Name _____ Class _____ Date _____

Skills Worksheet

Critical Thinking

ANALOGIES

Mark the letter of the pair of terms that best completes the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** Industrial Revolution : Agricultural Revolution ::
- **a.** animal muscle : fossil fuels
- **b.** hunters : gatherers
- **c.** agricultural revolution : hunter-gatherers
- **d.** hunter-gatherers : population growth

_____ **2.** pollution : health effects ::
- **a.** industrial : revolution
- **b.** cyanide : smog
- **c.** extinction : biodiversity
- **d.** automobiles : exhaust

_____ **3.** environmental science : biology ::
- **a.** botany : zoology
- **b.** biology : zoology
- **c.** zoology : geology
- **d.** social sciences : chemistry

_____ **4.** renewable resource : nonrenewable resource ::
- **a.** iron : water
- **b.** trees : sunlight
- **c.** water : trees
- **d.** trees : oil

_____ **5.** ecological footprint : land ::
- **a.** developed nation : consumption
- **b.** developing nation : consumption
- **c.** grazing : forest products
- **d.** land : ocean

_____ **6.** supply : demand ::
- **a.** overpopulation : resources
- **b.** renewable : nonrenewable
- **c.** computer production : sales of computers
- **d.** population : consumption

_____ **7.** commons : overgrazing ::
- **a.** Earth : resources
- **b.** short-term interests : long-term interests
- **c.** individual lands : sustainability
- **d.** individuals : society

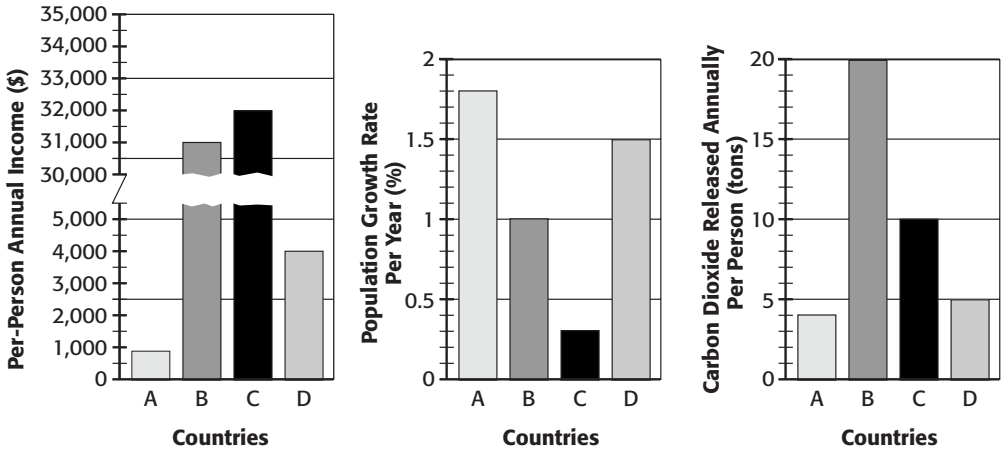
_____ **8.** biodegradable : nonbiodegradable ::
- **a.** pollutant : toxin
- **b.** plastic : newspaper
- **c.** cotton : polyester
- **d.** mercury : lead

INTERPRETING OBSERVATIONS

Read the following scenario, and answer the questions that follow.

Four students are given the assignment of classifying countries as developing or developed. Each student gathers the following information for one nation: per-person annual income, population growth rate, and tons of carbon dioxide produced by fossil fuels. The students compile their results in bar graphs.

Figure 1



9. Which country or countries would you classify as developing? Describe your reasoning.

10. Which country or countries are likely to have the highest rates of energy consumption? Explain your answer.

11. Which country is most likely the United States? How can you tell?

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answers.

12. Because large-scale species extinctions have occurred throughout Earth's history, we should not be concerned by the world's current high extinction rate.

13. Growing populations do not create social or environmental problems in areas where food resources are not limited.

14. Most people from developing countries have values and priorities very different from those of most people from developed countries.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

15. The "ecological footprint" of a citizen of a developed nation is about four times larger than that of a citizen of a developing nation. Why do you think this is the case?

16. If you could travel in time to a period before the Industrial Revolution, what actions would you initiate to minimize current environmental problems?

17. Solutions to complex environmental problems can be very costly. Communities or other affected groups might perform a cost-benefit analysis to determine whether the benefits of the desired solutions outweigh the financial cost. How might the results of a cost-benefit analysis be interpreted differently by a local citizen, a company CEO, and a city manager who monitors city funds while overseeing major improvement projects?

Critical Thinking *continued*

18. If Earth is considered a "closed system," how does that shape the outcome of environmental problems? How does this relate to local or regional environmental problems?

19. Identify a controversial environmental issue in your community that fits into one of the following three major categories: resource depletion, pollution, or loss of biodiversity. Discuss how the issue is being addressed, and whether or not the conflicts associated with "The Tragedy of the Commons" are affecting solutions to the problems.

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Skills Worksheet

Critical Thinking

ANALOGIES

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_____ **1.** gathering information : decision-making model ::
- **a.** variable : experimental model
- **b.** experimental model : correlations
- **c.** observing : experimental model
- **d.** map : graphical model

_____ **2.** mathematical formula : mathematical model ::
- **a.** mass = density/volume : equation
- **b.** flow chart : conceptual model
- **c.** risk : probability
- **d.** statistics : probability

_____ **3.** curiosity : imagination ::
- **a.** sample size : number of objects
- **b.** ability : inability
- **c.** creativity : art
- **d.** creativity : intellectual honesty

_____ **4.** values : principles ::
- **a.** models : representations
- **b.** noise : airplanes
- **c.** silence : noise
- **d.** airplanes : models

_____ **5.** positive short-term consequence : slowing of habitat destruction ::
- **a.** positive long-term consequence : population increase
- **b.** geology : environmental science
- **c.** slowing of habitat destruction : no consequence
- **d.** short-term consequence : negative short-termconsequence

_____ **6.** good scientists : scientific habits of mind ::
- **a.** hypothesis : prediction
- **b.** bad experiments : one variable and a control
- **c.** good experiments : one variable and a control
- **d.** good decisions : models

_____ **7.** mean : average ::
- **a.** distribution : normal
- **b.** hypothesis : guess
- **c.** data : graph
- **d.** sample : group of individuals

_____ **8.** experimenting : correlating ::
- **a.** directly counting : estimating
- **b.** reflecting : mirror
- **c.** observing : drawing conclusions
- **d.** guessing : estimating

INTERPRETING OBSERVATIONS

Read the following paragraph, and answer the questions below.

Students noticed that, since the time that grass began to grow on a barren hillside, less soil and water seemed to wash down the slope into the school yard during a rainstorm. The students thought that the grass helped hold the soil in place on the slope. The students predicted that more soil would wash down a slope without grass than a slope covered with grass. To find out if they were correct, the students conducted an experiment with three identical rectangular pans of soil. In pan 1, they planted grass seed and allowed it to grow to several centimeters tall. The students filled pan 2 with only soil. Then they took pan 1 and pan 2, and propped up at one end of each pan 15 cm high to create a slope. Pan 3, also filled with only soil, was propped up at one end 5 cm at one end to create a slope. Students poured equal amounts of water on the raised end of each pan and the students recorded their observations.

9. What hypothesis did the students test in their experiment?

10. What prediction did the students use to test their hypothesis?

11. Which steps in the experimental method are missing from the description above?

12. Did the students conduct a good experiment? Explain your answer.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

13. You encounter or use statistics and probability often in your day-to-day life.

14. The positive long-term consequences of car pooling or taking a bus to school outweigh the negative short-term consequences of driving yourself to school.

15. In order to become a good scientist, a scientist should believe everything he or she is told by other scientists and should disregard the new ideas of nonscientists.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

16. What impact might the increasing worldwide use of the Internet have on the final step of the experimental method?

17. Describe two ways in which you can benefit from applying scientific habits of mind in your everyday life.

18. When lawmakers consider legislation concerning environmental disasters, how might they be able to use their knowledge of "risk?"

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Skills Worksheet

Critical Thinking

ANALOGIES

In the space provided, write the letter of the pair of terms or phrases that best completes the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** stratosphere : troposphere ::
- **a.** biosphere : water
- **b.** mantle : core
- **c.** water cycle : lithosphere
- **d.** ocean : phytoplankton

_____ **2.** seismic waves : earthquake ::
- **a.** temperature : gas
- **b.** weather : air
- **c.** greenhouse effect : atmosphere
- **d.** electromagnetic radiation : sun

_____ **3.** tectonic plates : asthenosphere ::
- **a.** core : crust
- **b.** atmosphere : gases
- **c.** volcano : eruption
- **d.** ice sheets : pond

_____ **4.** winds : atmosphere ::
- **a.** currents : hydrosphere
- **b.** salinity : ocean
- **c.** earthquakes : ionosphere
- **d.** ocean : climate

_____ **5.** plants : sunlight ::
- **a.** water : evaporation
- **b.** organisms : water
- **c.** air : nitrogen
- **d.** erosion : rock

_____ **6.** river : gorge ::
- **a.** erosion : gas
- **b.** wind : tall rock formation
- **c.** water : wind
- **d.** sediments : rocks

_____ **7.** convection current : weather ::
- **a.** Richter scale : magnitude
- **b.** eruption : climate
- **c.** plate collision : mountain
- **d.** thermosphere : temperature

_____ **8.** aquifer : groundwater ::
- **a.** life : oxygen
- **b.** ocean : radiation
- **c.** atmosphere : water vapor
- **d.** biosphere : land

INTERPRETING OBSERVATIONS

Read the following paragraphs, and answer the questions below.

Alfred Wegener, a German who was educated as a meteorologist and geologist, was one of the first scientists to theorize about tectonic plates. Wegener suggested that past continents had drifted apart over time to form the present continents. This rearrangement of continents is known as continental drift.

Wegener published his first complete statement on continental drift in 1912. He supported his research by attempting to piece together the edges of the continents in order to reconstruct a formed supercontinent. Wegener believed that large blocks of the crust (tectonic plates) could, over very long periods of time, flow slowly over the mantle. Wegener's theories remained the subject of criticism until the 1960s, when geological evidence confirmed that the ocean floors had been spreading and that large crustal blocks were, in fact, moving. Plate tectonic theory has become the cornerstone of modern geology. A crater on the moon was named in honor of Alfred Wegener, "the father of plate tectonics."

9. What title would you give this essay?

10. Suppose Wegener had more concrete evidence to support his theories when his papers were first published. Do you think his peers would have accepted his theories more readily? Why or why not?

11. Describe one aspect of the map of the world that hints Wegener's theory might be correct.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

12. Because scientists are unable to predict when and precisely where an earthquake will occur, the government has a duty to issue building codes to ensure that all structures can withstand earthquakes.

13. Individuals, as well as industry—and automobile manufacturers in particular—have an obligation to work to reduce carbon dioxide emissions that may increase the level of greenhouse gases in the atmosphere.

14. We need to recycle our waste because Earth is a closed system with respect to matter, and new matter does not enter the environment.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

15. Fresh water supplies are replenished through the water cycle. Why, then, are drinking water supplies limited in some places and threatened in others? What natural and human factors might affect the availability of clean drinking water?

16. The global climate is affected by a complex interaction of processes that tend to either increase or decrease surface temperature. Some of these factors are influenced by humans and some are not. Give three examples of factors that affect global climate, and state whether each factor may tend to increase or decrease surface temperature.

17. Heat transfer by radiation allows energy to travel long distances through space. Heat is radiated in the form of electromagnetic waves. Light is also a form of electromagnetic radiation. Given a nonflammable object heated to a very high temperature, how do the color changes you observe explain the relationship between radiated heat and light?

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Skills Worksheet

Critical Thinking

ANALOGIES

In the space provided, write the letter of the pair of terms or phrases that best completes the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** antibiotic : bacteria ::
- **a.** insecticide : insect
- **b.** ant : cockroach
- **c.** pesticide : insecticide
- **d.** insect : species

_____ **2.** biotic : abiotic ::
- **a.** rocks : sand
- **b.** air : organism
- **c.** organism : water
- **d.** species : population

_____ **3.** organism : habitat ::
- **a.** community : population
- **b.** fish : coral reef
- **c.** shelter : nest
- **d.** squirrel : pond

_____ **4.** population : species ::
- **a.** field mice in Florida : field mice
- **b.** field mice in Florida : field mice in Maine
- **c.** field mice : rodents
- **d.** total organisms in a prairie : total bison in a herd

_____ **5.** natural selection : evolution ::
- **a.** jogging : running
- **b.** floods : rain
- **c.** dog : cat
- **d.** studying : passing a test

_____ **6.** skeleton : human body ::
- **a.** foot : birds
- **b.** egg : frogs
- **c.** cell walls : fungi
- **d.** rock : sand

_____ **7.** plants : land ecosystems ::
- **a.** sand : desert ecosystems
- **b.** phytoplankton : water ecosystems
- **c.** forests : trees
- **d.** snow : winter

_____ **8.** Hawaiian honeycreeper's beak : obtaining nectar ::
- **a.** sunburn : wearing sunscreen
- **b.** buying stamps : getting mail
- **c.** insect's skeleton : keeping warm
- **d.** sweet nectar : attracting pollinators

_____ **9.** cone : pine tree ::
- **a.** flower : rose bush
- **b.** leaves : oak tree
- **c.** fruit : wildflowers
- **d.** roots: cactus

_____ **10.** vertebrates : animals ::
- **a.** bacteria : protists
- **b.** angiosperms : plants
- **c.** molds : bacteria
- **d.** algae : fungi

INTERPRETING OBSERVATIONS

Read the following scenario, and answer the questions below.

Imagine that a population of rabbits was released during the winter into an ecosystem that is covered with snow most of the year. Fifty percent of the rabbits were dark gray and 50 percent of the rabbits were white. The only animal in the ecosystem that eats rabbits is a species of hawk.

The next winter, scientists visit the area and observe the rabbit population. As expected, the overall rabbit population has grown and the percentage of white rabbits has increased.

11. Explain what probably caused the increase in the percentage of white rabbits.

12. Predict what would happen to the rabbit population if the climate changed and the ecosystem only had snow a few months out of the year. Explain your answer.

13. Use a rabbit population as an example to explain Darwin's theory of evolution by natural selection.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

14. A tiny Chihuahua and a huge Great Dane have no common ancestors.

15. Prescribing antibiotics for every human disease will help eliminate diseases caused by bacteria.

16. A community can contain two populations of the same species.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

17. A family has an infestation of ants and wants to get rid of them. Why are insect pests difficult to control?

18. A friend says that it does not matter what happens in other ecosystems and that you won't be affected because you live in the city. Do you think your friend is right? Justify your answer.

19. It is safer to eat mushrooms grown on farms because many mushrooms that grow in the wild are poisonous. Imagine that to ensure that no one ate poisonous mushrooms, chemicals were used to kill fungi in a forest. How would this affect the forest ecosystem? Explain your reasoning.

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Skills Worksheet

Critical Thinking

ANALOGIES

Mark the letter of the pair of terms that best completes the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** producer : consumer ::
- **a.** car : driver
- **b.** factory : shopper
- **c.** deer : wolf
- **d.** photosynthesis : decomposition

_____ **2.** herbivores : omnivores ::
- **a.** photosynthesis : respiration
- **b.** elephant : ocean
- **c.** fruit : bird
- **d.** deer : bear

_____ **3.** carbon dioxide : carbon cycle ::
- **a.** fertilizer : phosphorus cycle
- **b.** atmospheric nitrogen : nitrogen cycle
- **c.** decomposers : carbon cycle
- **d.** limestone : carbon cycle

_____ **4.** deep ocean : hydrogen sulfide ::
- **a.** sunlight : deep ocean
- **b.** darkness : sunlight
- **c.** surface : carbon dioxide
- **d.** photosynthesis : sunlight

_____ **5.** oxygen : cellular respiration ::
- **a.** cup : saucer
- **b.** carbon dioxide : photosynthesis
- **c.** plants : adaptation
- **d.** needle : thread

_____ **6.** climax forest : clear-cut forest ::
- **a.** plants : animals
- **b.** food web : food chain
- **c.** sun : fire
- **d.** full : empty

INTERPRETING OBSERVATIONS

Read the following passage, and then answer the questions below.

Your family is considering buying a house near a nature preserve that has been established to maintain a portion of the original ecosystem. You attend a meeting in which the developer is explaining the plans for the project. One woman in the audience complains that she does not like the natural prairie grasses on the nature preserve. She wants the grasses removed and replanted with an imported grass. A man in the audience suggests that exotic animals on the preserve would make it more beautiful. One woman proposes that the developer construct a playground in the center of the preserve and build a paved road to it. She wants picnic tables set up throughout the preserve for family picnics.

7. What would be your response to the woman who wants to replace the native grasses?

8. What would be your response to the man who wants exotic animals placed on the site?

9. What would be your response to the woman who wants to put a playground on the site?

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

10. There would be no life on Earth without the sun.

11. Our activities do not affect the carbon cycle.

12. A severe drought in a grassland will reduce the number of consumers in the entire energy pyramid.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

13. Explain why the difference between primary and secondary succession is not always clear.

14. Explain what you think would happen to the phosphorus, carbon, and nitrogen cycles if the sun were to burn out.

Critical Thinking *continued*

15. Energy pyramids are useful for describing the energy losses in a food chain. Describe an energy pyramid for a group of organisms in your area.

16. Explain the importance of lichens to primary succession.

17. Explain how a clover is part of the carbon, nitrogen, and phosphorus cycles.

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Skills Worksheet

Critical Thinking

ANALOGIES

Mark the letter of the pair of terms that best completes the each of the analogies shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** understory : light ::
- **a.** canopy : epiphytes
- **b.** desert : water
- **c.** emergent layer : snakes
- **d.** grassland : antelopes

_____ **2.** cold : migration ::
- **a.** trees : deforestation
- **b.** heat : estivation
- **c.** water : vegetation
- **d.** temperature : elevation

_____ **3.** savanna : tropical ::
- **a.** desert : dry
- **b.** grassland : fertile
- **c.** taiga : temperate
- **d.** tundra : arctic

_____ **4.** conifers : taiga ::
- **a.** sand : desert
- **b.** permafrost : tundra
- **c.** shrubs : chaparral
- **d.** trees : savanna

_____ **5.** logging : forest ::
- **a.** farming : desert
- **b.** flooding : chaparral
- **c.** overgrazing : grassland
- **d.** hunting : tundra

_____ **6.** spines : cactus ::
- **a.** leaves : succulents
- **b.** lichens : moss
- **c.** scaly skin : reptiles
- **d.** camouflage : animals

_____ **7.** rain forest : vegetation ::
- **a.** taiga : altitude
- **b.** desert : animals
- **c.** savanna : bison
- **d.** grassland : topsoil

_____ **8.** high latitude : poles ::
- **a.** high altitude : cold
- **b.** low latitude : tropics
- **c.** low altitude : warmth
- **d.** equator : humidity

_____ **9.** deforestation : flooding ::
- **a.** trading : habitat destruction
- **b.** transpiration : water vapor
- **c.** precipitation : rainfall
- **d.** adaptation : predators

_____ **10.** tundra plants : wide, shallow roots ::
- **a.** tropical rain forest trees : buttresses
- **b.** chaparral plants : fires
- **c.** conifers : acidic soil
- **d.** savanna plants : deep root systems

INTERPRETING OBSERVATIONS

Examine the following descriptions, and answer the questions that follow.

Plant #1 is tall, with broad leaves that turn color in autumn.

Plant #2 has a waxy coating, spines, and a long and shallow root system.

Plant #3 has needle-like leaves and a pyramid shape, and is able grow in acidic soil.

11. What is the common name of plant #1 and what biome would it most likely grow in? Name one adaptation that helps it survive in its biome.

12. What is the common name of plant #2 and what biome would it most likely grow in? Name one adaptation that helps it survive in its biome.

13. What is the common name of plant #3 and what biome would it most likely grow in? Name one adaptation that helps it survive in its biome.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

14. Many types of ecosystems can exist within a given biome.

15. The conversion of grasslands to croplands was necessary.

16. Our ability to fight certain diseases is threatened by habitat destruction.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

17. Recommend a strategy for incorporating sustainable human activity into a tropical rain forest biome.

18. Brush fires are common in dry biomes, such as temperate grasslands, chaparral, and the taiga. Is fire beneficial or harmful to biomes? Defend your answer.

19. How does plant height affect the behavior of animals in a savanna? Describe how some animals have adapted.

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Skills Worksheet

Critical Thinking

ANALOGIES

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_____ **1.** phytoplankton : zooplankton ::
- **a.** primary producers: predators
- **b.** nekton : benthos
- **c.** bacteria : decomposers
- **d.** plants : animals

_____ **2.** freshwater wetland : Everglades ::
- **a.** barrier island : New York
- **b.** estuary : Chesapeake Bay
- **c.** mangrove : Rio de Janeiro
- **d.** coral reef : tropics

_____ **3.** beavers : ponds ::
- **a.** reptiles : swamps
- **b.** amphibians : lakes
- **c.** humans : artificial lakes
- **d.** waterfowl : wetlands

_____ **4.** surface water : photosynthesis ::
- **a.** brackish water : salinity
- **b.** deep water : decomposition
- **c.** wetlands : filtration
- **d.** algae : eutrophication

_____ **5.** marshes : swamps ::
- **a.** grasslands : forests
- **b.** ponds : oceans
- **c.** mosses : rivers
- **d.** cactuses : deserts

_____ **6.** rivers : snow melt ::
- **a.** lakes : groundwater
- **b.** Arctic : ice
- **c.** coastal wetlands : rain
- **d.** littoral zones : flooding

_____ **7.** trout : headwaters ::
- **a.** oxygen : runoff
- **b.** sediment : riverbed
- **c.** plankton : downstream
- **d.** rhizoids : rocks

INTERPRETING OBSERVATIONS

Read the following passage, and answer the questions below.

A small community was nestled along the edge of a sparkling, blue lake. Local residents often flocked to the lake to swim, boat, and fish. Many of the local residents were dairy farmers or grew crops for the local people. As the community grew, more factories came to the area and used the water from the lake for their manufacturing processes. Several years later the residents noticed that the fish were dying and a layer of thick, slimy algae was gradually covering the lake.

8. Describe what happened to the lake. What role did bacteria play in the transformation of the lake?

9. How could this problem impact the entire ecosystem?

10. Could this same problem occur at the headwaters of a river? Why or why not?

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

11. Plants and animals prefer to live on sandy shores rather than rocky shores.

12. Human activities do not threaten coral reefs.

13. Most photosynthesis occurs in the upper 100 meters of the ocean.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

14. Why is a toxic chemical spill on land potentially harmful to animals that live in the ocean?

15. Eutrophication sometimes occurs naturally. Explain how the process can be accelerated.

16. What do you think would happen to a North American freshwater trout if it were placed in a tropical ocean? Explain your answer in terms of factors that affect organisms in different aquatic ecosystems.

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Skills Worksheet

Critical Thinking

ANALOGIES

In the space provided, write the letter of the pair of terms or phrases that best complete the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** carrying capacity : population size ::
- **a.** niche : habitat
- **b.** amount of water : plant growth
- **c.** death rate : birth rate
- **d.** severe weather : density-dependent deaths

_____ **2.** predator : prey ::
- **a.** competition : species
- **b.** grazing : herbivores
- **c.** ants : acacia trees
- **d.** parasite : host

_____ **3.** species : population ::
- **a.** heart : body
- **b.** plants : animals
- **c.** cows : herd
- **d.** sunlight : trees

_____ **4.** limiting resource : carrying capacity ::
- **a.** turtle : pond
- **b.** sunlight : plant growth
- **c.** territory : density-independent deaths
- **d.** population growth : parasitism

_____ **5.** density : area ::
- **a.** dispersion : niche
- **b.** leaves : forest
- **c.** growth rate : time
- **d.** habitat : niche

_____ **6.** relationship : symbiosis ::
- **a.** evolution : population
- **b.** business : partnership
- **c.** mutualism : competition
- **d.** health : illness

_____ **7.** births : positive growth rate ::
- **a.** reproduction : extinction
- **b.** deaths : negative growth rate
- **c.** limited resource : exponential growth
- **d.** niche : habitat

_____ **8.** long generation time : short generation time ::
- **a.** dogs : cats
- **b.** ants : dogs
- **c.** elephants : bacteria
- **d.** daisies : trees

INTERPRETING OBSERVATIONS

Read the following, and answer the questions below.

Imagine that two species of monkeys are introduced to an island that provides them with an ideal habitat. One species is arboreal and eats fruits and leaves; the other is terrestrial and relies on fallen fruits and a few small insects it can pick from the ground for survival. The monkeys have an abundance of food, no local competition for the food, and no predators. After a decade, the number of frugivorous and leaf-eating arboreal monkeys increased faster than the terrestrial fruit and insect eaters.

After 20 years, the number of terrestrial monkeys in the island started to decrease rapidly, although the arboreal monkey population remained fairly stable.

9. Explain what probably caused the changes in the two monkey populations.

10. What type of biological interaction best explains the relative greater success of the arboreal monkeys?

11. Is the terrestrial population of monkeys destined to extinction? Explain.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answers.

12. An ecosystem can be viewed as a host that is parasitized by the organisms that live in or on it.

13. The only competitors that humans have for food are other humans and insects.

14. The interaction generated by human intervention to protect the gray wolf population in the northwestern United States can be defined as commensalism.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

15. Although there are many predators on the African savanna, none plays exactly the same role as the lion. Can any two species occupy exactly the same niche? Why or why not?

16. A biologist thinks that over time a parasite can influence the evolution of its host species. Do you think that she is right? Justify your answer.

17. To be considered part of the same population organisms must have a reasonable chance of mating with each other. Are two wild roses separated by a wide road part of the same population? Defend your answer.

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Skills Worksheet

Critical Thinking

ANALOGIES

In the space provided, write the letter of the pair of terms or phrases that best complete the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** demography : populations::
- **a.** ecology : atmosphere
- **b.** infant mortality : death rate
- **c.** meteorology : weather
- **d.** agriculture : farming

_____ **2.** age structure : population pyramid ::
- **a.** exponential growth : population growth
- **b.** survivorship : survivorship curve
- **c.** fertility rate : replacement level
- **d.** population growth : increased food production

_____ **3.** immigration : population increase ::
- **a.** migration : population decrease
- **b.** emigration : movement out of an area
- **c.** migration : movement into an area
- **d.** emigration : population decrease

_____ **4.** preindustrial stage : small, stable population ::
- **a.** transitional stage : population explosion
- **b.** industrial stage : large, stable population
- **c.** transitional stage : low growth rate
- **d.** post industrial stage : population explosion

_____ **5.** infrastructure : community ::
- **a.** wood : fuel for cooking
- **b.** resource depletion : standard of living
- **c.** foundation : house
- **d.** drinking and washing : water supply

_____ **6.** suburban sprawl : traffic jams::
- **a.** overpopulation : wildlife habitat
- **b.** unmanaged water supply : cholera
- **c.** deforestation : fuelwood
- **d.** nutrition : replacement rate

_____ **7.** family planning : fertility rate ::
- **a.** wood : fuel source
- **b.** education : infant mortality rate
- **c.** economic incentives : replacement level
- **d.** survivorship : life expectancy

INTERPRETING OBSERVATIONS

Read the following passage and answer the questions that follow.

The International Conference on Population and Development (ICPD) met in 1994 to discuss ways to slow the growth of the world population before Earth's resources are no longer able to support its population. The goals of the ICPD are to stabilize population growth by helping countries to develop and by helping improve the status of women. By 2015, the ICPD hopes to achieve these goals by providing access to safe and reliable family-planning methods, reducing infant and maternal mortality rates, increasing life expectancy, and achieving universal access to primary education.

8. How does improving the status of women influence the fertility rate?

9. How does decreasing infant mortality rate affect population growth?

10. What are some ways that more access to primary education could be provided in less-developed regions of the world?

AGREE OR DISAGREE

Agree or disagree with the following statements and support your answer.

11. Population-related problems are primarily the concern of developing countries.

12. Life expectancy in less-developed regions will always be lower than in more-developed regions.

13. Only developed countries are urbanized.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully and answer the questions that follow.

14. Compare and contrast Stage 1 and Stage 3 of the demographic transition.

15. Explain how rapid population growth can put a strain on resources and the environment and give examples to support your answer.

16. What kinds of unexpected events or patterns might change the prediction of a human population of 9 billion by 2050?

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Skills Worksheet

Critical Thinking

ANALOGIES

In the space provided write the letter of the pair of terms or phrases that best completes the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** harvesting : poaching ::
- **a.** ivory sales : CITES
- **b.** buying : stealing
- **c.** supply : demand
- **d.** traveling : ecotourism

_____ **2.** extinct : endangered ::
- **a.** dinosaur : crocodile
- **b.** fern : coal
- **c.** death : illness
- **d.** coral : reef

_____ **3.** seeds : germ-plasm bank ::
- **a.** stocks : stock exchange
- **b.** bottleneck : biodiversity
- **c.** gene : chromosome
- **d.** books : library

_____ **4.** keystone species : ecosystem ::
- **a.** peanut : Central America
- **b.** sea urchin : kelp beds
- **c.** gray wolf : Yellowstone National Park
- **d.** bison : hides

_____ **5.** endangered species : threat ::
- **a.** Florida panther : habitat loss
- **b.** California condor : captive breeding
- **c.** coffee plants : sustainable land use
- **d.** dragon tree : Mediterranean Basin

_____ **6.** exotic species : endemic species ::
- **a.** fire ants : livestock
- **b.** foreign : native
- **c.** hunter : sea otter
- **d.** threat : friend

_____ **7.** antibiotics : fungi ::
- **a.** biotechnology : medicine
- **b.** wheat : Southwest Asia
- **c.** shaman : medicine man
- **d.** medicines : plants

_____ **8.** genes : genetic diversity ::
- **a.** DNA : specific traits
- **b.** seeds : plants
- **c.** habitats : ecosystem diversity
- **d.** food webs : biosphere

INTERPRETING OBSERVATIONS

Read the following passage and answer the questions below.

To preserve the delicate balance in an ecosystem, many organisms play a crucial role. For example, insects and flowering plants are intricately united. On a smaller scale, lichens are organisms made of algae and fungi. Algae produce nutrients through photosynthesis, which are used by fungi, and the fungi supply algae with the water they need to survive. Lichens are hardy organisms that can live and reproduce attached to rocks, trees and soil. They can slowly break down rocks contributing in this way to the formation of the soil. Lichens grow in a variety of environments such as deserts, the Polar Regions and forests. They are food for big animals such as musk ox and caribou. If lichens ceased to exist, the negative impact on the environment of the world would be dramatic.

9. What type of species interaction is the author referring to in the preceding passage? Can you infer the importance of lichens for the biodiversity of Earth?

10. What is the reasoning behind the last statement in the passage?

11. Popular images of biodiversity often focus on large endangered animals, such as pandas and tigers. Why do you think it is equally important to consider the producer level of the food chain as endangered?

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

12. When disagreements between developers and environmentalists are worked out, usually neither side gets everything it wants, but both sides get something. This compromising approach is effective enough to save endangered species.

13. The Biodiversity Treaty will benefit society.

14. To protect biodiversity worldwide, many conservationists suggest that at least 10 percent of Earth's land be set aside as protected preserves. This percentage is the minimum and should be considered in all cases.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of the concepts presented in the chapter. Think carefully and answer the questions that follow.

The gray wolf is a species that people have maligned in campfire tales and stories such as "Little Red Riding Hood." Recently, the gray wolf was reintroduced into Yellowstone National Park and its population has increased. The wolves interact both with humans and wild animals. Some people agree with the reintroduction and others disagree.

15. Why is reintroducing the gray wolf important for the Yellowstone ecosystem?

16. Nearby ranchers claim that the wolves will prey on their livestock. Is it possible to evaluate this claim "before the fact"?

17. Is it possible to predict the effect(s) of eliminating a species from an ecosystem? Explain your answer.

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Skills Worksheet

Critical Thinking

ANALOGIES

Mark the letter of the pair of terms that best completes the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** dam : reservoir ::
- **a.** road closure : traffic jam
- **b.** braces : teeth
- **c.** farms : runoff
- **d.** groundwater : aquifer

_____ **2.** fertilizer : artificial eutrophication ::
- **a.** wastewater : point-source pollution
- **b.** oxygen : thermal pollution
- **c.** biomagnification : pesticides
- **d.** point-source : water pollution

_____ **3.** aquifer : land ::
- **a.** surface water : well
- **b.** river : ocean
- **c.** dam : river
- **d.** potable : pathogen

_____ **4.** pathogens : viruses ::
- **a.** porosity : groundwater
- **b.** dead fish : thermal pollution
- **c.** DDT : food chain
- **d.** ocean pollution : oil spill

_____ **5.** non point-source : point-source ::
- **a.** few : many
- **b.** few : one
- **c.** many : one
- **d.** one : few

_____ **6.** salt water : desalinate ::
- **a.** recharge zone : percolate
- **b.** nonpotable water : chlorinate
- **c.** unwanted gases : aerate
- **d.** alum : coagulate

_____ **7.** oil spills : ocean pollution ::
- **a.** river : water diversion
- **b.** nutrient runoff : eutrophication
- **c.** waste : conservation
- **d.** agriculture : evaporation

INTERPRETING OBSERVATIONS

Read the following passage, and answer the questions below.

At one time, most of the people living in Bangladesh depended upon surface water for their fresh water needs. This water was contaminated with pathogens that caused a high incidence of disease and death in the population. A system of rural wells was then built to provide safe drinking water for most of the people in Bangladesh. Now Bangladesh is trying to respond to another crisis. These new wells draw groundwater that is contaminated with arsenic. According to the World Health Organization, an estimated 35 to 77 million of the total 125 million residents are at risk of drinking arsenic-contaminated water. Drinking water with a high concentration of arsenic can cause a variety of illnesses, including lung, bladder, and skin cancers. Adding alum is a simple and inexpensive way to remove most of the arsenic from drinking water. This method is one of several temporary solutions that are being used to reduce the level of arsenic and to make the water usable.

8. The diagram in this chapter shows how alum is used in large-scale treatment of drinking water. How could a single household or village use this method to treat well water?

9. Arsenic is one of several heavy metals known to affect supplies of drinking water. Describe a situation in which a heavy metal could affect your local water supply.

10. Identify and describe a possible solution to treating the surface water so that it can be consumed safely.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

11. Water exists in two different forms.

12. Drip irrigation makes farming more efficient.

13. Aquifers are environmentally sensitive structures, even though they are made of materials like rock, sand, and gravel.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

14. What are three positive effects of diverting or stopping the flow of river water?

15. What are three negative effects of diverting or stopping the flow of river water?

16. How can some water be used even if it isn't clean enough to drink?

17. Explain why it is difficult to reduce or prevent nonpoint-source pollution.

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Skills Worksheet

Critical Thinking

ANALOGIES

In the space provided, write the letter of the pair of terms or phrases that best complete the analogy. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** scrubber : smokestack ::
- **a.** ZEV : smog
- **b.** catalytic converter : tailpipe
- **c.** VOCs : gasoline pumps
- **d.** car seats : vinyl chloride

_____ **2.** particulate matter : primary pollutant ::
- **a.** asbestos : radon
- **b.** ground-level ozone : secondary pollutant
- **c.** sulfur dioxide : fossil fuels
- **d.** VOC : smog

_____ **3.** temperature inversion : smog ::
- **a.** sick-building syndrome : indoor air pollution
- **b.** ZEV : emissions
- **c.** catalytic converter : emissions
- **d.** carpets : formaldehyde

_____ **4.** radon : lung cancer ::
- **a.** ozone : VOCs
- **b.** ventilation : indoor pollution
- **c.** asbestos : fire retardant
- **d.** noise pollution : hearing loss

_____ **5.** shielding : light pollution ::
- **a.** mold: indoor pollution
- **b.** scrubber : noise pollution
- **c.** SO_2 : acid precipitation
- **d.** ZEV : air pollution

_____ **6.** acid precipitation : Canada-U.S. Air Quality Agreement ::
- **a.** sick building syndrome : ZEV
- **b.** air pollution : Clean Air Act
- **c.** ventilation : sick-building syndrome
- **d.** sea-coal : medieval air pollution

_____ **7.** bronchitis : emphysema ::
- **a.** fossil fuel : nuclear power
- **b.** ZEV : VOC
- **c.** pneumonia : lung cancer
- **d.** lumens : light pollution

_____ **8.** 10 dB : 40 dB ::
- **a.** pH 2 : pH 5
- **b.** pH 7 : pH 5.6
- **c.** 40 dB : 50 dB
- **d.** pH 1 : pH 10

_____ **9.** acid precipitation : sulfur oxides, nitrogen oxides, water ::
- **a.** air pollution : dust, pollen, spores
- **b.** ozone : vehicle emissions, sunlight, oxygen
- **c.** VOCs : smog
- **d.** light pollution : sodium lamps

_____ **10.** vehicles, industry : outdoor air pollution ::
- **a.** nitrogen, oxygen : volcanoes
- **b.** farming, fires : construction
- **c.** ear protection : noise pollution
- **d.** plastics, building materials : indoor air pollution

INTERPRETING OBSERVATIONS

Read the following passage, and answer the questions that follow.

Lake Sulfox is having some problems with its fish population. Commercial fishermen are claiming that their catches have declined, and they are blaming the decline on the supposed acidification of the lake by a local coal-fired power plant. The Lake Sulfox Advisory Board has the following data on file. Higher sulfate levels in the lake mean greater acidity. Assume that the size of the fish harvest is a good indicator of the size of the fish population.

Annual Fish Harvest (metric tons)					
1998	**1999**	**2000**	**2001**	**2002**	**2003**
7500	6924	6322	5412	5503	5113

Mean Sulfate Levels (ppm)					
1998	**1999**	**2000**	**2001**	**2002**	**2003**
41.07	51.34	54.89	57.46	58.76	59.65

11. What is the apparent relationship between the size of the fish harvest and the sulfate levels in the lake?

12. Do the data prove that acidification of the lake by sulfates is responsible for the decline in the lake's fish population? Provide at least two reasons to support your viewpoint.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answers.

13. It is lifestyle choices, such as smoking tobacco, rather than air pollution that causes the large number of respiratory diseases found in today's society.

14. Mass transit in cities could go a long way to reduce urban air pollution.

15. Air pollution is an international problem that can only be solved through global treaties.

16. Noise pollution does not lead to long-term health effects on the human body.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

17. A company plans to correct sick-building syndrome in its headquarters. The company will remove moldy carpeting, install brand-new carpeting, and seal up all cracks in the building in order to keep out new mold and fungus spores. The air ducts will be left alone because they have worked fine for years without any cleaning. Suggest any ways that the company should change its plans, and explain the reason for each change.

18. The wind blows across Country A and into Country B. Country A has electric power plants that burn fossil fuels, and lakes with a pH of 5.1. Country B has power plants run by moving water (hydroelectric), and lakes with a pH of 4.2. Explain how this can be. What could the two countries do to correct the situation?

19. Manufacturing is often blamed for producing air pollution. However, according to economic theory, it is neither technologically feasible nor economically efficient to completely eliminate pollution. What do you think? Explain your reasoning.

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Skills Worksheet

Critical Thinking

ANALOGIES

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_____ **1.** carbon dioxide : plants ::
- **a.** CFCs : ozone layer
- **b.** oxygen : humans
- **c.** methane : livestock
- **d.** water vapor : global warming

_____ **2.** El Niño : warm phase ::
- **a.** weather : drought
- **b.** wind : solar energy
- **c.** poles : latitude
- **d.** La Niña : cold phase

_____ **3.** oblique sunlight : poles ::
- **a.** summer sunlight : winter sunlight
- **b.** day : night
- **c.** weather : climate
- **d.** vertical sunlight : equator

_____ **4.** chlorofluorocarbon : chlorine ::
- **a.** ozone : oxygen
- **b.** carbon dioxide : nitrogen
- **c.** reaction : atom
- **d.** ozone hole : stratosphere

_____ **5.** UV light : phytoplankton ::
- **a.** water : plants
- **b.** air : animals
- **c.** chlorine atoms : ozone molecules
- **d.** greenhouse effect : water vapor

_____ **6.** model : equations ::
- **a.** warming : cooling
- **b.** computer : calculations
- **c.** radiation : atmosphere
- **d.** language : alphabet

_____ **7.** polar ice mass : sea level ::
- **a.** coastal wetlands : floods
- **b.** clouds : weather
- **c.** ocean surface temperature : storms
- **d.** Gulf Stream : currents

_____ **8.** beaches : erosion ::
- **a.** agriculture : droughts
- **b.** atmosphere : rivers
- **c.** model : warming
- **d.** water : cooling

INTERPRETING OBSERVATIONS

Read the following passage and answer the questions that follow.

Ignoring the effects of air resistance, careful measurements of a falling object will show the object picks up more and more speed with each passing second. This is easy to prove by rolling a ball downhill. Friction notwithstanding, the ball will roll faster and faster the further it rolls. Many scientists have used this analogy when describing global warming in Arctic areas. The more these areas warm, the faster they continue to warm. Worldwide, over the past hundred years, scientists have measured the average temperature rise to be approximately 1°F. However, since 1970, measurements from some parts of Alaska indicate a 5°F rise. Though warmer temperatures bring increased snowfall, the same conditions each year are also melting the snow faster than it can accumulate. As Alaskan glaciers melt and expose more bare earth, the glaciers appear to be retreating northward. In many northern areas, as permafrost and ice beneath the surface melts, lands sink and roots of trees drown. Entire forests are disappearing from too much water and from damage brought about by increased insect populations.

9. Compare polar regions (with glaciers and snow-and-ice cover) to temperate regions. Which region is likely to experience a sharper temperature rise? Explain your answer.

10. Do you agree with scientists' predictions about the warming of Alaska and other polar regions? Justify your response.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

11. Industrialized countries should assist countries with tropical rain forests so that those governments can afford to leave their forests intact.

12. The correlation between carbon dioxide levels in the atmosphere and world temperatures for the past 160,000 years proves that higher carbon dioxide levels cause global warming.

13. Developing countries should not participate in treaties that set allowable levels of greenhouse emissions in developed countries.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

14. Some scientists predict that global warming will cause major ocean currents to shut down. The Gulf Stream moves warm water from equatorial areas toward northern latitudes. How might an ocean current shutdown affect the climate?

15. A catalyst speeds up a process but is not changed itself. CFCs are known to release catalysts that break down the ozone layer. How does this process work?

16. The carbon in fossil fuels was in the atmosphere long ago. Why does burning these fuels and releasing the carbon back into the atmosphere create a problem today?

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Critical Thinking

ANALOGIES

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_____ **1.** clear cutting : forest ::
- **a.** commuting : suburbs
- **b.** land-use planning : geographical data
- **c.** mining : mineral resources
- **d.** overgrazing : rangeland

_____ **2.** urban crisis : substandard housing ::
- **a.** marginal land : landslides
- **b.** deforestation : wildlife habitat
- **c.** land-use planning : public comment
- **d.** heat-island effect : planting trees

_____ **3.** greenbelts : improved drainage ::
- **a.** reforestation : clear-cutting
- **b.** GIS : intelligent design
- **c.** mass transit : reduced traffic
- **d.** wilderness corridors : conservation biologists

_____ **4.** rangeland : livestock ::
- **a.** wetlands : predators
- **b.** cropland : pesticides
- **c.** parks : trails
- **d.** forest land : timber

_____ **5.** city infrastructure : heat islands ::
- **a.** public transportation : urban areas
- **b.** rapid city expansion : suburbs
- **c.** virgin forest : tree farms
- **d.** industrialization : rural areas

_____ **6.** wilderness : natural ecosystem ::
- **a.** biodiversity : ecosystem service
- **b.** city : artificial ecosystem
- **c.** land cover : soil erosion
- **d.** suburbs : urbanization

_____ **7.** biosphere reserves : United Nations ::
- **a.** maps : U.S Census Bureau
- **b.** flood plains : local government
- **c.** national parks : Congress
- **d.** ecosystems : private developers

_____ **8.** slowing urbanization : developed countries ::
- **a.** urban crisis : deteriorating conditions
- **b.** limited resources : metropolitan areas
- **c.** rapid urbanization : developing countries
- **d.** urban sprawl : limited resources

INTERPRETING OBSERVATIONS

Read the following passage, and answer the questions that follow.

A meteorologist is assigned to monitor weather conditions for an area roughly 20 km square containing rural and urban land. The land is relatively flat. At one site, she records a temperature of 25°C (77°F). At a second site, located 10 km away, she records a temperature of 30°C (86°F).

9. Describe one possible explanation for the difference in temperature.

10. What could be done to moderate the temperature at the higher temperature site?

11. Would your solution for question 2 carry any additional benefits?

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

12. In the long run, it is more economically advantageous to protect and preserve open space.

13. Since reforestation occurs naturally, there is no need for people to get involved.

14. The lack of adequate subway systems in most urban areas of the United States reflects poor land-use planning.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

15. Discuss the advantages and disadvantages of selective cutting of forest areas.

16. If most people live in urban areas of the United States, why are the rural areas important?

17. What issues in your community reflect what is known as the "urban crisis"?

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Critical Thinking

ANALOGIES

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_____ **1.** humans : food ::
- **a.** prey : predators
- **b.** cars : gasoline
- **c.** proteins : carbohydrates
- **d.** fish : water

_____ **2.** manure : chemical fertilizers ::
- **a.** sprinklers : ditches
- **b.** pesticides : weeds
- **c.** mule : tractor
- **d.** fertilizing : plowing

_____ **3.** wild animals : livestock ::
- **a.** meat : factory farming
- **b.** fishing : aquaculture
- **c.** farmland : forest
- **d.** compost : sustainable agriculture

_____ **4.** land degradation : desertification ::
- **a.** crops : soil fertility
- **b.** farming : grazing
- **c.** topsoil : plowing
- **d.** erosion : topsoil loss

_____ **5.** breeding : genetic engineering ::
- **a.** farming : arable land
- **b.** terracing : topsoil
- **c.** manure : chemical fertilizer
- **d.** ruminants : plant material

_____ **6.** meat : food from plants ::
- **a.** concentrated nutrients : low production costs
- **b.** large land area : high energy demand
- **c.** low nutritional value : low consumer cost
- **d.** high consumer cost : concentrated nutrients

_____ **7.** amino acids : proteins ::
- **a.** legumes : nitrogen
- **b.** sugars : carbohydrates
- **c.** fatty acids : fish
- **d.** vitamins : calories

_____ **8.** drought : famine ::
- **a.** war : unequal food distribution
- **b.** subsistence farming : yield
- **c.** monocropping : high yield
- **d.** efficiency : green revolution

_____ **9.** earthworms : soil aeration ::
- **a.** clay : chemical weathering
- **b.** rhizobium bacteria : nitrogen fixation
- **c.** menhaden : commercial fishing
- **d.** crops : integrated pest management

_____ **10.** irrigation : salinization ::
- **a.** pesticide resistance : evolution
- **b.** insects : growth regulation
- **c.** no-till farming : soil conservation
- **d.** overgrazing : desertification

INTERPRETING OBSERVATIONS

Read the following passage, and answer the questions that follow. As you read the passage, keep in mind that wild plants are often better protected from pests than are crop plants.

> Before the advent of large-scale agriculture, farmers had fewer problems with insects and crop disease. These problems stem from the modern system of single-crop farming in which large areas of land are devoted to growing one crop only. Monocropping—another term for single-crop farming—expedites the adaptation and reproduction of plant parasites and reduces their chances of responding against these organisms.

11. Why would planting large areas with a single-crop plant expedite the adaptation and reproduction of plant parasites?

12. How does single-crop farming reduce the chances of plants to respond naturally against the insects that affect them?

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

13. If we develop salt-tolerant plants, we may be able to use ocean water for crop irrigation.

14. Political and economic problems can be more important than agriculture yields in determining whether people go hungry.

15. It would be better to engineer pest resistant crops than to rely on chemical pesticides.

16. The green revolution made it possible for subsistence farmers to grow more and produce a surplus to sell.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

17. Explain how biological pest control can kill only the target pest while chemical insecticides kill many different kinds of insects.

18. Explain why the heavy use of chemical insecticides in agriculture makes it necessary to regularly develop new insecticides.

19. Explain how political problems can be more important than agricultural yields in determining whether people go hungry.

20. Describe two farming practices that can help reduce soil erosion by water.

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Critical Thinking

ANALOGIES

Write the letter of the pair of terms or phrases in the space provided that best completes the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** element : compound ::
- **a.** gold : sodium
- **b.** erosion : water
- **c.** solution : acid
- **d.** metal : alloy

_____ **2.** surface mining : land ecosystem ::
- **a.** mineral : native element
- **b.** dredging : aquatic ecosystem
- **c.** coal : mine fire
- **d.** reclamation: plant life

_____ **3.** salt : solar evaporation ::
- **a.** lead : galena
- **b.** ore minerals : gangue minerals
- **c.** sodium chloride : halite
- **d.** limestone : quarrying

_____ **4.** metallic mineral : gold ::
- **a.** ore : native element
- **b.** silver : copper
- **c.** nonmetallic mineral : gypsum
- **d.** ores : hydrothermal solutions

_____ **5.** silica : glass ::
- **a.** copper : wire
- **b.** gold : copper
- **c.** alloys : medicine
- **d.** metals : gemstones

_____ **6.** erosion : sedimentation ::
- **a.** smelting : slag
- **b.** mine collapse : subsidence
- **c.** noise : contaminant
- **d.** stream : arsenic

_____ **7.** acid mine drainage : streams ::
- **a.** dredging : disturbance
- **b.** coal : acids
- **c.** noise : blasting
- **d.** sulfur deposits : topsoil

_____ **8.** reclamation : SMCRA ::
- **a.** coal : sulfur
- **b.** water quality : Clean Water Act
- **c.** dredging : river
- **d.** hazard : law

INTERPRETING OBSERVATIONS

Read the following passage and answer the questions that follow.

Imagine you are a manager for Surface Mining Corporation, a hypothetical coal company. You and your colleagues face a dilemma. By law, any land used for mining must be restored to the condition it was in before mining began. You have been given estimated costs for restoring the land around the fully worked Washanka Pit coal mine. The total cost of reclamation could be as high as $12 million. On the other hand, an estimate of fines and bonded liability suggest that the cost for failing to completely restore the land would not exceed $8 million under current law. Meanwhile, the price received for coal has been falling recently, causing a significant loss of company revenue. You want the company to be responsible to the environment, but you are also responsible to stockholders who desire that the company be profitable and to employees who want their jobs to continue.

9. Should Surface Mining Corporation proceed with full reclamation or should it abandon the mine site without reclamation? What was the most important consideration in making your decision?

10. How should government agencies and lawmaking bodies react when mining companies have strong incentives to abandon disturbed land without full reclamation?

AGREE OR DISAGREE

Write whether you agree or disagree with the following statements. Support your answers with detailed reasons.

11. Supplies of mineral resources required for the production of metals will one day run out. However, this is not a source of serious concern.

12. Lower standards of reclamation following mining activities are acceptable in areas with low human populations.

13. The benefits of opening mines to obtain new minerals usually outweigh the risks of environmental damage.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, then answer the questions that follow.

14. Deep-sea mining presents many technical, political, and environmental problems. Still, polymetallic sulfide deposits produced by the circulation of sea water through the hot volcanic rocks in some undersea locations has created significant mineral deposits of zinc, copper, lead, barium, silver, and gold. Some known deposits may contain several millions of tons of ore and may be comparable with the largest massive sulfide deposits currently being mined on land. What obstacles hinder mining and recovery of these minerals? What aspects of mining could lead to environmental damage when undersea mining, but not when mining on land?

15. A variant of surface mining called *mountaintop removal mining* is used in regions where narrow seams of coal are embedded in mountain formations. This mining method is common in the Appalachian region of the United States. In order to reach these coal seams, the top of a mountain is first broken up and removed by blasting. Once the overburden has been blasted off, the excess rock and earth is dumped over the side of the mountain into the valleys below, often burying the streams that run through them. How might this method of mining complicate the process of land reclamation?

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Skills Worksheet

Critical Thinking

ANALOGIES

In the space provided, write the letter of the pair of terms or phrases that best complete the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** steam : turbine ::
- **a.** wind : windmill
- **b.** bicycle : pedals
- **c.** batteries : clock
- **d.** reactor : cooling tower

_____ **2.** controlled fission : uncontrolled fission ::
- **a.** internal combustion : car engine
- **b.** consumption : electricity
- **c.** nuclear plant : atomic bomb
- **d.** methane hydrate : natural gas

_____ **3.** petroleum : plastics ::
- **a.** oil reserves : oil deposits
- **b.** trees : lumber
- **c.** fabric : cotton
- **d.** fossil fuels : fire

_____ **4.** control rods : nuclear reaction ::
- **a.** current : generator
- **b.** neutrons : uranium pellets
- **c.** steam : condensation
- **d.** brakes : car

_____ **5.** petroleum : reserves ::
- **a.** fusion : sun
- **b.** uranium : radon
- **c.** money : bank
- **d.** coal : sulfur

_____ **6.** electricity : grid ::
- **a.** methane hydrate : ice
- **b.** crude oil : wells
- **c.** coal : deposits
- **d.** natural gas : pipeline

_____ **7.** petroleum fuels : carbon dioxide ::
- **a.** coal : sulfur
- **b.** oil well : natural gas
- **c.** nuclear power : uranium
- **d.** fuel cells : hydrogen

_____ **8.** fission : splitting ::
- **a.** fusion : technical difficulty
- **b.** neutron : nucleus
- **c.** deuterium : helium
- **d.** fusion : joining

INTERPRETING OBSERVATIONS

Read the following passage, then answer the questions below.

When energy is cheap and plentiful, the average consumer doesn't have to think much about efficiency or cost. But the oil crisis of 1973 gave many people in the United States a new appreciation for the law of supply and demand.

The oil crisis was not a natural occurrence but an artificial shortage caused for political reasons. In October 1973, the Organization of Petroleum Exporting Countries (OPEC) began an oil embargo in which member countries acted to limit the sale of crude oil to the United States. Prices for petroleum products, notably gasoline, rose sharply because of this drastic cut in supply. Many Americans still remember the long lines at gas pumps that year, as well as gas prices that rose to record levels. The embargo ended in March 1974, but Americans continued to react to its economic effects. Car makers began to produce more fuel-efficient cars, and consumers bought them. Congress approved the development of the Trans Alaska oil pipeline, which boosted domestic oil production when it was completed in 1977.

In the decades since the embargo, oil prices have gone through other periods of change, as well as times of relative stability. The price of oil continues to affect both individual choices and government policy.

Sources: Energy Information Administration: 25th Anniversary of the Oil Embargo; WTRG Economics: Oil Prices History and Analysis

9. This embargo created an artificial drop in the supply of oil. How would a natural shortage differ from an embargo situation?

_____

_____

_____

_____

10. After 1973, American scientists began to make serious efforts to develop technologies that create electricity from renewable resources. Do you think this step was necessary? Explain your answer.

_____

_____

_____

_____

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

11. Producing electricity on a large scale inevitably has environmental costs.

12. Electricity should cost more so that people will use less.

13. Coal can be a clean source of energy.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

14. Compare how energy is used worldwide with how it is used in the United States.

15. World oil production is expected to begin falling by the year 2015. Why do you think this is the case?

16. Explain whether you think nuclear energy is a viable source for the future energy needs of the United States.

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Skills Worksheet

Critical Thinking

ANALOGIES

In the space provided, write the letter of the pair of terms or phrases that best complete the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** wind power : renewable energy ::
- **a.** tidal power : geothermal energy
- **b.** the sun : fuel cells
- **c.** hydrogen fuel : alternative energy
- **d.** biomass fuel : hydroelectric energy

_____ **2.** active solar heating : hot water ::
- **a.** photovoltaic cells : electricity
- **b.** passive solar heating : ethanol
- **c.** fuel cells : hybrid cars
- **d.** energy conservation : fluorescent bulbs

_____ **3.** moving water : hydroelectric energy ::
- **a.** semiconductors : wind power
- **b.** solar collectors : passive solar heating
- **c.** hydrogen : photovoltaic cells
- **d.** cold ocean water : tidal power

_____ **4.** gasoline engine : energy inefficiency ::
- **a.** hybrid car : energy efficiency
- **b.** incandescent bulb : fluorescent bulb
- **c.** generating hydrogen : energy conservation
- **d.** ocean water : thermal conversion

_____ **5.** burning biomass fuel : air pollution ::
- **a.** geothermal energy : land pollution
- **b.** solar energy : noise pollution
- **c.** hydroelectric energy : disrupted ecosystems
- **d.** fuel cells : water pollution

_____ **6.** sunlight : solar cells ::
- **a.** geysers : heat pumps
- **b.** gasoline : octane
- **c.** hydrogen : fuel cells
- **d.** air conditioning : heat pumps

_____ **7.** tidal power : salt water ::
- **a.** gasoline : hybrid car
- **b.** hydroelectric power : fresh water
- **c.** fuel efficiency : hybrid car
- **d.** turbine : passive solar

_____ **8.** energy conservation : pollution ::
- **a.** oil : gas
- **b.** sun : light
- **c.** gravity : hydroelectric
- **d.** hybrid cars : emissions

INTERPRETING OBSERVATIONS

Read the following passage, and then answer the questions below.

Imagine that you are a civil engineer who was just hired by the government of Iceland to plan a city. On the airplane you read about the "land of fire and ice," and learn that it was formed from tectonic activity. As a result, there are many volcanoes, geysers, and hot springs on the island. Also, because Iceland is located in northern latitudes, it receives a lot of snowfall in winter.

As your plane zooms in for a landing, you notice that the annual springtime snowmelt has formed large lakes and colossal waterfalls—two of which are very impressive! The sky is overcast, and some volcanoes are still capped with snow. There aren't very many trees around, only grass and shrubs in a rocky landscape.

9. What are two sources of energy you would use for your city? Explain your answer.

10. What might be a cost-effective way to provide hot water?

11. Would it be effective to use rooftop solar collectors to provide electricity or hot water? Explain your answer.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

12. Renewable energy sources cannot generate large amounts of electricity.

13. Fossil fuels are biomass fuel sources and are renewable.

14. Fifty years from now, the major source of energy for people on Earth will be solar cells.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

15. If hydrogen is the most common element on Earth, what makes generating hydrogen expensive and polluting? What is a possible solution that would generate hydrogen without polluting the environment?

16. You heat your home with electricity. You wish to reduce your electric bills, so you have decided to use a wood furnace. What are the environmental advantages and disadvantages of doing this? What other steps could you take to conserve electricity?

17. Nearly all forms of renewable energy come directly or indirectly from the sun. List the forms of renewable energy. Describe how the sun creates the various forms of renewable energy you listed. If you named any forms of renewable energy that do not come from the sun, identify their sources.

Name _____ Class _____ Date _____

Skills Worksheet

Critical Thinking

ANALOGIES

Mark the letter of the pair of terms that best completes the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** cardboard box : solid waste ::
- **a.** motor oil : hazardous waste
- **b.** barge : exported waste
- **c.** excavation : mining waste
- **d.** Yucca Mountain : nuclear waste

_____ **2.** landfill : groundwater ::
- **a.** vent pipes : methane
- **b.** incinerator : air
- **c.** factory : land
- **d.** playgrounds : chemicals

_____ **3.** sunlight : photodegradable ::
- **a.** polyester : nonbiodegradable
- **b.** decomposers : biodegradable
- **c.** paper : recyclable
- **d.** batteries : rechargeable

_____ **4.** dish towels : paper towels ::
- **a.** egg cartons : drink boxes
- **b.** green plastic : sugar molecules
- **c.** plastic bags : paper bags
- **d.** rechargeable batteries : regular batteries

_____ **5.** surface impoundment : evaporation ::
- **a.** Superfund : legislation
- **b.** furnace : incineration
- **c.** composting : decomposition
- **d.** recycling : source reduction

_____ **6.** waste production : increasing ::
- **a.** incinerators : reducing
- **b.** available land : decreasing
- **c.** raw materials : decomposing
- **d.** recycled materials : expanding

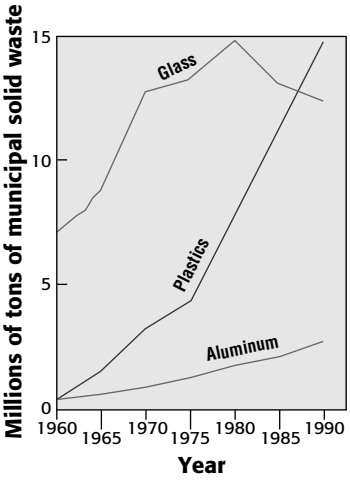
_____ **7.** household hazardous waste collection : local government ::
- **a.** waste export : international agreement
- **b.** Resource Conservation and Recovery Act : state government
- **c.** Superfund site cleanup : federal government
- **d.** Love Canal : school board

_____ **8.** better design : source reduction ::
- **a.** increased demand : recycling
- **b.** changing materials : solid waste
- **c.** reusing materials : glass bottles
- **d.** chemical treatment : oil spills

INTERPRETING OBSERVATIONS

Read the passage below, and answer the questions that follow.

The total amount of municipal solid waste generated in the United States has doubled in the last 40 years. Today, the average person living in the United States produces 4.4 pounds of solid waste per day. Because the human population and the amount of waste we create are increasing and the amount of land available is decreasing, it is getting harder to dispose of the waste we create.



9. During the 1970s, the production of waste per person grew slowly while an economic recession was occurring in the United States. How might the slower production of waste have been related to the recession?

10. In the 1980s, after the recession was over, why did the amount of waste per person increase? What could have been done to offset this trend?

11. During the 1990s, the amount of waste generated per person remained almost constant, yet the total waste generated increased steadily. Explain why such a situation could occur.

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

12. Leachate is a form of hazardous waste.

13. Compost is biodegradable.

14. There is little danger of hazardous waste entering groundwater if the waste is disposed of through deep-well injection.

REFINING CONCEPTS

15. Under certain conditions, biodegradable materials can take a long time to decompose. What factors could keep a newspaper in a landfill intact for years? What factors could speed up the process of decomposition?

16. As a packaging material, glass has some advantages over plastic, but it also has some disadvantages. List two disadvantages of using glass containers.

17. Recycling rates in Japan are much higher than they are in the United States. List two reasons why this might be the case.

Name _____ Class _____ Date _____

Skills Worksheet

Critical Thinking

ANALOGIES

In the space provided, write the letter of the pair of terms or phrases that best complete the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** coal dust : black lung disease ::
- **a.** lead : learning problems
- **b.** particulates : gastrointestinal infections
- **c.** pesticides : farming
- **d.** bacteria in food : influenza

_____ **2.** dose : response ::
- **a.** chemical : pollution
- **b.** air : lungs
- **c.** accident : injuries
- **d.** snail : vector

_____ **3.** radon : granite bedrock ::
- **a.** particulates : water
- **b.** selenium : soil
- **c.** gasoline : vehicles
- **d.** asthma : lungs

_____ **4.** wastewater : toxic chemicals ::
- **a.** drinking water : bath water
- **b.** particulates : air
- **c.** bath water : bathing
- **d.** raw sewage : pathogens

_____ **5.** toxic chemicals : health problems ::
- **a.** bacteria : pathogens
- **b.** pathogens : infectious diseases
- **c.** rain : clouds
- **d.** disease : soil erosion

_____ **6.** bacteria : antibiotics ::
- **a.** Lyme disease : habitat destruction
- **b.** vector : cross-species transfer
- **c.** virus : vaccine
- **d.** malaria : global warming

_____ **7.** mosquitoes : malaria ::
- **a.** fish : cholera
- **b.** emerging viruses : AIDS
- **c.** bacteria : tuberculosis
- **d.** snails : schistosomiasis

_____ **8.** rodent : hanta virus ::
- **a.** dog : hookworm
- **b.** smoking : lung cancer
- **c.** resistance : pesticides
- **d.** duck : Hong Kong flu

_____ **9.** directly by pollution : indirectly by pollution ::
- **a.** river blindness : tuberculosis
- **b.** asthma : lung cancer
- **c.** lead poisoning : cholera
- **d.** birth defects : brain damage

_____ **10.** epidemiology : disease ::
- **a.** cooking : eating a meal
- **b.** collecting wastes : landfills
- **c.** farming : using pesticides
- **d.** detective work : crime

INTERPRETING OBSERVATIONS

Read the following paragraph, and answer the questions below.

West Nile virus is an emerging virus that infects humans, horses, and birds, as well as other animals. Mosquitoes are the vector for West Nile virus. In 2001, there had never been a case of West Nile virus in any human or other animal in Illinois, although birds on the East Coast of the United States had been found with the virus the year before. By the end of summer in 2002, many humans, birds, and horses had been infected.

11. What makes West Nile virus an emerging virus?

12. How do you think the West Nile virus got to Illinois and infected humans? Explain your answer.

13. How can people help protect themselves from West Nile virus?

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

14. Forest fires are always a natural source of pollutants.

15. Industrial chemicals have no effect on people's health unless people work in or live near factories.

16. A friend of yours recycles aluminum, glass, cardboard, and newspapers, and she never litters. She claims that she does not cause any pollution. Do you agree or disagree with her? Defend your answer.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

17. Epidemiologists predict that the greatest threat to human health may be the outbreak of a new, very virulent strain of influenza virus. What kind of environment would increase the spread of this virus? Justify your answer.

18. What makes virus-caused diseases difficult to treat and control? Why are some bacterial diseases becoming more difficult to treat?

19. A city has an outbreak of a disease. Using epidemiology, what steps should health workers take?

Name _____ Class _____ Date _____

Skills Worksheet

Critical Thinking

ANALOGIES

Mark the letter of the pair of terms that best completes the analogy shown. An analogy is a relationship between two pairs of words or phrases written as a : b :: c : d. The symbol : is read "is to," and the symbol :: is read "as."

_____ **1.** attending public meetings: local policy ::
- **a.** globalization : privatization
- **b.** EIS : planning
- **c.** lobbying : national policy
- **d.** environmental problem : global warming

_____ **2.** EPA : Clean Water Act ::
- **a.** Department of Agriculture : Superfund
- **b.** U.S. Fish and Wildlife Service : Endangered Species Act
- **c.** EIS : state representative
- **d.** Nuclear Regulatory Commission : U.S. senator

_____ **3.** Earth Day : 1970 ::
- **a.** Kyoto Protocol : 1987
- **b.** Montreal Protocol : 1997
- **c.** Earth Summit : 1997
- **d.** Kyoto Protocol : 1997

_____ **4.** DDT : Rachel Carson ::
- **a.** lead additives : Jane Goodall
- **b.** Nashua River : Jacques Cousteau
- **c.** human population increases : Paul Ehrlich
- **d.** Sierra Club : Theodore Roosevelt

_____ **5.** loopholes : regulations ::
- **a.** environmental problems : market failures
- **b.** individuals : cooperation
- **c.** CFCs : ozone layer
- **d.** littering : recycling

_____ **6.** citizens : local government ::
- **a.** Clean Water Act : unfunded mandate
- **b.** countries : international organizations
- **c.** media : public opinion
- **d.** agencies : policies

_____ **7.** MARPOL : oceans ::
- **a.** CMS : migratory wildlife
- **b.** CITES : transportation
- **c.** IFCS : endangered species
- **d.** CBD : hazardous wastes

INTERPRETING OBSERVATIONS

Read the following passage, and answer the questions that follow.

> Two people fishing in a boat about 20 km offshore noticed paper, plastic, and other types of litter floating in the water. As they headed back to shore, they passed a large trash barge. Crew members on the deck of the ship were dumping the garbage overboard.

8. You are a citizen in the city whose trash was being transported by this barge. How is this scenario potentially an example of a market failure?

9. Identify at least one international agreement that pertains to this problem. Be specific. Describe the agreement and how it is enforced.

10. If you were one of the people on the fishing boat, what action would you take?

AGREE OR DISAGREE

Agree or disagree with the following statements, and support your answer.

11. An individual is obligated to do more to preserve the environment than is required by law.

12. Wealthy nations should offer poor nations economic incentives to protect the environment.

13. Television is the best source of information about environmental problems.

REFINING CONCEPTS

The statements below challenge you to refine your understanding of concepts covered in the chapter. Think carefully, and answer the questions that follow.

14. The United States and other highly developed nations have criticized the logging and burning of the rain forest in the Brazilian Amazon. Beyond the environmental implications—depletion of natural resources with no plan for renewal and an increase in global production of carbon dioxide—what makes this criticism controversial?

15. How does the widespread study of environmental science affect government policy?

16. Given that communities in the same area do not always coordinate plans, can environmental action on the local level be effective?

17. Give an example of how one person has changed the course of environmental policies in the United States.