

Name _____

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



Use the accompanying figure to answer the following questions.

- 1) How many citizens of Haiti does it take to equal the ecological footprint of the average citizen of the United States?
- A) Twelve citizens of Haiti equal the ecological footprint of the average U.S. citizen.
 - B) Six citizens of Haiti equal the ecological footprint of the average U.S. citizen.
 - C) It takes over 100 Haitian citizens to equal the ecological footprint of the average U.S. citizen.
 - D) Ten citizens of Haiti equal the ecological footprint of one average U.S. citizen.
 - E) They are essentially equal.

Answer: A

1) _____

- 2) Nearly 50% of the land on our planet is currently used for agriculture, with very little more agriculturally usable land available. If everyone on the planet had an ecological footprint the size of the average citizen of the United States, then _____.

A) we would have 50% more food to go around
B) about 50% of the people would starve
C) we could support 50% more people on our planet
D) we would be able to provide for everyone without much difficulty, using the other 50% of the land currently not being used
E) we would need at least two more planet Earths to feed and support everyone

Answer: E

- 3) The U.S. average footprint is _____ times larger than the world average footprint.

A) 2 B) 2.7 C) 3.3 D) 5 E) 6.7

Answer: B

- 4) The global average footprint per person has increased from 2.2 to 2.7 hectares since 2008, including the footprints of many developing nations such as India and China. This means that _____.

A) our collective lifestyle is even more unsustainable than before
B) our collective lifestyle is slightly more sustainable than before
C) some nations no longer have a measurable footprint
D) the populations of both India and China have decreased since 2008
E) the ability of the planet to sustain human beings has increased

Answer: A

MATCHING. Choose the item in column 2 that best matches each item in column 1.

Match the following.

- 5) One of many scientific fields of study within the broad scope of environmental science

Answer: D

- A) interdisciplinary science

B) paradigm

- ## 6) Information expressed with numbers

Answer: C

- C) quantitative data

D) ecology

- 7) The variable that is manipulated

Answer: F

- E) prediction

- ### 8) Expectation of experimental outcome

Answer: E

- F) independent variable

G) dependent variable

H) qualitative data

9) Widely accepted, well-tested explanation of one or more cause-and-effect relationships

Answer: C

A) hypothesis

B) social science

C) theory

D) environmentalism

9) _____

10) Statement that attempts to explain a phenomenon or answer a scientific question

Answer: A

10) _____

11) The study of human interactions and institutions

Answer: B

11) _____

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

12) Which of the following discoveries would be most likely to cause a scientific paradigm shift?

A) the discovery of a new species of salamander in the Amazon rainforest

B) the discovery of more rings around Uranus

C) the discovery of a new pathogenic virus transmitted by mosquitoes

D) the discovery that a dormant volcano is showing signs of activity

E) the discovery that excess heat is radiating from the center of the earth and causing global climate change

Answer: E

12) _____

13) Global population is projected to be about _____ in 2050.

A) 7 billion

B) 8 billion

C) 9 billion

D) 11 billion

E) 13 billion

Answer: C

13) _____

14) The scientific method _____.

A) results in conclusions based on speculation

B) involves testing observations to derive a working hypothesis

C) now has been replaced by a widely accepted shortcut that is less time-consuming and less expensive

D) cannot prove a hypothesis to be true

E) results in the proving of a theory

Answer: D

14) _____

15) To determine your specific impacts on the environment, you can _____.

A) determine your environmental handprint

B) calculate the biodiversity of your local community

C) calculate your ecological footprint

D) measure local air pollution and its impacts on your health

E) determine your community's impact on water quality in a nearby river

Answer: C

15) _____

- 16) A hypothesis is _____. 16) _____
A) the design of an experiment that can be used in scientific enquiry
B) a prediction about something that has not yet been observed
C) a proven scientific fact
D) a statement that explains an observed phenomenon or answers a question
E) an instrument that is used to examine environmental conditions
Answer: D
- 17) Roberto lives near a wind farm and is wondering about the environmental effects of the wind turbines. He _____ that the turbines make a sound like faint airplane engines and also that there are far fewer meadowlarks living near the windfarm than lived there before the windfarm was built. 17) _____
A) observes
B) hypothesizes
C) guesses
D) predicts
E) theorizes
Answer: A
- 18) Roberto lives near a wind farm and is wondering about the environmental effects of the wind turbines. He _____ that the turbines, which sound like faint airplane engines, are scaring off meadowlarks that used to nest in the area. 18) _____
A) theorizes
B) hypothesizes
C) hopes
D) predicts
E) observes
Answer: B
- 19) In a manipulative experiment _____. 19) _____
A) a scientist has been caught manipulating the data for economic gain
B) researchers manipulate as many variables as possible
C) the peer review process is bypassed
D) researchers manipulate the independent variable
E) replication of the experiment is not necessary
Answer: D
- 20) An environmental scientist is least likely to be involved with which of the following? 20) _____
A) studying X-ray emissions for evidence of black holes
B) studying the relationship between soil fungi and aspen trees in areas that are being restored after oil sand mining
C) helping a rancher determine the best ways to rotate herds of cattle to reduce erosion
D) determining the best fuel to generate electricity for a growing city in Arizona
E) launching NASA satellites that monitor changes in carbon dioxide production on Earth
Answer: A

- 21) Which of the following terms *best* describes the practice of environmental science? 21) _____
- A) integrative and interdisciplinary
 - B) theoretical and controversial
 - C) elitist and unnecessary
 - D) highly specialized and focused
 - E) abstract and theoretical
- Answer: A
- 22) Natural resources are _____. 22) _____
- A) resources provided by the Earth that are renewable and inexhaustible
 - B) the substances and energy sources that we take from the environment
 - C) resources provided by the Earth that are rapidly depleted by human societies
 - D) services provided by humans to help maintain ecosystems and their vital processes
 - E) nonrenewable materials provided by the Earth that are formed slowly over millions of years
- Answer: B
- 23) Solutions to environmental problems _____. 23) _____
- A) must work on a global scale
 - B) must always be designed and discussed in the political arena before implementation
 - C) should be designed with the goal of sustaining Earth's natural capital
 - D) must focus on short-term fixes because long-term solutions are generally unattainable
 - E) can be implemented only by scientists
- Answer: C
- 24) 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? 24) _____
- A) Ruben needs to take careful measurements of Paddington's weight and height at least once a week for it to be a good experiment.
 - B) This is an example of an excellent, controlled experiment as it is written.
 - C) Ruben needs to control for the amount of exercise, sunshine, water, and care that Paddington gets each week, so that they are equal from week to week.
 - D) Ruben needs to feed his mother's 6-year-old chocolate Shar-Pei named SallyJo a standard diet so that he can compare Paddington to a control.
 - E) This is a poorly designed experiment, because there are no control dogs and no treatment replicates.
- Answer: E
- 25) The process by which several researchers review another researcher's manuscript prior to publication to ensure research quality is referred to as _____. 25) _____
- A) investigative inquiry
 - B) overkill
 - C) critical analysis
 - D) quality control
 - E) peer review
- Answer: E

- 26) Geothermal energy, wind energy, and solar radiation are all examples of _____. 26) _____
- A) nonrenewable resources
 - B) biotic environmental factors
 - C) renewable environmental resources
 - D) biodegradable materials
 - E) biodiversity

Answer: C

- 27) Which of the following BEST embodies the qualities of a scientific theory? 27) _____
- A) Squirrels in central Illinois prefer to build their nests in oak trees instead of hickory trees.
 - B) Dangerous wildfires in California could be avoided by better fire prevention strategies.
 - C) All gases, liquids, and solids consist of atoms.
 - D) Students who study for their environmental science exams will perform better on those exams than those who do not.
 - E) Prairies that have large herds of bison show greater plant diversity than prairies without bison.

Answer: C

- 28) Ecosystem services _____. 28) _____
- A) are economically valuable services provided by natural systems
 - B) are valuable to natural systems but not to human-created systems
 - C) are required to rebalance natural systems that we have disturbed
 - D) contribute to keeping ecosystems productive
 - E) are actions humans must take in order to protect and serve ecological systems

Answer: A

- 29) The concept of sustainable development includes _____. 29) _____
- A) convenience and global economic improvements
 - B) the needs of future generations
 - C) the importance of developing the arts
 - D) each nation being sovereign over its own resources, to be used as its citizens deem appropriate
 - E) growth in profits from international trade

Answer: B

- 30) You have read about the mistakes made on Easter Island. On Tikopia, a small island in the Solomon Islands, the people acted in other ways. When they realized that the pigs they had imported were damaging the environment, they killed them all. They had to have permission from a chief to fish, which prevented overfishing. They also practiced contraception. These actions all indicate that _____. 30) _____
- A) they felt that everything was a nonrenewable resource
 - B) they believed in full resource utilization
 - C) they felt that everything was a renewable resource
 - D) they were concerned with only one year at a time
 - E) they were attempting to enact sustainability

Answer: E

- 31) Which of the following actions would increase the size of a person's ecological footprint? 31) _____
- A) turning down the thermostat in the winter
 - B) planting a vegetable garden
 - C) moving out of mom and dad's basement into one's own house
 - D) installing a photovoltaic solar panel on one's roof
 - E) taking public transportation instead of driving

Answer: C

- 32) What type of graph would be best for showing the relationship between two quantitative variables? 32) _____
- A) statistics table
 - B) pie chart
 - C) data table
 - D) scatter plot
 - E) bar graph

Answer: D

- 33) In a controlled experiment, _____. 33) _____
- A) the researcher controls for the effects of all variables except one
 - B) the researcher knows the outcome before beginning the experiment
 - C) the researcher has several hypotheses, one of which will be proven correct
 - D) you need only a single experimental organism which is tested again and again
 - E) the researcher controls for the effects of only one variable

Answer: A

- 34) All of the following are examples of quantitative data EXCEPT _____. 34) _____
- A) the amount of sleep normally gotten by the students in a class
 - B) the number of siblings that students have
 - C) the gender of the students in a class
 - D) the cholesterol levels of the students in a class
 - E) the exam scores for the students in a class

Answer: C

- 35) When does peer review occur during the scientific process? 35) _____
- A) after the paper (manuscript) is written and before it is published
 - B) during the statistical analysis of the data collected
 - C) during the research phase of a project
 - D) after the research is complete and before the paper (manuscript) is written
 - E) after the paper (manuscript) is published

Answer: A

- 36) A study's results are deemed worthy of acceptance into the body of scientific knowledge if they are published in journals which _____. 36) _____
- A) conform to current political and religious views
 - B) use the peer review process
 - C) meet guidelines advocated by environmentalists or consumer groups
 - D) charge a high fee for acceptance
 - E) are funded by corporations financing the research

Answer: B

37) What type of graph would be best for showing means for several different treatments?

37) _____

- A) line graph
- B) pie chart
- C) scatter plot
- D) bar graph
- E) data table

Answer: D

38) Which of the following lists the steps of the scientific method in correct order?

38) _____

- A) Hypothesis → Prediction → Questions → Observations → Test → Results
- B) Hypothesis → Prediction → Questions → Test → Observations → Results
- C) Observations → Questions → Hypothesis → Prediction → Test → Results
- D) Questions → Observations → Prediction → Hypothesis → Test → Results
- E) Questions → Prediction → Hypothesis → Observations → Test → Results

Answer: C

39) What is a key "take-home message" about Easter Island?

39) _____

- A) The invasive brown tree snake can wipe out an entire population of humans in a short amount of time.
- B) Humans that live in tropical areas will not die of exposure to extremely low temperatures.
- C) Tropical soils are insufficient for growing enough crops for a population to be self-sustaining.
- D) An island population must live as responsible stewards of its resources.
- E) Making and placing large stone statues is a waste of time.

Answer: D

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

40) 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.

41) Use the assessment tool at www.ecologicalfootprint.com or some other website that calculates your ecological footprint to calculate your ecological footprint. Once you determine the factors that evaluate your use of water, energy, waste disposal, transportation, and food consumption, use the results of your specific ecological footprint to determine three *specific* actions you can take to *reduce the size* of your ecological footprint. Make sure that your specific actions each fit into a different category (water, energy, waste, transportation, and food). Summarize your assessment.

Answer: The answers will vary based on results of individual student lifestyle. Students can reflect on their results and could then consider making lifestyle adjustments that support a greater environmental sustainability.

42) Differentiate between environmental science and environmentalism. Define each term and explain how they are similar and how they differ.

Answer: Environmental science is the pursuit of knowledge about the workings of the environment and our interactions with it. Environmentalism is a social concern focused on protecting the natural environment and, by extension, humans, from undesirable changes brought about by certain human choices. Environmental scientists and environmentalists study the same issues, but environmental scientists use an objective scientific approach to understanding environmental problems. Environmentalists, on the other hand, may use dramatic and often emotional approaches to alter the political and social understanding or to educate the public about environmental problems.

43) Compare and contrast the types of knowledge gained and the research methods of natural and social sciences when considering environmental problems. Why do both types of disciplines need to be a part of environmental science?

Answer: The natural sciences are made up of disciplines that study the physical and biological facets of the natural world and their interactions with each other. These disciplines rely on all types of studies that generate mainly quantitative data, allowing scientists to acquire and interpret information about the natural world. The social sciences are made up of disciplines that study human behaviors, interactions, and institutions. The scientists in these disciplines mainly collect qualitative data using a variety of research techniques that are similar to natural scientists. Studies that examine how cultures perceive an environmental concept may be used to implement environmental policy. Because environmental problems involve accurate assessment of the scope of the problem by which policy that affects humans is devised, both types of sciences are needed to be a part of environmental science.

44) What qualities are present in an endeavor that is sustainable?

Answer: A sustainable endeavor is one that allows future generations to carry it on at the same level of productivity that we do at present. Whatever natural capital is required will remain equally available in the future as it is now. The environmental effects of the enterprise will not damage, degrade, or deplete the systems with which it interfaces. Materials and energy will be used efficiently, wastes will be minimal and nontoxic, and the ecological footprint of the enterprise will remain unchanged or may diminish as better technology becomes available.

45) Discuss the differences between a manipulative experiment and a natural experiment.

Answer: In a manipulative experiment, the researcher chooses and manipulates the independent variable while controlling for the effects of other variables, but in a natural experiment the researcher records differences in variables as they are expressed in the natural environment, such as the mean weight of tomatoes grown in dry versus wet climates. In such experiments, the independent variable varies naturally, and effects of other variables are not necessarily controllable.

46) 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)
- D. use of statistical analysis to analyze the data

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

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 try comparing the dogs and the diet that they feed them to test their hypothesis that the local veterinarian's special dog food mix will enhance growth development. Each student adopts a puppy from the local pound. Pablo plans to feed his goldendoodle the special diet, while Johanna plans to use generic dry kibble from the supermarket for her bulldog.

- 47) The independent variable in this study will be _____. 47) _____
- A) how much the dogs grow
 - B) the age of the dogs
 - C) the sex of the dogs
 - D) the type of food the dogs receive
 - E) the breed of the dogs

Answer: D

- 48) One dependent variable in this study will be _____. 48) _____
- A) the breed of the dogs
 - B) the sex of the dogs
 - C) the age of the dogs
 - D) how much the dogs grow
 - E) the type of food the dogs receive

Answer: D

- 49) When they write up their initial proposal, the instructor will probably _____. 49) _____
- A) tell them that they need at least 100 dogs to do the study
 - B) tell them they have some serious problems with the proposal, but it is fixable if they are willing to find more dogs for their study
 - C) tell them that the proposal is impossible and that such a study cannot be done at all
 - D) give them an F and tell them to start over—it would take many years to do such a study
 - E) give them an A for thoroughness and allow them to proceed with the experiment

Answer: B

- 50) Pablo and Johanna have too many _____. 50) _____
- A) variables that they didn't control and not enough replicates
 - B) replicates and not enough variables
 - C) independent variables and not enough dependent variables
 - D) controlled variables and not enough uncontrolled variables
 - E) dependent variables and not enough independent variables

Answer: A

- 51) Pablo and Johanna appear not to have given consideration to the importance of controlling for _____. 51) _____
- A) possible differences resulting from using two different breeds of dog
 - B) the age of the dogs
 - C) the source of the dog food
 - D) the possibility that one dog food is healthier than the other dog food
 - E) the food that the dogs are being fed

Answer: A

Read the following scenario and answer the questions below.

After meeting with their instructor, Pablo and Johanna know that they need to change their experimental design. They contact puppy farm and arrange to do their study with 3-month-old litters of pups from four Irish setters, for a total of 24 puppies consisting of 12 females and 12 males.

52) In order to have two groups of puppies (control and experimental), Pablo and Johanna should _____ 52) _____

- A) put the 12 females in one group and the 12 males in the other group
- B) put all the puppies from two of the litters in one group and all of the puppies from the other two litters in the other group
- C) randomly choose one dog for the control group and use the other 23 in the experimental group
- D) put 6 males and 6 females in each group, with some from each litter in each group
- E) flip a coin for each dog to see which group it will be in

Answer: D

53) Pablo and Johanna should probably run the experiment _____ 53) _____

- A) for one month, weighing and measuring the pups before and after
- B) for at least three years, weighing and measuring the pups every week
- C) for several months, weighing and measuring the pups before and after
- D) for several months, weighing and measuring the pups twice every day
- E) for several months, weighing and measuring the pups every week

Answer: E

54) If the puppies in the experimental group gain, on average, 3 pounds more than those in the control group over a 4-month period and seem healthier and more energetic, then _____ 54) _____

- A) there is a high probability that the veterinary diet is better than kibble for all dogs
- B) they have proven that the kibble diet is best for female dogs
- C) there is a high probability that the kibble is better for puppies
- D) there is a high probability that the veterinary diet is better than kibble for puppies
- E) they have proven the veterinary diet is best for all dogs

Answer: D