MULTIPLE CHOICE

1. The classification and collection of data that are in the form of numbers is called
   a. statistics.       c. distribution.
   b. probability.      d. mean.
   ANS: A  DIF: 1      REF: 2      OBJ: 1

2. The group that does not receive the experimental treatment in an experiment is the
   a. control group.   c. data.
   b. experimental group. d. variable.
   ANS: A  DIF: 1      REF: 1      OBJ: 3

3. By examining _____, scientists can test predictions for situations in which it is impossible or unethical to use experiments.
   a. correlations       c. control groups
   b. observations      d. variables
   ANS: A  DIF: 1      REF: 1      OBJ: 4

4. Scientists use statistics to
   a. graph data.       c. communicate ideas to each other.
   b. analyze data.     d. All of the above
   ANS: B  DIF: 1      REF: 2      OBJ: 1

5. In an experiment, the factor of interest is called the
   a. control group.   c. hypothesis.
   b. experimental group. d. variable.
   ANS: D  DIF: 1      REF: 1      OBJ: 3

6. The average mass of a wolf in a pack of wolves is an example of
   a. mean.           c. sample size.
   b. distribution.   d. statistical population.
   ANS: A  DIF: 1      REF: 2      OBJ: 1

7. A model of a dinosaur is an example of a _____ model.
   a. graphical       c. conceptual
   b. mathematical    d. physical
   ANS: D  DIF: 1      REF: 2      OBJ: 3
8. The chance that an earthquake will occur in your town during the next year is an example of
   a. correlation.                        c. risk.
   b. skepticism.                       d. distribution.
   ANS: C                DIF: 1          REF: 2          OBJ: 4

9. The experimental method includes which of the following steps?
   a. remaining skeptical, organizing data, and analyzing data
   b. drawing conclusions, being open to new ideas, and communicating results
   c. observing, hypothesizing, predicting, experimenting, and communicating results
   d. being curious, imagining, being able to see patterns, observing, and predicting
   ANS: C                DIF: 1          REF: 1          OBJ: 1

10. Why are mathematical models important?
   a. They are especially useful in situations with many variables.
   b. They can be used to create useful digital images.
   c. They can represent how a system or process works.
   d. All of the above
   ANS: D                DIF: 1          REF: 2          OBJ: 5

11. Which step in the experimental method are scientists conducting when they photograph birds in flight?
   a. observing                                      c. drawing conclusions
   b. hypothesizing                                  d. analyzing data
   ANS: A                DIF: 1          REF: 1          OBJ: 1

12. If you consider what will add to our understanding of the natural world in making an environmental decision, you are examining a(n) _____ value.
   a. ethical/moral                                     c. environmental
   b. aesthetic                                          d. scientific
   ANS: D                DIF: 1          REF: 3          OBJ: 1

13. Before you can make a decision using a decision-making model, what step must you take?
   a. Explore the consequences of each option.
   b. Consider which values apply to the issue.
   c. Gather information.
   d. All of the above
   ANS: D                DIF: 1          REF: 3          OBJ: 2
14. In a scientific investigation, it is important that the number of objects or events being sampled be
   a. a guess of how likely an unwanted outcome will occur.
   b. large enough to give an accurate estimate for the whole population.
   c. equal to the mean number of objects or events not sampled.
   d. equal to the total statistical population.
   
   ANS: B  DIF: 1  REF: 2  OBJ: 2

15. A good hypothesis is more than a guess because it
   a. is based on intuition rather than observation.
   b. states what is likely to happen.
   c. makes logical sense.
   d. Both (b) and (c)
   
   ANS: C  DIF: 1  REF: 1  OBJ: 2

16. Curiosity and imagination are important in science because they are
   a. skills needed to organize and analyze data.
   b. models that represent objects and systems in the environment.
   c. abilities in scientists that help expand our knowledge.
   d. None of the above
   
   ANS: C  DIF: 1  REF: 1  OBJ: 5

17. What essential characteristic does a good experiment have?
   a. A control group is given the experimental treatment.
   b. A single variable is tested.
   c. A control is used.
   d. Both (b) and (c)
   
   ANS: D  DIF: 1  REF: 1  OBJ: 3

18. Your county is considering buying land to form a nature preserve. On this land, an endangered species
   of bird is known to breed. Which of the following is a possible negative short-term consequence to the
   county making this decision?
   a. The population of the endangered species increases.
   b. Habitat destruction is immediately decreased.
   c. Environmental controls are made less strict outside the preserve area.
   d. Habitats outside the preserve area become damaged by overdevelopment.
   
   ANS: C  DIF: 1  REF: 3  OBJ: 3
19. When making a decision about whether or not to build a dam, you are considering an economic value when you ask which of the following questions?
   a. Will the dam provide new leisure activities?
   b. How many jobs will building the dam generate?
   c. Will building the dam destroy natural resources?
   d. Is it right to build a dam here?

   ANS: B  DIF: 1  REF: 3  OBJ: 1

20. What step in a simple environmental decision-making model are you taking when you consider whether or not people will benefit financially from setting aside land as a national park?
   a. exploring consequences
   b. making a decision
   c. gathering information
   d. None of the above

   ANS: A  DIF: 1  REF: 3  OBJ: 2

21. The three final steps of the experimental method in their correct order are
   a. drawing conclusions, analyzing data, and repeating experiments.
   b. drawing conclusions, repeating experiments, and communicating results.
   c. observing, hypothesizing, and drawing conclusions.
   d. repeating experiments, communicating results, and drawing conclusions.

   ANS: B  DIF: 1  REF: 1  OBJ: 1

22. When you ask the question, “If a marsh is included as part of a nature preserve, will it protect our water resources?” you are considering which of the following types of values?
   a. aesthetic
   b. educational
   c. environmental
   d. social/cultural

   ANS: C  DIF: 1  REF: 3  OBJ: 1

23. Which of the following models would you use to represent the shape of Earth’s surface beneath the oceans?
   a. graphical
   b. mathematical
   c. conceptual
   d. physical

   ANS: A  DIF: 1  REF: 2  OBJ: 3

COMPLETION

1. The chance that an event will happen is known as ____________________.

   ANS: probability  DIF: 2  REF: 2  OBJ: 4
2. A(n) ____________________ is a logical statement about what will happen in an experiment if the hypothesis is correct.

ANS: prediction

DIF: 2 REF: 1 OBJ: 1

3. Numeric information called ____________________ is gathered in an experiment.

ANS: data

DIF: 2 REF: 1 OBJ: 1

4. In statistics, the group of individuals used to represent the population is called the ____________________.

ANS: sample

DIF: 2 REF: 2 OBJ: 2

5. Equations used to represent how a scientific process works are called ____________________ models.

ANS: mathematical

DIF: 2 REF: 2 OBJ: 3

6. Principles or standards we consider important are known as ____________________.

ANS: values

DIF: 2 REF: 3 OBJ: 1

7. When scientists are not able to use an experiment to test a prediction, ____________________ can be examined.

ANS: correlations

DIF: 2 REF: 1 OBJ: 4

8. The probability of an outcome that is unwanted occurring is called ____________________.

ANS: risk

DIF: 2 REF: 2 OBJ: 4
9. A(n) _________________________ model is a systematic process you can use to help you make decisions about environmental issues.

ANS: decision-making

DIF: 2  REF: 3  OBJ: 2

10. The _________________________ consists of a series of steps used by scientists to identify and answer questions.

ANS: experimental method

DIF: 2  REF: 1  OBJ: 1

11. An example of a(n) ____________________ model is a flow chart showing how water moves between the atmosphere and Earth’s surface.

ANS: conceptual

DIF: 2  REF: 2  OBJ: 3

12. A(n) ____________________ is one type of graph that is particularly useful for organizing and comparing experimental data for several things in one graph.

ANS: bar graph

DIF: 2  REF: 1  OBJ: 1

13. The procedure used by scientists to test a hypothesis is called a(n) ____________________.

ANS: experiment

DIF: 2  REF: 1  OBJ: 1

14. Good scientists demonstrate the habit of mind called __________________ when they do not believe everything they are told.

ANS: skepticism

DIF: 2  REF: 1  OBJ: 5

15. In an experiment, the group that receives the experimental treatment is called the ________________________.

ANS: experimental group

DIF: 2  REF: 1  OBJ: 3
16. Maps and charts are examples of ____________________ models.

ANS: graphical

DIF: 2 REF: 2 OBJ: 3

17. Scientists use statistics to describe ____________________________, groups of similar things they are interested in learning more about.

ANS: statistical populations

DIF: 2 REF: 2 OBJ: 1

18. Information known as a(n) ____________________ is gathered by using the senses.

ANS: observation

DIF: 2 REF: 1 OBJ: 1

19. One step in a decision-making model is to explore both positive and negative ____________________ of each option.

ANS: consequences

DIF: 2 REF: 3 OBJ: 2

20. The _________________________ is the group that does not receive the experimental treatment in an experiment.

ANS: control group

DIF: 2 REF: 1 OBJ: 3

21. The first step in the decision-making model is to _________________________.

ANS: gather information

DIF: 2 REF: 3 OBJ: 1

22. A(n) ____________________ is a testable explanation for an observation.

ANS: hypothesis

DIF: 2 REF: 1 OBJ: 1
23. Three-dimensional models you can touch are referred to as ________________ models.

ANS: physical

DIF: 2 REF: 2 OBJ: 3

24. A(n) ________________ can explain an observation and predict what might happen in the future.

ANS: theory

DIF: 1 REF: 3 OBJ: 2

SHORT ANSWER

1. Explain how you would determine the mean age of the students in your school.

ANS:
First I would find out how many students are in the school and what all their ages are. Then I would add all the ages and divide the sum by the number of students in the school. This would give me the “arithmetic average,” or “mean.”

DIF: 3 REF: 2 OBJ: 1

2. Refer to the paragraph above. Identify two instances when the scientist demonstrates a key habit of mind and identify what that habit of mind is.

ANS:
The scientist demonstrated skepticism about the lack of natural water sources and curiosity when she investigated the dark rock section.

DIF: 3 REF: 1 OBJ: 5

3. Refer to the paragraph above. Explain how scientific habits of mind are important in the situation described above.

ANS:
Skepticism and curiosity lead the scientist to make the important discovery of a water source, adding to scientific knowledge about the desert.

DIF: 3 REF: 1 OBJ: 5
A die is a game piece that has six sides numbered 1 through 6. A student calculates that when the die is tossed, the probability of rolling a “5” is equal to one out of six, or 1/6 or 0.17. To test this probability, the student tosses the die 20 times, and rolls a “5” 2 out of 20 times.

4. In the paragraph above, what was the sample size used by the student?

ANS: 20

DIF: 3 REF: 2 OBJ: 2

5. a) In the paragraph above, how does the result the student got after tossing the die compare to the calculated probability?

b) Based on your answer, what can you infer about the sample size used by the student? Explain your answer.

ANS: a) The result was 2 out of 20, or 2/20 or 0.1, which is less than the calculated probability of 1/6 or 0.17.

b) Because the two probabilities were different, you should infer that the sample size was too small, resulting in an inaccurate result. For example, a sample size of one roll is unlikely to match the calculated probability, while a sample size of 1,000 rolls is likely to match the calculated probability unless the die was one of a pair of “loaded” or “weighted” dice.

DIF: 3 REF: 2 OBJ: 2

6. Explain why conceptual models are important to scientists. Give two examples of a conceptual model.

ANS: Conceptual models can help explain how a system works or is organized. They help scientists understand the components of a system, or how something works or is put together. Examples include a flow chart of how heat is generated from burning coal, and a diagram of how oxygen cycles through the atmosphere.

DIF: 3 REF: 2 OBJ: 5

7. Explain why mathematical models are important to scientists. Give two examples of a mathematical model.

ANS: Mathematical models can be used to represent how a system or process works. They are especially useful in situations with many variables such as weather forecasting. They can also be used to create useful images, such as digital satellite images. Possible examples include any equations familiar to the students.

DIF: 3 REF: 2 OBJ: 5
8. What values would you consider in deciding whether or not to water your garden during a dry spell when your state has imposed restrictions on water use?

ANS:
Sample answer: I would consider the ethical/moral value of whether or not it is right to break the restrictions, the aesthetic value of whether or not it is pleasing to have a wilted garden, and the environmental value of whether or not I would be helping to protect our water resources.

DIF: 3  REF: 3  OBJ: 1

9. Explain why you agree or disagree with this statement: Environmental values should be placed above all others.

ANS:
Sample answer: I agree, because environmental values protect our natural resources, without which we cannot survive.

DIF: 3  REF: 3  OBJ: 1

10. Explain how probability and risk are related.

ANS:
Probability is the chance that an event will happen, and risk is the probability that an unwanted event will happen.

DIF: 3  REF: 2  OBJ: 4

11. What is a “normal distribution”?

ANS:
A normal distribution is the arrangement of data in which they are grouped symmetrically around the mean.

DIF: 3  REF: 2  OBJ: 1
PROBLEM

1. Local authorities have proposed building a dam along a river. The river provides a home for many wild organisms, and houses are also located along the river. List the positive and negative consequences of building the dam.

ANS:
Answers may vary but should reflect the student’s understanding of the decision-making model. Sample answer: positive short-term consequences: construction jobs will be created and home owners may make a good profit when their land is sold; negative short-term consequence: habitats will be disturbed and destroyed; positive long-term consequences: recreational opportunities will be created and a local source of water and energy will exist; negative long-term consequences: home owners who don’t want to move will lose their homes and organisms may become endangered when their habitats are destroyed.

DIF: 3  REF: 3  OBJ: 3

2. One of your family members proposes that your household stop using oil to heat your house. They believe it would be better for the environment if you harness the energy of the sun by building solar collectors, and use this energy alone for heating. Since doing so would be expensive and unfamiliar, you are not sure if you agree. Explain how you would use the decision-making model to help you decide.

ANS:
Answers may vary but should reflect the student’s understanding of the decision-making model. Sample answer: First, I would gather information from the Internet and library books on oil heat and solar energy. Second, I would consider which values apply to this issue, such as environmental, economic, and aesthetic values. Third, I would explore the consequences of using oil heat and using solar energy. Fourth, I would evaluate all the information and make a decision.

DIF: 3  REF: 3  OBJ: 2

ESSAY

1. Name and describe four types of models commonly used by scientists and give two examples of each.

ANS:
Sample answer: Physical models are three dimensional models you can touch, such as a model of the structure of DNA or a hydrogen atom. Graphical models include maps and charts, such as a road map and star chart. Conceptual models are verbal or graphical explanations for how a system works or is organized, such as a flow chart of how mercury is released from burning coal to reach people or a diagram of how oxygen cycles through the atmosphere. Mathematical models are equations that represent how a system or process works. Possible examples include any mathematical equations the students are familiar with.

DIF: 3  REF: 2  OBJ: 3
2. You are a scientist studying the organisms and water conditions in a local lake. Over several years you notice that both the number of a certain type of fish in the lake has decreased and the acidity of the lake water has increased. You are curious, so you plan to conduct an experiment to learn more.
   a. What observations have you made?
   b. State a hypothesis based on your observations.
   c. State a prediction you will use to test your hypothesis.
   d. Describe how you will use the steps in the experimental method to conduct your experiment.

ANS:

   a. The number of a certain type of fish has decreased and the acidity of the water has increased.
   b. Sample answer: Increasing acidity is killing the fish in the lake.
   c. Sample answer: Fish will die when the acidity of their water is increased.
   d. Answers may vary but should reflect an understanding of the experimental method and its steps.

DIF: 3  REF: 1  OBJ: 1

3. Describe a situation in which you have demonstrated a key habit of mind shared by scientists. Be sure to identify the habit of mind.

ANS:

Answers may vary. Sample answer: I demonstrated creativity in solving a problem. When we ran out of poster paper for our fund raiser signs, I suggested we cut up large cardboard boxes to use as poster paper.

DIF: 3  REF: 1  OBJ: 5