

Exam

Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) The concept of sustainable development considers _____. 1) _____
A) the fastest ways to economic prosperity B) the importance of developing the arts
C) the needs of future generations D) growth in profits from international trade

Answer: C

- 2) The current total world population is just over _____. 2) _____
A) 5 billion B) 6 billion C) 7 billion D) 8 billion E) 9 billion

Answer: C

Read the following scenario, and answer the questions below.

Pablo and Johanna have to do a yearlong study for their biology course. After some discussion, they decide to propose comparing their dogs and the diet that they feed them to test their hypothesis that the local veterinarian's special dog food mix will enhance growth and development. Each student will adopt a puppy from the local pound. Pablo will feed his shepherd-mix dog the special diet of wet and dry foods from the local vet, while Johanna will use generic dry kibble from the supermarket for her bulldog.

- 3) The independent variable in this study is _____. 3) _____
A) the type of food the dogs receive B) the age of the dogs
C) the breed of the dogs D) how much the dogs grow

Answer: A

- 4) Which one of the following terms *least* applies to science? 4) _____
A) Outcome based B) Biased C) Repeatable D) Creative

Answer: B

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- 5) One dependent variable in this study is _____. 5) _____
A) the breed of the dogs B) the age of the dogs
C) how much the dogs grow D) the type of food the dogs receive

Answer: A

- 6) Which of the following terms *best* describes the practice of environmental science? 6) _____
A) Abstract and theoretical B) Integrative and interdisciplinary
C) Theoretical and controversial D) Highly specialized and focused

Answer: B

- 7) The confidence in a scientific theory is most related to _____. 7) _____
A) the amount of unbiased supporting evidence
B) the number of publications that discuss the subject in question
C) the reputations of the investigating scientists and their related universities
D) the number of grants received to study the subject

Answer: A

- 8) Compared to real science, pseudoscience _____. 8) _____
A) does not conform to the established scientific rigors
B) does not include bias or subjective values
C) is anything that threatens or contradicts your point of view
D) is anything that confirms your point of view

Answer: A

- 9) At virtually any level of use, nonrenewable resources can be _____. 9) _____
A) replenished once depleted
B) recycled or reused
C) converted to renewable ones
D) exhausted or depleted

Answer: D

Read the following scenario, and answer the questions below.

THE EXPERIMENT:

Researchers wanted to determine whether pesticide Z is effective at killing grasshoppers that typically invade cornfields. Two 10-acre cornfields located 1 mile apart were chosen. The cornfield to the west was sprayed only with water. The cornfield on the east received the same amount of water with a 10% solution of pesticide Z. The number of grasshoppers in the fields was recorded every week for 10 weeks.

RESULTS:

The number of grasshoppers in the west field treated only with water doubled after 10 weeks.
The number of grasshoppers in the east field treated with pesticide Z declined by 50% after 10 weeks.

- 10) If both fields had the same amount of grasshoppers at the start of the experiment, how many times more grasshoppers were in the west field than the east field after 10 weeks? 10) _____
A) Twice as many
B) Half as many
C) Four times more
D) Cannot be determined

Answer: C

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

- 11) You are hired by a pesticide company to determine whether its new pesticide ("Zap-em") is effective at controlling soybean aphids, an invasive species that costs American farmers millions of dollars a year in crop damage and control costs. Describe an experiment you would perform to test the effectiveness of Zap-em.

Answer: Students' answers will vary but should include all of the following components:

- (a) replicate plots (It would be inappropriate to test Zap-em on a single field.);
- (b) treatment and control plots, assigned randomly (Zap-em plots need to be compared to plots not sprayed with Zap-em.);
- (c) dependent variables to be measured (e.g., crop yield, amount of crop damage, and density of soybean aphids in plots); and
- (d) use of statistical analysis to analyze the data.

12) Why is it important to understand our interactions with the environment? What will studying environmental science enable you to do?

Answer: We depend on the environment for air, water, food, shelter, and everything else. We are capable of modifying and harming the environment whether we intend to or not. Understanding our interactions with the environment is the essential first step toward devising positive, sustainable solutions that will allow future generations to enjoy a rich and full world. Studying environmental science will give us the tools we need to evaluate information on environmental change and to think critically and creatively about possible actions to take in response.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 13) Ruben has a new puppy named Paddington and wants to feed him the best possible food. He decides on an experiment where he will feed Paddington the very best canned food plus a dietary supplement of vitamins recommended by a veterinarian. Which of the following best describes Ruben's project? 13) _____
- A) Ruben needs to use his mother's 6-year-old chocolate Sharpei named Scout to feed a standard diet so he can compare Paddington to a control dog.
 - B) Ruben needs to take careful measurements of Paddington's weight and height at least once a week for it to be a good experiment.
 - C) This is an example of an excellent, controlled experiment.
 - D) This is not an experiment.

Answer: D

- 14) Qualitative data _____. 14) _____
- A) cannot be used to support or disprove hypotheses
 - B) are expressed as numbers and can be tested using statistics
 - C) are high-quality data that have been peer reviewed
 - D) are nonnumerical and indicate a characteristic of something

Answer: D

- 15) The scientific peer-review process ensures that _____. 15) _____
- A) the results of scientific studies are permanent and certain
 - B) scientific studies have proper design and methods and are free from bias
 - C) all published scientific studies have clearly defined control groups
 - D) all scientific studies receive publication despite the level of bias

Answer: B

- 16) Scientists investigating a drug to cure a disease in birds conduct experiments. In these experiments, what would be the control group? 16) _____
- A) Birds that receive the drug being tested
 - B) Birds that receive another drug not being tested
 - C) Rats that receive the drug being tested
 - D) Birds that do not receive the drug being tested

Answer: D

- 17) A pharmaceutical company wishes to study a possible new headache medicine. They are doing human trials with 1,000 volunteers who experience frequent headaches. The researchers will need to _____ 17) _____
- A) have 10 volunteers in the control group
 - B) put all women in the control group and all men in the experimental group
 - C) control for the type of headache—stress, migraine, or other causes
 - D) give all 1,000 volunteers the same amount of the new medication

Answer: C

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RESULTS:

The number of grasshoppers in the west field treated only with water doubled after 10 weeks.
The number of grasshoppers in the east field treated with pesticide Z declined by 50% after 10 weeks.

- 18) What was the independent variable in the above experiment? 18) _____
- A) The number of grasshoppers receiving the pesticide
 - B) The number of grasshoppers after 10 weeks
 - C) Whether pesticide Z was applied
 - D) The location of the fields

Answer: C

- 19) Which of the following *best* illustrates sustainability? 19) _____
- A) Constructing coal mines that do not require extensive surface excavations
 - B) Using an ethanol-gasoline blend in a vehicle instead of pure gasoline
 - C) Upgrading or replacing computers every few years to improve performance
 - D) Transitioning from traditional to renewable sources of energy

Answer: D

- 20) All science and scientific discoveries are founded upon _____. 20) _____
- A) observations
 - B) proven theories
 - C) competing hypotheses
 - D) experiments

Answer: A

Read the following scenario, and answer the questions below.

Pablo and Johanna have to do a yearlong study for their biology course. After some discussion, they decide to propose comparing their dogs and the diet that they feed them to test their hypothesis that the local veterinarian's special dog food mix will enhance growth and development. Each student will adopt a puppy from the local pound. Pablo will feed his shepherd-mix dog the special diet of wet and dry foods from the local vet, while Johanna will use generic dry kibble from the supermarket for her bulldog.

- 21) When Pablo and Johanna write up their initial proposal, the instructor will probably _____. 21) _____
- A) tell them to start over—it would take many years to do such a study
 - B) give them an A for thoroughness, and allow them to proceed with the experiment
 - C) tell them that they need at least 100 dogs to do the study
 - D) tell them they have a serious problem with the proposal, but it is fixable if they are willing to take care of more dogs

Answer: D

- 22) A hypothesis is _____. 22) _____
- A) a statement that explains an observed phenomenon or answers a question
 - B) a prediction about something that has not yet been observed
 - C) the design of an experiment that can be used in scientific inquiry
 - D) a proven scientific fact

Answer: A

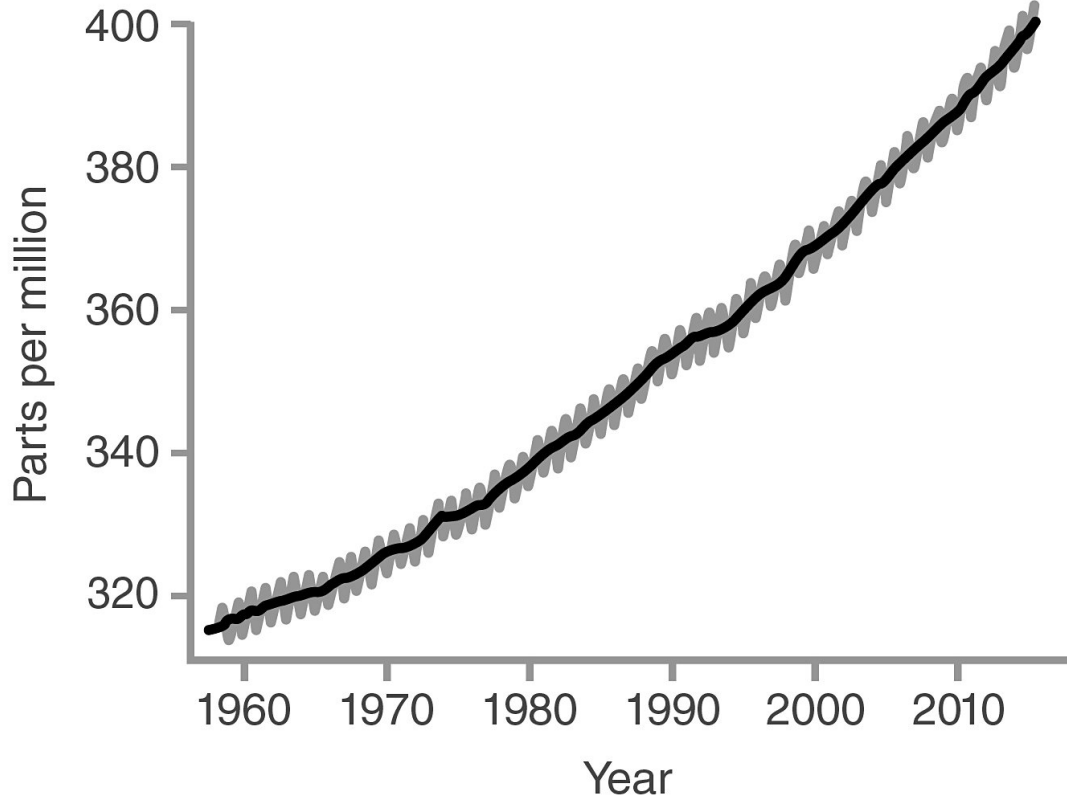
- 23) Some students on a biology field trip were sitting around watching honeybees. Some of the students noticed that bees spent more time on some flowers than on other flowers. As they talked about this behavior, the students offered various explanations. Some thought that the bees were avoiding predators on some flowers, while other students suggested that some flowers may have sweeter nectar. These speculations about bee behavior are examples of _____. 23) _____
- A) theories B) bias C) hypotheses D) data

Answer: C

- 24) The process by which several researchers review another researcher's manuscript prior to publication to ensure research quality is referred to as _____. 24) _____
- A) quality control
 - B) peer review
 - C) investigative inquiry
 - D) hypothesis testing
 - E) critical analysis

Answer: B

Atmospheric CO₂ at Mauna Loa Observatory



25) What is the independent variable in this study?

25) _____

- A) Since this is a manipulative study, there is not an independent variable.
- B) Carbon dioxide concentration
- C) Observatory location
- D) Time (year)

Answer: D

26) Geothermal energy, wind energy, and solar radiation are all examples of _____.

26) _____

- A) biotic environmental factors
- B) nonrenewable resources
- C) renewable resources
- D) biodiversity

Answer: C

27) A hypothesis can *best* be described as _____.

27) _____

- A) a comparison between groups with an explanation for differences
- B) an explanation that has been tested many times
- C) a proposed explanation based on observation
- D) a proven fact

Answer: C

28) Which of the following observations lends itself *best* to scientific experimentation?

28) _____

- A) Male house finches seem to sing more when there is a female house finch around than when they are alone.
- B) *Archaeopteryx* had a dinosaur-like skeleton but also had feathers.
- C) Someone egged my house last night.
- D) My sister does not drive very well.

Answer: A

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

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RESULTS:

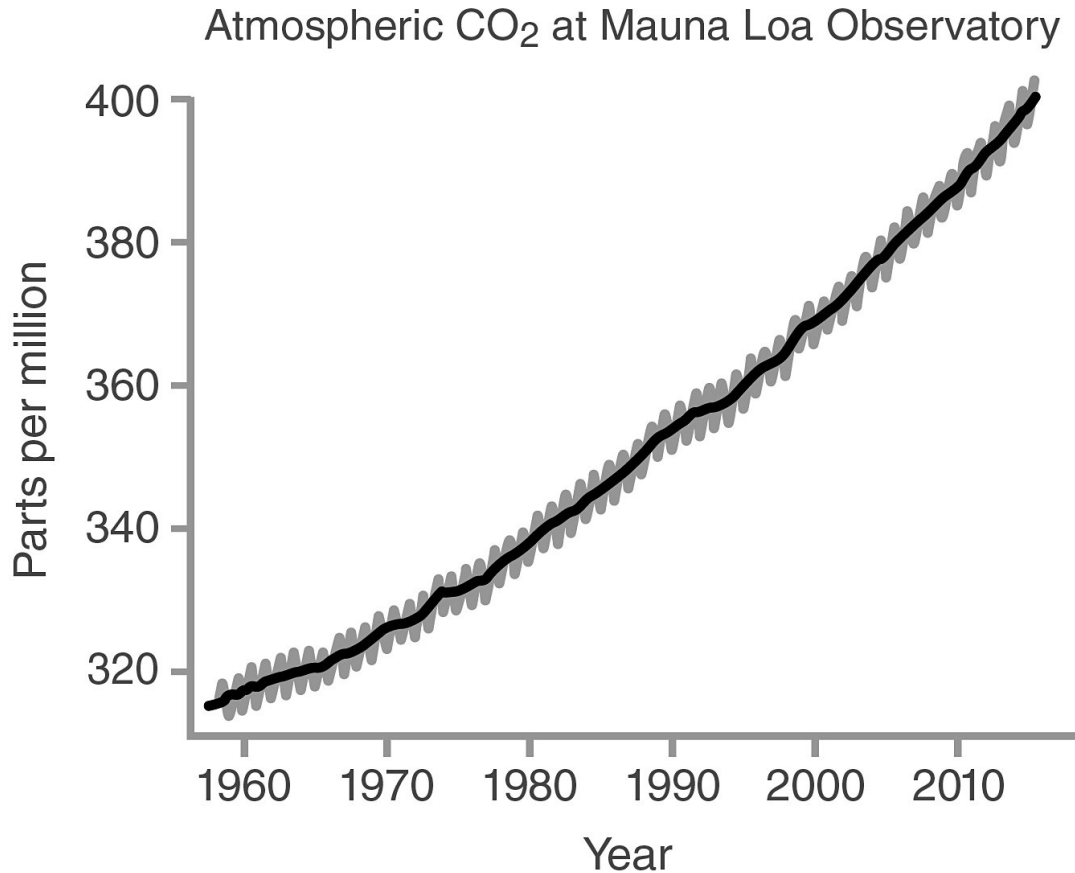
The number of grasshoppers in the west field treated only with water doubled after 10 weeks.

The number of grasshoppers in the east field treated with pesticide Z declined by 50% after 10 weeks.

- 29) Researchers wanted to determine whether pesticide Z is effective at killing grasshoppers that typically invade cornfields. Two 10-acre cornfields located 1 mile apart were chosen. The cornfield to the west was sprayed only with water. The cornfield on the east received the same amount of water with a 10% solution of pesticide Z. The number of grasshoppers in the fields was recorded every week for 10 weeks. The number of grasshoppers in the west field treated only with water doubled after 10 weeks. The number of grasshoppers in the east field treated with pesticide Z declined by 50% after 10 weeks. Discuss two problems with the design of this experiment, and propose solutions to these problems.

Answer: First, the cornfields need to be closer together. Two cornfields a mile apart are more likely to have other factors such as soil, slope, and even precipitation differences that might affect the study. It would be more appropriate to study cornfields right next to each other. A second problem is with the sample size. You cannot perform statistical analyses with sample sizes of only one plot, so the conclusions drawn that are based on the results of the experiment would not be scientifically sound. The researchers would be better off subdividing the fields and replicating the treatment on several plots. They could then run statistical analyses and draw more solid conclusions as to whether the difference between treatment and control is meaningful. (An alternative potential problem a student might point out is the difficulty of counting every grasshopper in a 10-acre cornfield, with the repeated disturbance potentially damaging the crop, and with the unreasonable amount of time and person-power required. The student could then propose instituting some kind of representative sampling method, such as a series of small traps that are open for a short length of time.)

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.



- 30) Which of the following is the most reasonable conclusion based on the data in the figure? 30) _____
- A) There is a great deal of uncertainty in measurements of global atmospheric carbon dioxide levels.
 - B) Average annual atmospheric carbon dioxide concentrations have been increasing since 1960.
 - C) Forest fires and fossil fuel combustion are increasing atmospheric carbon dioxide concentrations.
 - D) Carbon dioxide molecules multiply themselves over time.

Answer: B

- 31) Which of the following statements *best* illustrates bias in scientific investigations? 31) _____
- A) An experiment testing the effect of a new drug has only one control group.
 - B) Investigations of the cause of AIDS are limited by our inability to see viruses.
 - C) Researchers studying heron nests notice that some baby herons fall out of nests and are killed.
 - D) Investigations of the health effects of smoking are funded and published by a tobacco company.

Answer: D

- 32) What is an *essential* characteristic of the scientific method? 32) _____
- A) The questions asked are designed to always prove that the hypothesis is incorrect.
 - B) Uncertainty of the question becomes an absolute certainty after using the method.
 - C) Scientific observations always support the questions asked.
 - D) The hypotheses are always testable by careful observation and/or experiment.

Answer: D

- 33) An experiment _____. 33) _____
A) involves the manipulation of data
B) is designed to generate a new scientific hypothesis
C) is an activity designed to test the validity of a hypothesis
D) often involves manipulating as many variables as possible

Answer: C

- 34) Which of the following would be an emergent property of a motorcycle? 34) _____
A) It has two wheels, a seat, and a gas tank.
B) It is very expensive.
C) It can be used for travel from point A to point B.
D) It is made mostly of rubber, plastic, and metal.

Answer: C

- 35) Sustainable development _____. 35) _____
A) is hypothetically attainable but is beyond our current technologies
B) is technically impossible to accomplish, since resources would still be used up
C) involves using resources to meet today's needs without compromising future availability
D) ensures an economy that will decline over time, since our economy hinges on the assumption that resources are finite

Answer: C

- 36) Of the following, which is the *best* scientific hypothesis for the question, "How do bees help pollinate flowers?" 36) _____
A) We should help bees survive by planting more flowers that provide nectar and pollen.
B) Bees can see light-colored flowers better than dark-colored flowers.
C) Bees help transfer pollen as they visit flowers to eat the pollen and drink the nectar.
D) Bees are attracted to flowers by both color and smell.

Answer: C

- 37) A study's results are deemed worthy of acceptance into the body of scientific knowledge if they are published in journals that _____. 37) _____
A) charge a fee for acceptance
B) meet guidelines advocated by environmentalists or consumer groups
C) are funded by corporations funding the research
D) use the peer-review process

Answer: D

- 38) Which of the following research topics is most likely to require the use of models? 38) _____
A) The effectiveness of an influenza vaccine
B) The effects of creating a wolf-hunting season on gray wolf populations in Minnesota
C) The effects of wildfire on sapling recruitment in lodgepole pine forests
D) The effects of herbicide on dandelions and lawn grass

Answer: B

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- 39) Which field was the control? 39) _____
A) The west field
B) The east field
C) Both fields were controls for one another.
D) There were no controls in this experiment.

Answer: A

- 40) Which of the following does a scientist typically do immediately after collecting data in an experiment? 40) _____
A) Formulate a hypothesis
B) Publish results
C) Draw conclusions
D) Perform statistical analyses

Answer: D

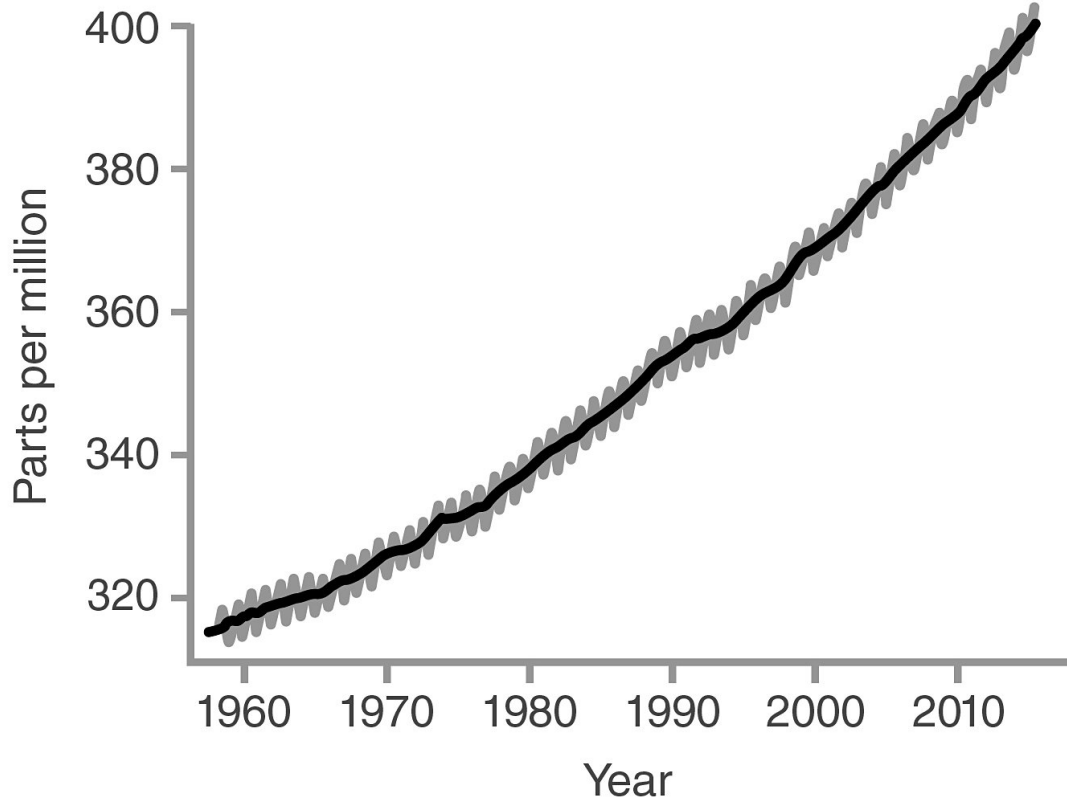
- 41) Negative feedback processes tend to function within an ecosystem to _____. 41) _____
A) stabilize it
B) cause ecological relationships to flourish
C) reinforce harmful changes
D) cause further ecological destruction

Answer: A

- 42) Which of the following statements *best* embodies the qualities of a scientific theory? 42) _____
A) Dangerous wildfires in California could be avoided by better fire prevention strategies.
B) All gases, liquids, and solids consist of atoms.
C) Squirrels in central Illinois prefer to build their nests in oak trees instead of hickory trees.
D) Prairies that have large herds of bison show greater plant diversity than prairies without bison.

Answer: B

Atmospheric CO₂ at Mauna Loa Observatory



43) How much higher is atmospheric CO₂ concentration at Mauna Loa Observatory in 2015 than it was in 1960? 43) _____

- A) 25% higher
- B) Twice as high
- C) Four times higher
- D) 80% higher

Answer: A

Answer Key

Testname: CHAPTER SS

- 1) C
- 2) C
- 3) A
- 4) B
- 5) A
- 6) B
- 7) A
- 8) A
- 9) D
- 10) C
- 11) Students' answers will vary but should include all of the following components:
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 - (b) treatment and control plots, assigned randomly (Zap-em plots need to be compared to plots not sprayed with Zap-em.);
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- 13) D
- 14) D
- 15) B
- 16) D
- 17) C
- 18) C
- 19) D
- 20) A
- 21) D
- 22) A
- 23) C
- 24) B
- 25) D
- 26) C
- 27) C
- 28) A
- 29) First, the cornfields need to be closer together. Two cornfields a mile apart are more likely to have other factors such as soil, slope, and even precipitation differences that might affect the study. It would be more appropriate to study cornfields right next to each other. A second problem is with the sample size. You cannot perform statistical analyses with sample sizes of only one plot, so the conclusions drawn that are based on the results of the experiment would not be scientifically sound. The researchers would be better off subdividing the fields and replicating the treatment on several plots. They could then run statistical analyses and draw more solid conclusions as to whether the difference between treatment and control is meaningful. (An alternative potential problem a student might point out is the difficulty of counting every grasshopper in a 10-acre cornfield, with the repeated disturbance potentially damaging the crop, and with the unreasonable amount of time and person-power required. The student could then propose instituting some kind of representative sampling method, such as a series of small traps that are open for a short length of time.)
- 30) B

Answer Key

Testname: CHAPTER SS

- 31) D
- 32) D
- 33) C
- 34) C
- 35) C
- 36) C
- 37) D
- 38) B
- 39) A
- 40) D
- 41) A
- 42) B
- 43) A