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Correct Answers are located at the end of each chapter.

CHECK ALL THE APPLY. Choose all options that best completes the statement or answers the question.

1) Which of the following is/are true concerning emerging and reemerging diseases?
   A) Scientists are only concerned by emerging disease.
   B) COVID-19 is an example of an emerging disease.
   C) Both emerging and reemerging diseases have the potential to cause global health issues.
   D) Emerging and reemerging diseases are always caused by viruses.

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

2) Organs are composed of tissues, which are composed of cells. This is an example of which characteristic of life?
   A) Living things grow and develop.
   B) Living things respond to stimuli.
   C) Living things maintain themselves by homeostasis.
   D) Living things have levels of hierarchical organization.
   E) Living things are adapted to the environment.

3) The smallest structural and functional unit in a multicellular organism is a(n)
   A) cell.
   B) tissue.
   C) organ.
   D) organ system.
   E) organism.

4) Which level of biological organization is composed of several tissues?
   A) organism
   B) organ system
   C) organ
   D) cell
   E) molecules

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5) Which sequence correctly lists the different levels of biological organization, from the smallest and simplest to the largest and most complex?
   A) cells-organs-tissues-organ systems-organism
   B) cells-tissues-organ systems-organs-organism
   C) tissues-cells-organs-organ systems-organism
   D) tissues-organs-organ systems-organism-cells
   E) cells-tissues-organs-organ systems-organism

6) Bacteria and other single-celled organisms split in two, producing identical copies of themselves. This is an example of which characteristic of life?
   A) Living things reproduce and develop.
   B) Living things respond to stimuli.
   C) Living things maintain themselves by homeostasis.
   D) Living things have levels of hierarchical organization.
   E) Living things are adapted to the environment.

7) Which sequence of classification categories is in the proper order from least to most inclusive?
   A) genus, class, kingdom, domain, order, phylum, species, family
   B) domain, class, genus, family, species, order, phylum, kingdom
   C) species, genus, family, order, class, phylum, kingdom, domain
   D) genus, species, order, class, family, kingdom, domain, phylum
   E) species, genus, family, class, order, phylum, kingdom, domain

8) What is the correct format for the binomial name of a manatee?
   A) *Trichechus Manatus*
   B) *trichechus manatus*
   C) TRICHECHUS manatus
   D) *Trichechus manatus*
   E) *trichechus*
   Manatus

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9) Corn belongs to the kingdom
   A) Plantae.
   B) Animalia.
   C) Fungi.
   D) Protista.
   E) Archaea.

10) The three major domains of life are
   A) plantae, animalia, and archaea.
   B) bacteria, fungi, and eukaryotes.
   C) eukarya, prokarya, and animalia.
   D) archaea, bacteria, and eukarya.
   E) eukarya, prokarya, and fungi.

11) A multicellular, photosynthetic organism with complex, specialized cells and tissues would most likely be assigned to
   A) kingdom Animalia.
   B) kingdom Fungi.
   C) domain Archaea.
   D) kingdom Protista.
   E) kingdom Plantae.

12) Regions of the earth inhabited by living organisms are known collectively as
   A) the biosphere.
   B) an ecosystem.
   C) a population.
   D) an organism.
   E) a community.

13) All the populations living within a given area constitute a(n)
   A) biosphere.
   B) ecosystem.
   C) population.
   D) domain.
   E) community.

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14) A community of populations, along with the surrounding physical environment, constitutes a(n)
A) biosphere.
B) ecosystem.
C) population.
D) habitat.
E) community.

15) The most important factor that determines where major ecosystems are found in the biosphere is
A) soil type.
B) available vegetation.
C) climate.
D) oxygen levels.
E) political boundaries.

16) The term "biodiversity" refers to
A) a study of the physical, non-living components of an ecosystem.
B) the similarities between species.
C) the rate of extinction of species due to human activities.
D) the total number of species, variation of species, and the ecosystems in which they live.
E) the study of food chains within an ecosystem.

17) An informed statement that can be tested in a manner suited to the processes of science is known as a <!--Markup Copied from Habitat-->
A) hypothesis.
B) phenomenon.
C) control.
D) variable.
E) theory.

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18) Which answer choice lists the steps of the scientific method in the correct order?
A) hypothesis, observation, experiment, conclusion, data collection
B) conclusion, hypothesis, observation, experiment, data collection
C) observation, hypothesis, experiment, data collection, conclusion
D) observation, experiment, hypothesis, conclusion, data collection
E) data collection, conclusion, hypothesis, experiment, observation

19) Which of the following is one of the domains of life?
A) Animalia
B) Eukarya
C) Plantae
D) Protista
E) Fungi

20) Technology is the
A) application of scientific knowledge to the interests of humans.
B) study of living organisms.
C) study of the interactions between living organisms and their environment.
D) application of common knowledge for a practical purpose.
E) application of laws to benefit society.

21) A physician specializes in surgery involving the following group of organs: mouth, esophagus, stomach, and intestines. Overall, what is the highest level of organization that this physician is specialized in?
A) cell
B) tissue
C) organ
D) organ system
E) organism

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22) Which statement about living organisms is false?
A) Living organisms create energy.
B) Living organisms maintain homeostasis.
C) Living organisms reproduce.
D) Living organisms have adaptations.
E) Living organisms grow and develop.

23) When you are overheated, you perspire, and when you are too cold, you shiver to generate heat. Which property of life is best represented by this example?
A) homeostasis
B) development
C) behavior
D) organization
E) adaptation

24) The body temperature in humans is maintained around 37°C. Which characteristic of life does this information represent?
A) Living organisms acquire materials and energy from the environment.
B) Living organisms maintain homeostasis.
C) Living organisms adapt.
D) Living organisms grow and develop.
E) Living organisms respond to stimuli.

25) The bones in a bird are hollow, reducing its weight for flight. This is an example of which characteristic of life?
A) Living organisms grow and develop.
B) Living organisms acquire materials and energy from the environment.
C) Living organisms reproduce.
D) Living organisms adapt to their environment.
E) Living organisms are homeostatic.

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26) Which classification category includes the most species?
A) family
B) genus
C) class
D) phylum
E) kingdom

27) Which of these classification categories contains the most closely related group of organisms?
A) domain
B) genus
C) family
D) phylum
E) kingdom

28) The common name for "cat" in Spanish is "gato" and in Chinese is "mao." Which of the following statements pertaining to the use of scientific names instead of common names is false?
A) Common names may refer to more than one kind of organism.
B) Scientific names can be known and recognized by all scientists throughout the world.
C) The scientific name is related to the classification of that organism.
D) The common name more clearly identifies an organism as unique than does the scientific name.

29) All the banded sunfish (*Enneacanthus obesus*) in a pond would comprise a(n)
A) population.
B) ecosystem.
C) community.
D) biosphere.
E) species.

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30) When comparing energy and chemicals in an ecosystem
A) both chemicals and energy cycle over and over again.
B) chemicals cycle over and over again but energy does not cycle.
C) neither chemicals nor energy cycle.
D) energy cycles over and over again but chemicals do not cycle.

31) When researchers test a new human cancer drug using mice, the mice constitute the
A) hypothesis.
B) data.
C) experimental design.
D) model.
E) control.

32) Which of the following domains contains organisms that are adapted to life in extreme environments?
A) domain Archaea
B) domain Bacteria
C) domain Eukarya
D) domain Animalia
E) domain Plantae

33) Which domains contain organisms that lack a membrane-bound nucleus?
A) Archaea and Bacteria
B) Archaea and Eukarya
C) Bacteria and Eukarya
D) Eukarya and Animalia
E) Archaea and Animalia

34) Which of the following is a true statement regarding extinction predictions?
A) It is estimated that as much as 10% of all species may be in danger of extinction before the end of the century.
B) Coral reef ecosystems are far more threatened than tropical rainforest ecosystems.
C) Extinctions are rarely related to climate change.
D) Current rates of extinction may eventually equal the rates of the 5 previous mass extinctions.

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35) Wood becomes petrified when its tissues are replaced by minerals. Although petrified wood is no longer part of a living organism, which property of life will still be present in the wood?
A) organization
B) homeostasis
C) growth and reproduction
D) response to stimuli
E) metabolism

36) An unoccupied spacecraft has been sent to another planet to detect new life forms. If the probe could only send back one image, which property or properties of life would be observable in the picture?
A) organization
B) homeostasis and metabolism
C) growth
D) response to stimuli
E) evolution

37) Ever since the antibiotic drug penicillin was discovered in 1928, the incidence of resistant bacteria has steadily increased as a direct result of
A) biodiversity.
B) natural selection.
C) homeostasis.
D) development.
E) reproduction.

38) Nutrient molecules obtained from the food we eat are used to build cellular structures or for energy. This best represents which characteristic of life?
A) Living things acquire materials and energy from the environment.
B) Living things are homeostatic.
C) Living things are adapted.
D) Living things grow and develop.
E) Living things respond to stimuli.

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39) You have discovered a previously unknown organism. It is multicellular with a filamentous form, and it absorbs food from its environment. Upon microscopic examination, you see that the cells have nuclei. How would you classify this organism?

A) domain Bacteria
B) kingdom Animalia
C) kingdom Protista
D) kingdom Fungi
E) kingdom Plantae

40) Which of these is an example of inductive reasoning used to form a hypothesis?

A) Every fungus that has ever been studied absorbs its food; therefore, food absorption is characteristic of fungi.
B) All fungi absorb their food; if mushrooms are fungi, then the mushroom absorbs its food.
C) A mushroom is classified in the kingdom Fungi of the domain Eukarya.
D) The cell from a mushroom has a nucleus.
E) Fungi are not capable of photosynthesis.

41) You are conducting an experiment to determine which brand of fertilizer results in the greatest amount of fruit production by tomato plants. In this example, the response variable would be the

A) brand of fertilizer.
B) unfertilized tomato plants.
C) fertilized tomato plants.
D) amount of fruit produced by the tomato plants.
E) variety of tomato plants.

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42) Which of the following might plausibly be said by a scientist?
A) Although no one else gets the same results as I do, since I get the results in my experiments, it is still science.
B) Since all the accumulated body of data support it, my hypothesis is undoubtedly "true."
C) Test methods are unimportant since anyone can run another test; it is the results that make the substance of science.
D) The test's results and conclusion finish the scientist's job; it is enough that a scientist alone knows the results.
E) There is always a possibility that a more advanced experiment might falsify my hypothesis.

43) Which of the following is a potential consequence if the agricultural industry produced food without the use of technology?
A) There could be a significant decrease in the amount of food produced.
B) There would be a collapse of many of the terrestrial ecosystems on Earth.
C) The extinction of the top level species that reside in the communities around the agricultural land.
D) The amount of food produced would increase.
E) None of these consequences will occur if people stop using technology in the agriculture industry.

44) Which of the following represents a potential threat to biodiversity?
A) People construct artificial reefs to support marine life.
B) Humans clear land for agriculture and housing.
C) Energy flows through an ecosystem, with much lost as heat.
D) Tropical rain forests and coral reefs are found where solar energy is the most abundant.
E) In a food chain, one organism feeds on another.

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45) Which statement regarding science and technology is true?

A) Science, without the assistance of technology, has brought about life-improving discoveries, such as antibiotics.
B) Technology, without the assistance of science, helps us to understand the causes of cancer.
C) Science is defined as the application of technological knowledge. <!--Markup Copied from Habitat-->
D) Combining both science and technology may ease the feeding of the world population by producing new plant strains.

46) If a new anti-cancer drug is found to be effective in initial tests with mice, what might researchers conclude?

A) If the drug was effective in a large number of mice, it will therefore be effective in humans.
B) If the drug was effective in a small proportion of mice, it will be effective in a small proportion of humans.
C) The mice have provided a positive control in this experiment that proves the drug is effective in humans.
D) The drug is effective in the mouse model; it must still be tested in humans.
E) The effect of the drug on mice has no bearing on the effect of the drug on humans.

47) Some students consume large amounts of coffee and so-called energy drinks to help them stay alert when studying. You notice that many who engage in this practice seem to do poorly on exams. Suppose you want to investigate the relationship between caffeine consumption and exam performance. Which of the following statements would be an appropriate hypothesis?

A) Consuming large amounts of caffeine while studying reduces performance on exams.
B) One should avoid consuming too much caffeine while studying.
C) Too much caffeine is harmful to your health.
D) Many students consume large amounts of caffeine while studying.
E) Caffeine increases alertness but also increases anxiety.

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48) You are conducting an experiment to determine what concentration of disinfectant is most effective in killing bacteria. In this example, the concentration of disinfectant would represent the
A) control.
B) experimental variable.
C) response variable.
D) data.
E) hypothesis.

49) In the late 1800s, Louis Pasteur was searching for a vaccine for anthrax in livestock. One French veterinarian had a local reputation for being able to cure anthrax by applying oils and wrapping the animal in cloth to induce a fever. Pasteur also knew that some animals recovered well on their own when left untreated. Pasteur tested the effectiveness of the local veterinarian's methods by injecting four cattle with anthrax bacteria. He then directed the veterinarian to perform his procedures on two cattle. The other two cattle were left alone. What is the rationale for Pasteur's experimental design?
A) Two cattle represent a test of the veterinarian's hypothesis; two represent a test of Pasteur's hypothesis.
B) Two cattle represent a test of the treatment; two serve as a control to determine the likelihood of survival without treatment.
C) Two cattle represent a test based on inductive reasoning; two serve to test deductive reasoning.
D) The two cattle that are treated are the only test being conducted; the other two cattle serve no purpose beyond representing all the untreated cattle in France.
E) The two cattle not being treated were just a whim on Pasteur's part.

50) As the human population size increases
A) ecosystems remain unaffected.
B) fewer fossil fuels are burned and carbon dioxide levels remain constant.
C) it becomes evident that preserving the biosphere has no benefit to humans.
D) fewer ecosystems are destroyed, resulting in an abundance of biodiversity.
E) biodiversity is adversely affected as humans have destructive effects on ecosystems.

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51) Which statement about ecosystems is true?

A) Chemicals flow through ecosystems in a one-way direction and are not recycled.
B) Energy continually cycles through an ecosystem.
C) Some organisms can produce their own food and these organisms form the base of the food chain.
D) Within an ecosystem there is a community of organisms, but non-living components are absent.
E) The location of ecosystems around the world appears to be random. There is no relationship between ecosystem location and factors like climate.

52) In the late 1800s, Louis Pasteur was searching for a vaccine for anthrax in livestock. One French veterinarian had a local reputation for being able to cure anthrax by applying oils and wrapping the animal in cloth to induce a fever. Pasteur also knew that some animals got well on their own when left untreated. Pasteur tested the effectiveness of the local veterinarian's methods by injecting four cattle with anthrax bacteria. He then directed the veterinarian to perform his procedures on two cattle. The other two cattle were left alone. One cow from each group died and the other one in each group survived. Pasteur dismissed the veterinarian's procedure as ineffective, but he also considered this to be a poor test. Why would he consider this to be a poor test?

A) The difference in survival between the two groups was not dependent on the treatment.
B) In a small group with 50% survival, the treated cows would have survived anyway.
C) The number of cows that survived was the same as the number of cows that died.
D) With such a small group, you cannot determine if survival was dependent on the treatment or random chance.
E) The production of a fever in the treated cattle interfered with the outcome.

53) Which of the following statements regarding the scientific method is false?

A) Inductive reasoning is used to form a hypothesis.
B) Observations are used to form a hypothesis.
C) Experiments need to be repeatable.
D) The control and experimental groups are identical except for one variable.
E) The response variable is also known as the independent variable.

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54) All of the following statements regarding the scientific method are correct except
A) Scientific studies are reported in scientific journals.
B) At the end of an experiment, a hypothesis is determined to be absolutely true or absolutely false.
C) The control is not subjected to the experimental variable.
D) Data is analyzed using statistical tests.
E) When analyzing data, the lower the p-value, the greater the confidence in the results.

55) The statement “plants grown from cross-pollinated seeds will grow taller and produce more fruit than plants grown from self-pollinated seeds” is an example of a(n)
A) hypothesis.
B) theory.
C) scientific principle.
D) scientific law.
E) experimental design.

56) Historically, the protists were classified in "kingdom Protista." Recently, however, the protists were reclassified into "supergroups." What was the reason for this reclassification?
A) There were too many protist species to fit into a single kingdom.
B) Scientists decided to reclassify protists based on their nutritional mode. For example, all the photosynthesizers were placed together into one supergroup.
C) Scientists reclassified protists based on how many cells the organism contains. For example, there is a supergroup for one-celled organisms, a supergroup for two-celled organisms, etc.
D) New DNA evidence suggests that not all protists share a common ancestor and therefore their classification needed to be reorganized.

57) While exploring a river deep in the Amazon, you discover a new protists. The protist is green and photosynthesizes. In which supergroup will your new protist be classified?
A) Chromalveolata
B) Archaeplastida <!--Markup Copied from Habitat-->
C) Excavata
D) Amoebozoa <!--Markup Copied from Habitat-->
E) Opisthokonta <!--Markup Copied from Habitat-->

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Answer Key

Test name: Chapter 01

1) [B, C]
2) D
3) A
4) C
5) E
6) A
7) C
8) D
9) A
10) D
11) E
12) A
13) E
14) B
15) C
16) D
17) A
18) C
19) B
20) A
21) D
22) A
23) A
24) B
25) D
26) E
27) B
28) D
29) A
30) B
31) D
32) A
33) A
34) D
35) A
36) A
37) B

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38) A
39) D
40) A
41) D
42) E
43) A
44) B
45) D
46) D
47) A
48) B
49) B
50) E
51) C
52) D
53) E
54) B
55) A
56) D
57) B

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ORGANIZATION OF THE INSTRUCTOR'S MANUAL

Chapter Contents

Learning Outcomes
Learning outcomes presented in the Instructor's Manual give the instructor a quick overview of the major themes covered in the chapter.

Lecture Outline
Each chapter in *Inquiry into Life* begins with a "Chapter Outline." This outline is expanded with annotations in the Instructor's Manual and has several functions. An instructor can use it for their lecture notes since it contains the important concepts from the textbook and is cross-referenced to topic headings in the textbook. The outline can be made into Microsoft Office PowerPoint slides so students can follow along with the lecture, or an instructor may reproduce the extended outline to give to students before or after the lecture on that particular chapter. The organization of lecture concepts is a critical decision made by each instructor. A disorganized presentation is difficult for students to follow, and the distinct concepts may not build to an overall understanding. The selection of examples to illustrate concepts, the selection of which concepts to represent, and in what order they should be presented are critical factors in good teaching. The organization given here reflects the organization and voice of the textbook authors, Sylvia Mader and Michael Windelspecht.

Lecture Enrichment Ideas
This section suggests unique presentation and lecture strategies and methods to involve students in and out of the classroom. These topics and projects are not all inclusive but may help an instructor try something new and increase the interest of students. Lists of suggested term paper topics are provided so a teacher does not have to "reinvent the wheel."

Essay Questions with Answers
Each section contains several essay questions with answers for inclusion on student performance evaluations.

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CHAPTER 1: BIOLOGY: THE STUDY OF LIFE

LEARNING OUTCOMES

1.1 The Characteristics of Life

1. Identify the basic characteristics of life.
2. Distinguish between the levels of biological organization.
3. Recognize the importance of adaptation and evolution to life.

1.2 The Classification of Life

1. Distinguish between taxonomy and systematics.
2. Distinguish between the three domains of life.
3. Explain the role of supergroups in the classification of life.

1.3 The Process of Science

1. Identify the components of the scientific method.
2. Distinguish between a theory and a hypothesis.
3. Analyze a scientific experiment and identify the hypothesis, experiment, control groups, and conclusions.

1.4 Science and the Challenges Facing Society

1. Distinguish between science and technology.
2. Summarize some of the major challenges facing science.

LECTURE OUTLINE

1.1 The Characteristics of Life

The diversity of life seems overwhelming, and yet all living things have certain characteristics in common.

Life Is Organized

Organisms can be organized in a hierarchy of levels. A **cell** is the smallest unit of life.

Life Requires Materials and Energy

Organisms need an outside source of materials and **energy** to maintain their organization or carry on life's other activities.

Life Has the Capacity to Reproduce and Develop

All forms of life have the capability to make another organism like themselves. The union of sperm and egg proceeds through stages of development.

Life Responds to Its Environment

All life responds to external stimuli, often by moving toward or away from a stimulus such as the sight of food.

Life Maintains an Internal Environment

Many of the metabolic activities of a cell or organism function in maintaining *homeostasis*—a constant internal environment.

Life Has the Ability to Adapt

Evolution is the process by which a population changes over time. These changes are adaptations to the environment that enable an organism to successfully survive and reproduce and lead to the diversity of life.

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1.2 The Classification of Life

Taxonomy is the discipline of grouping and organizing organisms according to certain rules.
Systematics is the study of the evolutionary relationships between species.

Domains

Biologists classify all life as belonging to one of three *domains:* **Archaea, Bacteria,** and **Eukarya.**

Eukaryotic Supergroups and Kingdoms

Eukarya have been classified into four kingdoms: **protists, fungi, plants,** and **animals.** **Supergroups** have also been developed to account for evolutionary relationships between these four kingdoms.

Additional Levels of Classification

Other categories include **phylum, class, order, family, genus,** and **species.** Each of these categories is more specific than the one preceding it.

Scientific Names

Taxonomists use a specific binomial system in which each organism is identified by a *Genus* name followed by a *species* name, written in italics.

1.3 The Process of Science

Science is an objective way of knowing about the natural world based on the *scientific method,* a standard series of steps used in gaining new knowledge that is widely accepted among scientists.

Observation

Nature is orderly and measurable, so a natural event, or *phenomenon,* can be understood more fully through *observation.*

Hypothesis

After making observations and gathering knowledge about a phenomenon, a scientist uses **inductive reasoning** to come up with a **hypothesis,** a tentative explanation for the natural event that can be tested and may predict the outcome.

Predictions and Experiments

Testing a hypothesis involves conducting **experiments** using deductive reasoning, good experimental design, and both test and control groups. Sometimes scientists use model organisms, such as mice, because they can control specific variables in the experiment.

Presenting and Analyzing the Data

Data may be presented in a variety of formats, including tables and graphs.

Statistical Data

In statistics, the standard error, or standard deviation, tells us how uncertain a particular value is.

Statistical Significance

There is always the possibility that the results are due to chance or to some factor other than the experimental variable.

Scientific Publications

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Scientific studies are customarily published in scientific journals.

Scientific Theory
The ultimate goal of science is to understand the natural world in terms of **scientific theories,** or accepted explanations of how the world works.

An Example of the Scientific Method
If investigators want to determine which of two antibiotics is better for the treatment of ulcers, they try to vary just the experimental variables, in this case, the medications.

Experimental Design

The hypothesis is: Newly discovered antibiotic B is a better treatment for ulcers than antibiotic A, which is in current use. The investigators decide to use three experimental groups of people with ulcers: one control group and two test groups. The control group is not treated with either antibiotics but are given a placebo. Test group 1 is treated with antibiotic A, while test group 2 is treated with antibiotic B.

Results and Conclusion

After administering the same amount of medication or placebo the same way for a period of time, the investigators examine the patients for ulcers. A graph of the percentage of people who no longer have ulcers allows the researchers to conclude whether their hypothesis has been supported.

1.4 Science and the Challenges Facing Society
Technology is the application of scientific knowledge to the interests of humans. Scientific investigations are the basis for the majority of our technological advances.

Climate Change
Climate change describes changes in normal cycles of Earth's climate that can be attributed to human activity. This is mostly due to imbalances in the chemical cycling of carbon that cause a rise in temperature.

Biodiversity and Habitat Loss
It is estimated that presently we are losing hundreds of species every year due to human activities. The destruction of healthy ecosystems has many unintended negative effects.

Emerging and Reemerging Diseases
Changes in human behavior, new uses for technology, and increased exposure to animals or insect populations can all result in new diseases. Over the past decade, emerging diseases (avian influenza, swine flu, severe acute respiratory syndrome, and Middle East respiratory syndrome) have been in the news. In 2020, a global pandemic called COVID-19 caused by a novel SARS virus emerged. Both emerging and reemerging diseases (e.g., Ebola) have the potential to cause human health problems across the globe.

LECTURE ENRICHMENT IDEAS

1. Describe the many properties of quartz crystals: that crystals *grow* over time, little crystals are *reproduced* at angles off the sides of parent crystals, the crystal possesses a predictable angular *structure* that is not like the chaotic environment, and sheets of quartz even show a response to environmental stimuli—they convert light to current in a piezoelectric effect! With so many features of life, why isn't quartz considered living?

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2. We are sending robot spacecraft to Mars to further investigate the possibility of life on that planet. In the past, we have looked for properties that life expresses on earth: respiration, growth, movement, and so on. Discuss whether the model of Earth's properties of life is the only model possible.
3. Buy a recent tabloid newspaper from the newsstands featuring a pseudoscience topic (students readily recognize these from the grocery checkout stands). Read one brief account of a particularly preposterous assertion and ask what is necessary for a scientist to believe this, what internal contradictions belie its claims, and what tests would be necessary to provide it with scientific legitimacy, and so on.
4. Display an assortment of screws, bolts, nails, brads, staples, and other fasteners. Ask students to *classify* them in groups for easier display in a store, and so on. On what basis do they group screws and bolts, tacks and nails, and so on (by common structures, threading, production methods, functions, etc.)? The basis for biological classification is commonly phylogenetic origin but likewise uses common structures and functions.
5. Have students propose various scientific experiments based on their observations of phenomena around them. Discuss how to control the variables, how to obtain objective data, how to interpret results, and so on.

ESSAY QUESTIONS WITH ANSWERS

1. By itself, a virus cannot reproduce, grow and develop, respond to stimuli, take in material and energy from the environment, nor show any adaptation. However, it is organized with a protein coat that surrounds hereditary material and once inside another living cell the virus takes over the host's metabolic machinery in order to grow, develop, and reproduce new virus particles. Therefore, is the virus a living or dead organism?
   Answer: Scientists do not have a unanimous answer to this question because viruses have characteristics of being both alive and dead. Because viruses are unable to carry out metabolic processes themselves, some scientists prefer to consider viruses activated *and* inactivated.
2. Explain what is scientifically wrong with the following assertions:
   a. I clang bells each day, and there are no tigers around my house; therefore, clanging bells drives away tigers.
      Answer: There is no test of bell clanging with tigers present; therefore, there is no cause and effect established.
   b. If water dousing, homeopathic cures, and so on work for just me but not for anyone else, it is still science.
      Answer: Science is not personal; results must be repeatable.
3. Why does evolution explain both the unity and the diversity of life?
   Answer: All organisms share the same basic characteristics of life because we all share a common ancestor (unity). During the past 4 billion years, Earth's environment has changed drastically, and the diversity of life has been shaped by the evolutionary responses of organisms to these changes (diversity).

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