sort is sent to experts in the particular field for reading and comments by peers. Choosing appropriate peer reviewers ensures that reviewers are knowledgeable enough to make an accurate assessment of the work. The peer review system, despite its potential drawbacks, has worked well for science for many years. When an editor must make a decision about whether to publish a scientific paper or a program manager must decide whether to give money to a grant proposal, the informed opinions of scientific peers can be invaluable.

Difficulty: Medium

Response:

The Organization of Science 1.4

37. Why is the scientific process a continuous cycle?

Ans: Because scientific ideas, even well established ones, are constantly being tested and re-evaluated, scientific enquiry is more like a cycle of testing and (if necessary) modification of ideas. Scientists may enter the cycle of inquiry at any stage and continue to generate and test ideas until a consensus emerges about a hypothesis. The cycle may start again when new discoveries are made or new technology allows for more in-depth investigations.

Difficulty: Medium

Response:

The Scientific Method

38. Describe William Harvey's experiments to establish the circulation of the blood.

Ans: Harvey dissected dead animals and then dissected recently killed animals. He moved on to studies of the human body using tourniquets and by applying pressure to veins and arteries. He was able to show by his body of work that blood continuously circulates in the human body.

Difficulty: Medium

Response:

Scientific Method 1.2

39. What part does creativity play in the scientific method? Give an example.

Ans: Scientists are necessarily creative people because the scientific method requires creative means to devise hypotheses, design experiments, find places to make observations, present results in a clear and concise manner, persuade colleagues, etc.

Difficulty: Medium

Response:

The Scientific Method 1.2

40. Why do scientists use mathematics?

Ans: Mathematics is a concise language that allows scientists to communicate results and make precise predictions.

Difficulty: Difficult

Response:

Scientific Method 1.2

41. How does biodiversity protect the natural living system from weather-related stress?

Ans: Biodiversity carried the system through periods of high stress because some species were more tolerant of drought than others. In the Cedar Creek example discussed in this chapter, the presence of drought-resistant organisms was more important than nutrients to the success of the system.

Difficulty: Difficult

Response:

Scientific Method 1.2

42. In what ways did the creation of the periodic table of elements follow the scientific method?

Ans: Mendeleev followed a methodical approach to figure out how chemical elements relate to one another by examining their chemical behavior and thus inferring their physical relationships.

Difficulty: Difficult

Response:

Scientific Method 1.2

43. With the limited amount of money available to fund scientific research, some projects must be given priorities over others. If you were reviewing applications for grant funding, what criteria might you use to decide which projects were funded first?

Ans: Many times this depends upon priorities based on social needs, originality of the research, efficient use of funds, methods of exploration and experimentation, etc..

Difficulty: Difficult

Response:

The Organization of Science 1.4

44. Discuss the reasons scientists might give as a rationale for their career choice.

Ans: Scientists study their respective fields out of personal curiosity, desire to help society, and a sense of personal fulfillment, among many possible reasons. Scientists are professionals like other professional working people such as lawyers, doctors, etc.

Difficulty: Difficult

Response:

The Role of Science 1.1

45. Design an experiment to test the importance of temperature in the maturation of grasses.

Ans: This experiment should include independent and dependent variables and should be designed with control plots of grasses (plots where there is no temperature change) and plots with varying degrees of temperature above and below normal.

Difficulty: Difficult

Response:

Scientific Method 1.2

46. Describe some data that you might graph using measurements you made of time and distance.

Ans: These graphs might include movement of automobiles, avalanches, storms, etc.

Difficulty: Difficult

Response:

The Scientific Method 1.2

47. Explain the difference between basic science and integrated science.

Ans: Basic science explores questions of energy, forces, and other natural phenomena. Integrated science combines methods from many different areas to study natural systems.

Difficulty: Difficult

Response:

The Organization of Science 1.4

48. Describe the interactions between science and society.

Ans: Examples of such interactions could include advances in medicines, “advances” in warfare, space travel, computers and other electronics, etc.

Difficulty: Difficult

Response:

The Organization of Science 1.4

49. Devise an experiment to test a product seen on television and include all steps in the scientific method.

Ans: A hypothesis should be developed and a simple experimental design devised to test the hypothesis. A control group should be used. The experiment should be run and careful, objective observations made. These observations should be interpreted, and graphed. If the experiment leads to further questions, or a modification of the original hypothesis, additional experiments could be conducted to test them.

Difficulty: Difficult

Response:

The Scientific Method 1.2

50. Your roommate brings in a newspaper with a headline that reads “Invisible Aliens Walk Among Us.” Could you test the validity of this headline? Explain how you could or why you could not.

Ans: Because the aliens are presumed to be invisible, this would greatly limit the experimental design to test their existence. Also, the task presumes that aliens exist, which is based on a belief that may not be testable by science

Difficulty: Difficult

Response:

Other Ways of Knowing 1.3