

Scientific Method Practice

Name: _____

Date: _____

1. A biologist in a laboratory reports a new discovery based on experimental results. If the experimental results are valid, biologists in other laboratories should be able to
 - A. repeat the same experiment with a different variable and obtain the same results
 - B. perform the same experiment and obtain different results
 - C. repeat the same experiment and obtain the same results
 - D. perform the same experiment under different experimental conditions and obtain the same results
2. In his theory, Lamarck suggested that organisms will develop and pass on to offspring variations that they need in order to survive in a particular environment. In a later theory, Darwin proposed that changing environmental conditions favor certain variations that promote the survival of organisms. Which statement is best illustrated by this information?
 - A. Scientific theories that have been changed are the only ones supported by scientists.
 - B. All scientific theories are subject to change and improvement.
 - C. Most scientific theories are the outcome of a single hypothesis.
 - D. Scientific theories are not subject to change.
3. A biologist reported success in breeding a tiger with a lion, producing healthy offspring. Other biologists will accept this report as fact only if
 - A. research shows that other animals can be crossbred
 - B. the offspring are given a scientific name
 - C. the biologist included a control in the experiment
 - D. other researchers can replicate the experiment

4. Which statement best describes a scientific theory?
 - A. It is a collection of data designed to provide support for a prediction.
 - B. It is an educated guess that can be tested by experimentation.
 - C. It is a scientific fact that no longer requires any evidence to support it.
 - D. It is a general statement that is supported by many scientific observations.
5. A student hypothesized that lettuce seeds would not germinate (begin to grow) unless they were covered with soil. The student planted 10 lettuce seeds under a layer of soil and scattered 10 lettuce seeds on top of the soil. The data collected are shown in the accompanying table.

Data Table

| Seed Treatment | Number of Seeds Germinated |
|--------------------------|-----------------------------------|
| Planted under soil | 9 |
| Scattered on top of soil | 8 |

To improve the reliability of these results, the student should

- A. conclude that darkness is necessary for lettuce seed germination
- B. conclude that light is necessary for lettuce seed germination
- C. revise the hypothesis
- D. repeat the experiment using a larger sample size

6. An experimental design included references from prior experiments, materials and equipment, and step-by-step procedures. What else should be included before the experiment can be started?

- A. a set of data
- B. a conclusion based on data
- C. safety precautions to be used
- D. an inference based on results

7. Reasons for conducting peer review include all of the following *except*

- A. analyzing the experimental design
- B. pointing out possible bias
- C. identifying an illogical conclusion
- D. changing data to support the hypothesis

8. An investigation was carried out to determine which of three antibacterial soaps is most effective. Four petri dishes labeled A, B, C, and D were set up. The same amount and type of bacteria was added to each dish. Next, 2 mL of a different brand of soap were added to dishes B, C, and D. Then, 2 mL of water were added to dish A, instead of soap. The dishes were incubated at 37°C for 24 hours. At the end of the investigation, the amount of bacteria in each dish was determined. Dish D had the least bacteria. It was concluded that the soap in dish D was the most effective soap to use against bacteria. Which statement best describes the validity of this conclusion?

- A. The conclusion is not valid since the same amount of bacteria was used in each dish.
- B. The conclusion is valid since too small a sample of bacteria was used in this investigation.
- C. The conclusion is valid since the amounts of bacteria were measured at the end of the investigation.
- D. The conclusion might not be valid since the investigation was carried out only once.

9. A mineral supplement designed to prevent the flu was given to two groups of people during a scientific study. Dosages of the supplement were measured in milligrams per day, as shown in the table below.

Supplement Dosages

| Group | Dosage (mg/day) |
|-------|-----------------|
| A | 100 |
| B | 200 |

After 10 weeks, neither group reported a case of the flu. Which procedure would have made the outcome of this study more valid?

- A. test only one group with 200 mg of the supplement
 - B. test the supplement on both groups for 5 weeks instead of 10 weeks
 - C. test a third group that receives 150 mg of the supplement
 - D. test a third group that does not receive the supplement
10. A biologist formulates a hypothesis, performs experiments to test his hypothesis, makes careful observations, and keeps accurate records of his findings. In order to complete this process, the biologist should
- A. adjust the data to support the hypothesis
 - B. eliminate data that do not support the hypothesis
 - C. write a research paper explaining his theories before performing his experiments, in order to gain funding sources
 - D. evaluate the findings and, if necessary, alter the hypothesis based on his findings, and test the new hypothesis

11. An investigation was designed to determine the effect of ultraviolet light on mold spore growth. Two groups of mold spores were grown under identical conditions, except one group was exposed only to ultraviolet light, while the other group was grown in total darkness. In this investigation, the group of mold spores grown without receiving any ultraviolet light is known as the

- A. control B. hypothesis
C. dependent variable D. limiting factor

12. Base your answer(s) to the following question(s) on the information and chart below and on your knowledge of biology.

It has been hypothesized that a chemical known as BW prevents colds. To test this hypothesis, 20,000 volunteers were divided into four groups. Each volunteer took a white pill every morning for one year. The contents of the pill taken by the members of each group are shown in the chart below.

| Group | Number of Volunteers | Contents of Pill | % Developing Colds |
|-------|----------------------|-----------------------------------|--------------------|
| 1 | 5,000 | 5 grams of sugar | 20 |
| 2 | 5,000 | 5 grams of sugar 1 gram of BW | 19 |
| 3 | 5,000 | 5 grams of sugar 3 grams of BW | 21 |
| 4 | 5,000 | 5 grams of sugar 9 grams of BW | 15 |

Which group served as the control in this investigation?

- A. 1 B. 2 C. 3 D. 4

13. The analysis of data gathered during a particular experiment is necessary in order to

- A. formulate a hypothesis for that experiment
B. develop a research plan for that experiment
C. design a control for that experiment
D. draw a valid conclusion for that experiment

14. A student was comparing preserved specimens of three plant species, X, Y, and Z, in a classroom. Which statement is an example of an observation the student could have made and *not* an inference?

- A. The leaves produced by plant X are 4 cm across and 8 cm in length.
B. Plant Y has large purple flowers that open at night.
C. Plant X produces many seeds that are highly attractive to finches.
D. The flowers of plant Z are poisonous to household pets.

15. Which statement about the use of independent variables in controlled experiments is correct?

- A. A different independent variable must be used each time an experiment is repeated.
B. The independent variables must involve time.
C. Only one independent variable is used for each experiment.
D. The independent variables state the problem being tested.

16. A student conducted an experiment to determine if listening to different types of music would affect pulse rate. She thought that pulse rate would change with different types of music. Each person participating in her experiment listened to seven different selections of music for 30 seconds each. The pulse rates were taken after each 30-second interval of music. Based on her experiment, the student concluded that a person's pulse rate changed when listening to different types of music.

The component missing from this experiment is a

- A. prediction B. hypothesis
C. control group D. research plan

17. A student designed an investigation to determine the effect of temperature on the rate of seed germination. The student placed moist filter paper in each of four culture dishes. Ten bean seeds were placed on the filter paper in each dish. The four dishes were numbered and placed in the dark at different temperatures as follows: Dish 1: 10°C, Dish 2: 15°C, Dish 3: 20°C, Dish 4: 25°C. The total number of germinated seeds in each culture dish was counted each day for two weeks.

Which data table is best for recording the results of this investigation?

A.

| Petri Dish | Day | Temperature | Amount of Light |
|------------|-----|-------------|-----------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

B.

| Petri Dish | Amount of Water | Number of Germinated Seeds | Amount of Light |
|------------|-----------------|----------------------------|-----------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

C.

| Day | Temperature | | | |
|-----|-------------|--------|--------|--------|
| | Dish 1 | Dish 2 | Dish 3 | Dish 4 |
| | | | | |

D.

| Day | Number of Germinated Seeds | | | |
|-----|----------------------------|------|------|------|
| | 10°C | 15°C | 20°C | 25°C |
| | | | | |

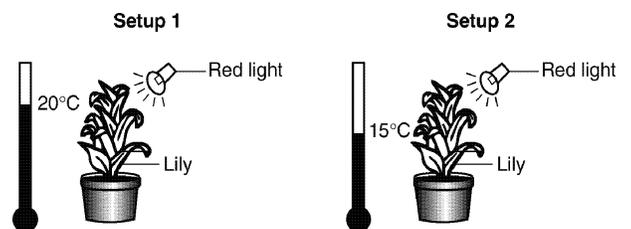
18. Base your answer to the following question on the information below and on your knowledge of biology.

A student states that exercise will affect the number of times a person can squeeze a clothespin in a certain amount of time. An experiment is carried out to test this hypothesis. One group of ten students sits quietly before squeezing a clothespin as many times as possible during a one-minute interval. A second group of ten students does 25 jumping jacks before squeezing a clothespin as many times as possible during a one-minute interval.

State *one* way the experiment could be improved in order to increase the validity of the results.

19. Base your answer(s) to the following question(s) on the information and diagram below.

An investigation was carried out using the two setups shown below. Other than the difference shown in the diagram, all other conditions were identical.



State one possible hypothesis that could be tested using these setups.

20. Plants respond to their environment in many different ways. Design an experiment to test the effects of *one* environmental factor, chosen from the list below, on plant growth.

Acidity of precipitation

Temperature

Amount of water

In your answer, be sure to:

- identify the environmental factor you chose
- state *one* hypothesis the experiment would test
- state how the control group would be treated differently from the experimental group
- state *two* factors that must be kept the same in both the experimental and control groups
- identify the independent variable in the experiment
- label the columns on the data table below for the collection of data in your experiment

Environmental factor: _____

Data Table

| | |
|--|--|
| | |
| | |