
1. Which activity would be an appropriate first step when designing an experiment?

- A) reporting a conclusion based on multiple experimental trials
- B) researching the problem, using information from a variety of sources
- C) creating a data table to organize experimental observations
- D) repeating the experiment with a different hypothesis

2. 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

3. Many plants can affect the growth of other plants near them. This can occur when one plant produces a chemical that affects another plant.

Design an experiment to determine if a solution containing ground-up goldenrod plants has an effect on the growth of radish seedlings. In your experimental design be sure to:

- state a hypothesis to be tested

- describe how the experimental group will be treated differently from the control group
- explain why the number of seedlings used for the experiment should be large
- identify the type of data that will be collected
- describe experimental results that would support your hypothesis

4. The development of an experimental research plan should *not* include a

- A) list of safety precautions for the experiment
- B) list of equipment needed for conducting the experiment
- C) procedure for the use of technologies needed for the experiment
- D) conclusion based on data expected to be collected in the experiment

5. Which statement most accurately describes scientific inquiry?

- A) It ignores information from other sources.
 - B) It does not allow scientists to judge the reliability of their sources.
 - C) It should never involve ethical decisions about the application of scientific knowledge.
 - D) It may lead to explanations that combine data with what people already know about their surroundings.
-

6. A science researcher is reviewing another scientist's experiment and conclusion. When would the reviewer *most likely* consider the experiment invalid?

- A) if the sample size produced a great deal of data
- B) if other individuals are able to duplicate the results
- C) if it contains conclusions not explained by the evidence given
- D) if the hypothesis was not supported by the data obtained

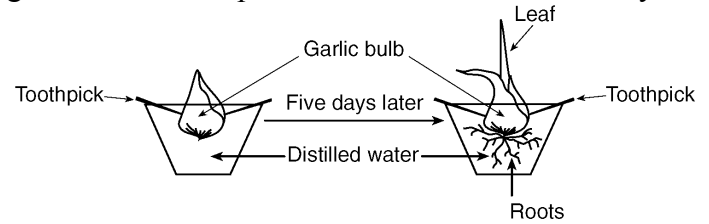
7. Which source would provide the most reliable information for use in a research project investigating the effects of antibiotics on disease-causing bacteria?

- A) the local news section of a newspaper from 1993
- B) a news program on national television about diseases in plants
- C) a current professional science journal article on the control of disease
- D) an article in a weekly news magazine about reproduction in viruses

8. 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.

9. The diagram below illustrates the result of growing a garlic bulb in a cup of distilled water over five days.



Design an experiment consisting of a control and three different experimental groups to test the prediction, "Garlic grows better as the salt concentration of the solution in which it is grown increases." In your answer, be sure to:

- describe the control to be used in the experiment
- describe the difference between the three experimental groups
- state one type of measurement that should be made to determine if the prediction is accurate
- describe one example of experimental results that would support the prediction

10. Researchers performing a well-designed experiment should base their conclusions on

- A) the hypothesis of the experiment
- B) data from repeated trials of the experiment
- C) a small sample size to insure a reliable outcome of the experiment
- D) results predicted before performing the experiment

11. 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

12. A student hypothesized that lettuce seeds would not sprout (germinate) unless they were exposed to darkness. 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 table below.

Data Table

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

One way to improve the validity of these results would be to

- 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
13. Why do scientists consider any hypothesis valuable?
- A) A hypothesis requires no further investigation.
 - B) A hypothesis may lead to further investigation even if it is disproved by the experiment.
 - C) A hypothesis requires no further investigation if it is proved by the experiment.
 - D) A hypothesis can be used to explain a conclusion even if it is disproved by the experiment.
14. 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

15. 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 table below.

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
16. Which procedure must be followed for the results of an experiment to be considered valid?
- A) The experiment must be repeated a number of times and yield similar results.
 - B) After one trial, the results of the experiment must be published.
 - C) The results must be expressed in the form of a table or graph.
 - D) The data must include metric measurements.
17. A biologist plans to spend a year investigating the mating behavior of a certain species of frog. To make meaningful observations, the biologist should observe
- A) a small number of frogs in their natural habitat
 - B) a large number of frogs in their natural habitat
 - C) several groups of frogs maintained in different temperatures in the laboratory
 - D) several groups of frogs maintained on different diets in the laboratory

-
18. 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
19. Based on experimental results, a biologist in a laboratory reports a new discovery. If the experimental results are valid, biologists in other laboratories should be able to perform
- A) an experiment with a different variable and obtain the same results
 - B) the same experiment and obtain different results
 - C) the same experiment and obtain the same results
 - D) an experiment under different conditions and obtain the same results
20. A study was conducted using two groups of 10 plants of the same species. During the study, the plants were placed in identical environmental conditions. The plants in one group were given a growth solution every 3 days. The heights of the plants in both groups were recorded at the beginning of the study and at the end of a 3-week period. The data showed that the plants given the growth solution grew faster than those not given the solution.

When other researchers conduct this study to test the accuracy of the results, they should

- A) give growth solution to both groups
 - B) make sure the conditions are identical to those in the first study
 - C) give an increased amount of light to both groups of plants
 - D) double the amount of growth solution given to the first group
-

21. A company that manufactures a popular multivitamin wanted to determine whether their multivitamin had any side effects. For its initial study, the company chose 2000 individuals to take one of their multivitamin tablets per day for one year. Scientists from the company surveyed the participants to determine whether they had experienced any side effects. The greatest problem with this procedure is that

- A) only one brand of vitamin was tested B) the study lasted only one year
C) the sample size was not large enough D) no control group was used

22. 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

23. 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.

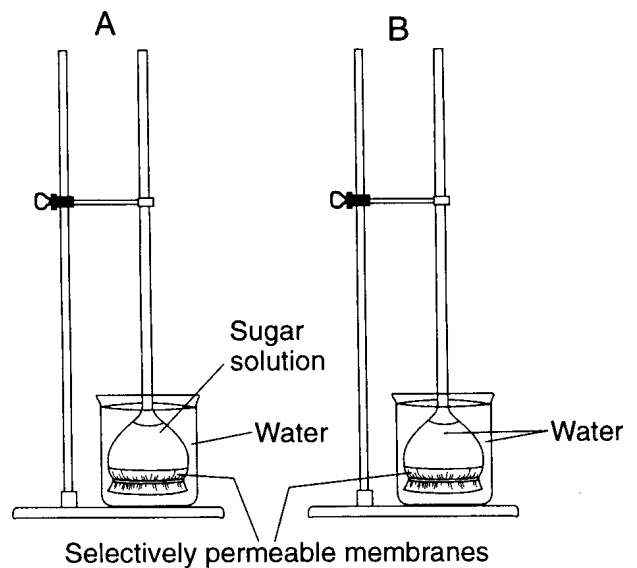
24. The first trial of a controlled experiment allows a scientist to isolate and test

- A) a logical conclusion
B) a variety of information
C) a single variable
D) several variables

25. How does the CONTROL GROUP setup in an experiment differ from the other setups in the same experiment?

- A) It tests a different hypothesis.
B) It has more variables.
C) It does not receive the experimental treatment (Independent Variable).
D) It utilizes a different method of data collection.

26. Which apparatus shown below is serving as the control for the experiment?



- A) A B) B
C) Both A and B D) Neither A or B

27. A student is investigating the effect of different environmental factors on the growth of a certain species of bean plant over a period of 30 days. Which factor would *not* function as a variable in this investigation?

- A) species of bean plant
B) soil moisture content
C) amount of light
D) atmospheric temperature

28. In an investigation designed to determine the effect of the amount of water on plant growth, two groups of equal-sized bean plants of the same species were grown under identical conditions, except for the amount of water they were given. One group was watered with 200 milliliters of water once a day, while the other group was watered with 400 milliliters of water once a day. After several days, the heights of the plants were measured. It was determined that the plants watered with 400 milliliters of water once a day showed more growth.

The variable in this investigation is the

- A) type of bean plants used in the experiment
- B) amount of water given the plants each day
- C) type of soil the bean plants were growing in
- D) group of bean plants watered with 200 ml of water

29. A new drug for the treatment of asthma is tested on 100 people. The people are evenly divided into two groups. One group is given the drug, and the other group is given a glucose pill. The group that is given the glucose pill serves as the

- A) experimental group
- B) limiting factor
- C) control
- D) indicator

30. Base your answer to the following question on the information and data table below and on your knowledge of biology.

In an experiment using chicken eggs, 100 fertilized eggs were injected with a saline (salt) solution containing vitamin B during day 1 of their incubation period. At the same time, a second group of 100 fertilized eggs was injected with plain saline solution. All the chicks that hatched on the 21st day were weighed and measured at hatching. The results are recorded in the data table below.

Data Table

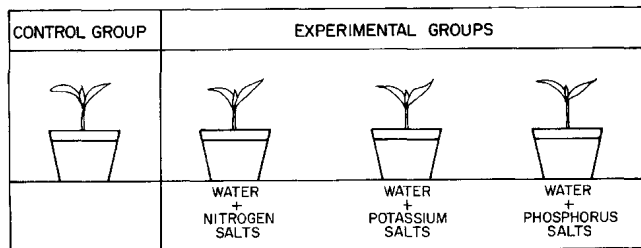
Treatment	Number of Eggs Hatched on the 21st Day	Average Weight of Chicks at Hatching (g)	Average Leg Length at Hatching (cm)
Vitamin B Injection	91	50	3.2
Saline Injection	65	35	1.5

The purpose of injecting the second group of eggs with plain saline solution is to

- A) produce disease-resistant chicks
- B) provide a control for the experiment
- C) encourage the growth of larger eggs
- D) increase the number of fertilized eggs

Base your answers to questions 31 and 32 on the information and diagrams below and on your knowledge of biology.

An experiment was performed to determine the effect of different mineral salts on plant growth. Forty pots containing identical plants were divided into four equal groups and placed in a well-lighted greenhouse. Each pot contained a nonmineral potting medium and one plant. Materials were then added to each experimental group of pots as shown



31. Which measurement would most likely be taken to determine the effect of different mineral salts upon the experimental groups?

- A) weight of the medium in each pot
- B) temperature of the 40 pots
- C) height of the 40 plants
- D) distance of each plant from the light source

32. What was added to the control group of pots?

- A) water, only
- B) nitrogen salts, only
- C) potassium salts, only
- D) potassium and phosphorus salts

33. In an experiment, what should be the relationship between the control group and the experimental group?

- A) They should be different in size
- B) They should resemble each other in at least two respects
- C) They should not be similar in any respect
- D) They should be identical in all respects except one

34. Which statement best describes a hypothesis?

- A) A hypothesis is the process of making careful observations.
- B) The conclusion drawn from the results of an experiment is part of a hypothesis.
- C) A hypothesis serves as a basis for determining what data to collect when designing an experiment.
- D) The facts collected from an experiment are written in the form of a hypothesis.

35. Which sentence represents a hypothesis?

- A) Environmental conditions affect the pollination of plants.
- B) Boil 100 milliliters of water, let it cool, and then add 10 seeds to the water.
- C) Is water depth in a lake related to available light in the water?
- D) A lamp, two beakers, and elodea plants are selected for the investigation.

36. A new concept that is tested in a scientific investigation is known as

- A) a theory
- B) the hypothesis
- C) an inference
- D) an observation

37. In a scientific investigation, after the question is defined, the next step is most likely

- A) formulating a hypothesis
- B) identifying needed equipment
- C) designing the experiment
- D) collecting the data

38. 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

-
39. Conclusions based on an experiment are most likely to be accepted when
- A) they are consistent with experimental data and observations
 - B) they are derived from investigations having many experimental variables
 - C) scientists agree that only one hypothesis has been tested
 - D) hypotheses are based on one experimental design

40. A piece of refrigerated, cooked meat will remain safe to eat for a longer period of time than a refrigerated piece of raw meat of similar size. Which statement is a valid inference based on this information?
- A) Cooking meat kills many bacteria and fungi.
 - B) Cool temperatures stimulate the growth of microbes on raw meat.
 - C) Raw meat cannot be preserved.
 - D) Cooked meat contains antibodies that destroy decomposers.

Base your answers to questions **41** and **42** on the information below and on your knowledge of biology.

A scientist conducted an experiment to test the hypothesis that maple seeds exposed to acid rain will take longer to germinate than seeds exposed to normal rain, which has a pH of 5.6. The scientist set up four groups, each containing 200 maple seeds. The water used for each group had a different pH value: 5.6, 4.0, 3.0, and 2.0. All other conditions were kept the same. After ten days, the number of seeds that had germinated in each group was counted.

41. Identify the control group in this experiment.
42. State *one* example of experimental results that would indicate that acid rain, which has a pH between 4.5 and 4.0, could be responsible for a *decrease* in the number of young maple trees in some forest regions.



43. Scientists in the United States, Europe, and Africa have now suggested that the hippopotamus is a relative of the whale. Earlier studies placed the hippo as a close relative of wild pigs, but recent studies have discovered stronger evidence for the connection to whales. This information suggests that

- A) genetic engineering was involved in the earlier theories
- B) structural evidence is the best evolutionary factor to consider
- C) natural selection does not occur in hippopotamuses
- D) scientific explanations can change with new evidence.

44. A biologist used the Internet to contact scientists around the world to obtain information about declining amphibian populations. He was able to gather data on 936 populations of amphibians, consisting of 157 species from 37 countries. Results showed that the overall numbers of amphibians dropped 15% a year from 1960 to 1966 and continued to decline about 2% a year through 1997.

What is the importance of collecting an extensive amount of data such as this?

- A) Researchers will now be certain that the decline in the amphibian populations is due to pesticides.
- B) The data collected will prove that all animal populations around the world are threatened.
- C) Results from all parts of the world will be found to be identical.
- D) The quantity of data will lead to a better understanding of the extent of the problem.

45. Diagrams, tables, and graphs are used by scientists mainly to

- A) design a research plan for an experiment
- B) test a hypothesis
- C) organize data
- D) predict the independent variable

46. Graphs of the data from laboratory investigations are used to

- A) observe general trends in the data
- B) make the observed data more accurate
- C) prevent errors in measuring data
- D) help change the original data tables

47. 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
-