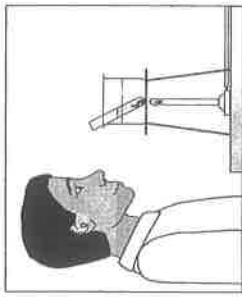


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Review

Scientific Method, Metric Measurement and Graphing

7. Base your answer on the diagram below and on your knowledge of biology.



1. When heating a solution in a test tube, a student should
 - 1) point the test tube in any direction
 - 2) hold the test tube with two fingers
 - 3) cork the test tube
 - 4) wear goggles
2. The directions for a laboratory activity call for 50 milliliters (ml) of solution A. A student accidentally takes 55 ml from the stock bottle. What should the student do with the extra 5 ml of solution A?
 - 1) Return the extra 5 ml to the stock bottle and replace the cap.
 - 2) Pour the extra 5 ml down the drain and rinse the sink with cold water.
 - 3) Dilute the extra 5 ml with 100 ml of water and pour it down the drain.
 - 4) Set the extra 5 ml aside in a labeled beaker and ask the teacher for advice.

3. Chlorophyll can be removed from leaves by boiling them in alcohol, a flammable solvent. In addition to wearing safety goggles, which is the safest procedure to follow?
 - 1) A stoppered test tube of leaves and alcohol should be held over a Bunsen burner.
 - 2) A stoppered test tube of leaves and alcohol should be placed into a beaker of alcohol on a tripod over a Bunsen burner.
 - 3) A beaker of leaves and alcohol should be placed on a tripod over a Bunsen burner.
 - 4) A beaker of leaves and alcohol should be placed into a larger beaker of water and heated on a hot plate.

4. An unsafe procedure for heating a nutrient solution in a flask would be to
 - 1) heat the solution at the lowest temperature possible on a hot plate
 - 2) stopper the flask tightly to prevent evaporation of the solution
 - 3) use a Bunsen burner to heat the solution
 - 4) stir the solution while it is heating

5. Which safety precaution is recommended when a liquid is being heated in a test tube?
 - 1) When holding the test tube, keep fingers closest to the open end of the tube.
 - 2) Direct the flame of the burner into the open end of the test tube.
 - 3) Stopper the test tube with a rubber stopper.
 - 4) Wear goggles and a laboratory apron.

6. The development of an experimental research plan should not include a
 - 1) list of safety precautions for the experiment
 - 2) list of equipment needed for conducting the experiment
 - 3) procedure for the use of technologies needed for the experiment
 - 4) conclusion based on data expected to be collected in the experiment

Which statement describes two unsafe laboratory practices represented in the diagram?

- 1) The flame is too high and the test tube is unstoppered.
 - 2) The opening of the test tube is pointed toward the student and the student is not wearing goggles.
 - 3) The test tube is unstoppered and the student is not wearing goggles.
 - 4) The beaker has water in it and the flame is under the tripod.
8. A student performed an experiment to demonstrate that a plant needs chlorophyll for photosynthesis. He used plants that had green leaves with white areas. After exposing the plants to sunlight, he removed a leaf from each plant and processed the leaves to remove the chlorophyll. He then tested each leaf for the presence of starch. Starch was found in the area of the leaf that was green, and no starch was found in the area of the leaf that was white. He concluded that chlorophyll is necessary for photosynthesis.

Which statement represents an assumption the student had to make in order to draw this conclusion?

- 1) Starch is synthesized from the glucose produced in the green areas of the leaf.
 - 2) Starch is converted to chlorophyll in the green areas of the leaf.
 - 3) The white areas of the leaf do not have cells.
 - 4) The green areas of the leaf are heterotrophic.
9. In 1910, Thomas Morgan discovered a certain pattern of inheritance in fruit flies known as sex linkage. This discovery extended the ideas of inheritance that Gregor Mendel had discovered while working with garden peas in 1865. Which principle of scientific inquiry does this illustrate?
 - 1) A control group must be part of a valid experiment.
 - 2) Scientific explanations can be modified as new evidence is found.
 - 3) The same experiment must be repeated many times to validate the results.
 - 4) Values can be used to make ethical decisions about scientific discovery.

Review

10. 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 goldenrood 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

11. Which statement most accurately describes scientific inquiry?

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

12. Which statement best describes a scientific theory?

- 1) It is a collection of data designed to provide support for a prediction.
- 2) It is an educated guess that can be tested by experimentation.
- 3) It is a scientific fact that no longer requires any evidence to support it.
- 4) It is a general statement that is supported by many scientific observations.

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

- 1) the hypothesis of the experiment
- 2) data from repeated trials of the experiment
- 3) a small sample size to insure a reliable outcome of the experiment
- 4) results predicted before performing the experiment

14. 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.

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

- 1) conclude that darkness is necessary for lettuce seed germination
- 2) conclude that light is necessary for lettuce seed germination
- 3) revise the hypothesis
- 4) repeat the experiment

15. Why do scientists consider any hypothesis valuable?

- 1) A hypothesis requires no further investigation.
- 2) A hypothesis may lead to further investigation even if it is disproved by the experiment.
- 3) A hypothesis requires no further investigation if it is proved by the experiment.
- 4) A hypothesis can be used to explain a conclusion even if it is disproved by the experiment.

16. A student observes that an organism is green. A valid conclusion that can be drawn from this observation is that

- 1) the organism must be a plant
- 2) the organism cannot be single celled
- 3) the organism must be an animal
- 4) not enough information is given to determine whether the organism is a plant or an animal

17. A biologist reported success in breeding a tiger with a lion, producing healthy offspring. Other biologists will accept this report as fact only if

- 1) research shows that other animals can be crossed
- 2) the offspring are given a scientific name
- 3) the biologist included a control in the experiment
- 4) other researchers can replicate the experiment

18. A student formulated a hypothesis that cotton will grow larger bolls (pods) if magnesium is added to the soil. The student has two experimental fields of cotton, one with magnesium and one without. Which data should be collected to support this hypothesis?

- 1) height of the cotton plants in both fields
- 2) diameter of the cotton bolls in both fields
- 3) length of the growing season in both fields
- 4) color of the cotton bolls in both fields

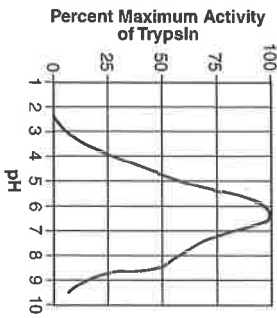
19. Which statement about the use of independent variables in controlled experiments is correct?

- 1) A different independent variable must be used each time an experiment is repeated.
- 2) The independent variables must involve time.
- 3) Only one independent variable is used for each experiment.
- 4) The independent variables state the problem being tested.

20. The first trial of a controlled experiment allows

- 1) a logical conclusion
- 2) a variety of information
- 3) a single variable
- 4) several variables

21. What is the dependent variable in the experiment summarized in the graph below?



22. 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
- conclude that darkness is necessary for lettuce seed germination
 - conclude that light is necessary for lettuce seed germination
 - revise the hypothesis
 - repeat the experiment using a larger sample size
23. In T₁ exams, researchers gave a cholesterol-reducing drug to 2,335 people and an inactive substitute (placebo) to 2,081. Most of the volunteers were men who had normal cholesterol levels and no history of heart disease. After 5 years, 97 people getting the placebo had suffered heart attacks compared to only 57 people who had received the actual drug. The researchers are recommending that to help prevent heart attacks, all people (even those without high cholesterol) take these cholesterol-reducing drugs. In addition to the information above, what is another piece of information that the researchers must have before support for the recommendation can be justified?
- Were the eating habits of the two groups similar?
 - How does a heart attack affect cholesterol levels?
 - Did the heart attacks result in deaths?
 - What chemical is in the placebo?

Review

24. How does the control setup in an experiment differ from the other setups in the same experiment?
- It tests a different hypothesis.
 - It has more variables.
 - It differs in the one variable being tested.
 - It utilizes a different method of data collection.
25. 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
- control
 - hypothesis
 - dependent variable
 - limiting factor
26. 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?
- species of bean plant
 - soil moisture content
 - amount of light
 - atmospheric temperature
27. Which statement best describes a hypothesis?
- A hypothesis is the process of making careful observations.
 - The conclusion drawn from the results of an experiment is part of a hypothesis.
 - A hypothesis serves as a basis for determining what data to collect when designing an experiment.
 - The facts collected from an experiment are written in the form of a hypothesis.
28. Which sentence represents a hypothesis?
- Environmental conditions affect germination.
 - Boil 100 milliliters of water, let it cool, and then add 10 seeds to the water.
 - Is water depth in a lake related to available light in the water?
 - A lamp, two beakers, and elodea plants are selected for the investigation.
29. 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
- genetic engineering was involved in the earlier theories
 - structural evidence is the best evolutionary factor to consider
 - natural selection does not occur in hippopotamuses
 - scientific explanations are tentative and subject to change
30. A laboratory procedure calls for heating 50 milliliters of a sugar solution to 60°C. Which piece of laboratory equipment will *not* be needed?
- protective eyewear
 - ruler
 - thermometer
 - graduated cylinder

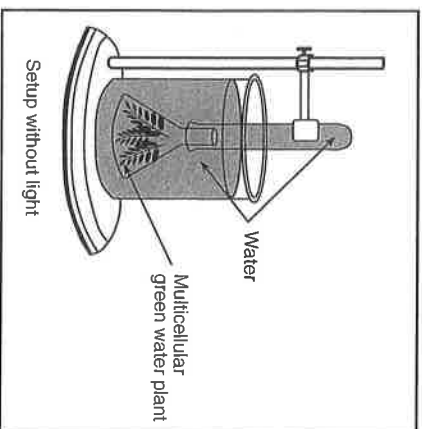
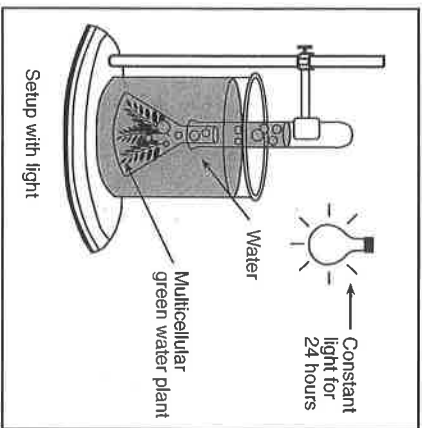
Base your answers to questions 31 through 33 on the information below and on your knowledge of biology.

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.

- Identify the dependent variable in this experiment.
- Identify the control group in this experiment.
- 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.

Review

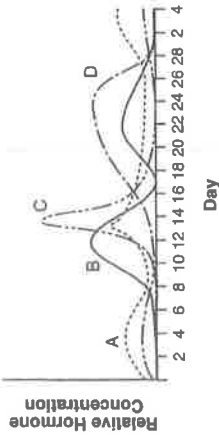
34. An experimental setup is shown in the diagram below.



- Which hypothesis would most likely be tested using this setup?
- Green water plants release a gas in the presence of light.
 - Roots of water plants absorb minerals in the absence of light.
 - Green plants need light for cell division.
 - Plants grow best in the absence of light.
35. 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 1986 and continued to decline about 2% a year through 1997. What is the importance of collecting an extensive amount of data such as this?
- Researchers will now be certain that the decline in the amphibian populations is due to pesticides.
 - The data collected will prove that all animal populations around the world are threatened.
 - Results from all parts of the world will be found to be identical.
 - The quantity of data will lead to a better understanding of the extent of the problem.
36. Which group of measurement units is correctly arranged in order of increasing size?
- kilometer, centimeter, millimeter, meter
 - millimeter, kilometer, centimeter, meter
 - meter, kilometer, centimeter, millimeter
 - millimeter, centimeter, meter, kilometer

Review

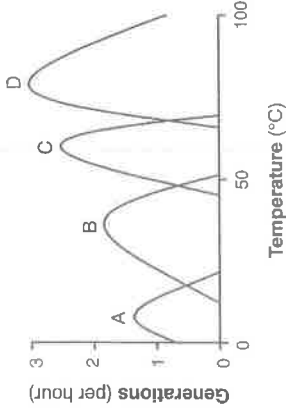
37. The graph below shows the relative concentrations of certain hormones in the blood during the human female reproductive cycle.



Which hormone has the lowest concentration on which day?

- 1) hormone A on day 4
- 2) hormone B on day 2
- 3) hormone C on day 12
- 4) hormone D on day 20

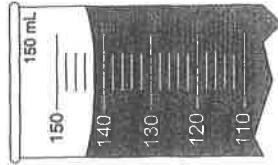
38. The graph below provides information about the reproductive rates of four species of bacteria, A, B, C, and D, at different temperatures.



Which statement is a valid conclusion based on the information in the graph?

- 1) Changes in temperature cause bacteria to adapt to form new species.
- 2) Increasing temperatures speed up bacteria reproduction.
- 3) Bacteria can survive only at temperatures between 0°C and 100°C.
- 4) Individual species reproduce within a specific range of temperatures.

39. A chicken bone was placed in a graduated cylinder containing 100 milliliters of water. The diagram below illustrates the new level of water.

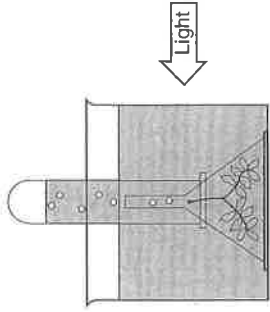


What is the volume of the chicken bone?

- 1) 41 mL
- 2) 42 mL
- 3) 141 mL
- 4) 142 mL

Review

40. An experiment was set up to test the effect of light intensity on the rate of photosynthesis, as shown in the diagram below.



Data were collected by counting gas bubbles released in a 5-minute period when the light source was placed at various distances from the experimental setup. The data are shown in the table below.

Data Table

Distance From Light (cm)	Bubbles in 5-Minute Period
15	27
23	20
30	13
45	6

The number of bubbles released when the light source is at a distance of 38 centimeters would most likely be closest to

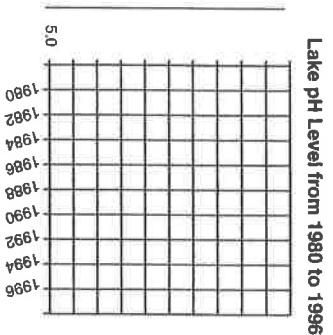
- 1) 6
- 2) 10
- 3) 13
- 4) 22

Review

Base your answers to questions 41 through 45 on the information and data table below and on your knowledge of biology.

The table shows data collected on the pH level of a lake from 1980 to 1996. Using the information in the data table, construct a line graph on the grid below, following the directions below.

Year	pH Level
1980	6.7
1984	6.3
1986	6.4
1988	6.2
1990	5.9
1992	5.6
1994	5.4
1996	5.1



41. Identify one factor that should have been kept constant each time water samples were collected from the lake.
42. Label the x and y axes.
43. Mark an appropriate scale on the y -axis. The scale has been started for you.
44. Plot the data from the data table. Surround each point with a small circle and connect the points.



45. Describe the trend in pH level in the lake over this 16-year period.

Review
Answer Key
rosenthalscimethod [Sep 15, 2010]

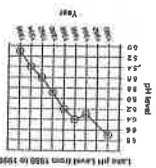
1. 4
2. 4
3. 4
4. 2
5. 4
6. 4
7. 2
8. 1
9. 2

10. Examples:

- Radish seedlings grow faster when exposed to goldenrod solution.
- Radish seedlings treated with the solution will not grow as tall as the control group. — The solution will not affect the height of radish seedlings.
- The experimental group will be given the solution while the control group is given plain water. — The experimental group will have ground up goldenrod in the soil.
- A large sample will increase the validity of the results. — Since some may die, there will be enough left to do the experiment.
- The number of seedlings that survive in each group will be counted.
- The height of the seedlings
- Radish seedlings exposed to goldenrod solution were twice as tall as the control group in two weeks. — If the radish seedlings treated with the solution do not grow as tall as those in the control group, the hypothesis is supported. — If there is no difference between the height of the group treated with the solution as compared to the control group, the hypothesis will be supported.

11. 4
12. 4
13. 2
14. 4
15. 2
16. 4
17. 4
18. 2
19. 3
20. 3

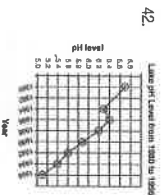
45. Examples: — The pH level decreased over this time period.



44.

34. 1
35. 4
36. 1
37. 2
38. 4
39. 2
40. 2

41. Examples: — water depth — time of year



43.

