Name _____ Class _____ Date _____

1.1 Our Island, Earth

Key Concepts

- Environmental scientists study how the natural world works, and how humans and the environment affect each other.
- In the last several hundred years, both human population and resource consumption have increased dramatically.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Environment		
Environmental science		
Environmentalism		
Natural resource	A material or energy source provided by nature that people need to survive	I think of all the resources in my school library and then think of what that means in a natural environment.
Renewable natural resource		

Name _____ Class _____ Date _____

Term	Definition	How I Remember
Nonrenewable natural resource		
Sustainable		
Fossil fuel		
Ecological footprint		

Our Environment

1. List three examples of nonliving things in the environment.

_____

2. Give two reasons why environmental science is important.

_____

_____

_____

3. Name four of the disciplines that contribute to the study of our interactions with the environment.

_____

4. What is the difference between environmental science and environmentalism?

_____

_____

_____

Name _____ Class _____ Date _____

Population Up, Resources Down

For Questions 5–10, write True *if the statement is true. If the statement is false, replace the underlined word to make the statement true. Write your changes on the line.*

_____ **5.** Nature makes natural resources at <u>similar</u> speeds.

_____ **6.** Fruit is an example of a <u>renewable</u> resource.

_____ **7.** For most of human history, population has been <u>high</u> and relatively stable.

_____ **8.** The Industrial Revolution marked a shift from a rural society to an urban society powered by <u>renewable</u> resources.

_____ **9.** Our ecological footprint is affected by the number of people on Earth and how much we <u>consume</u>.

_____ **10.** The tragedy of the commons refers to the overuse of <u>unregulated</u> resources.

11. In what way is living on Earth similar to living on an island?

_____

_____

12. Why are sunlight and oil on opposite sides of the renewability continuum?

_____

_____

_____

_____

13. What could cause a renewable natural resource to become a nonrenewable resource?

_____

_____

14. How can a nonliving thing have an ecological footprint?

_____

_____

15. What is one way the tragedy of the commons could be avoided?

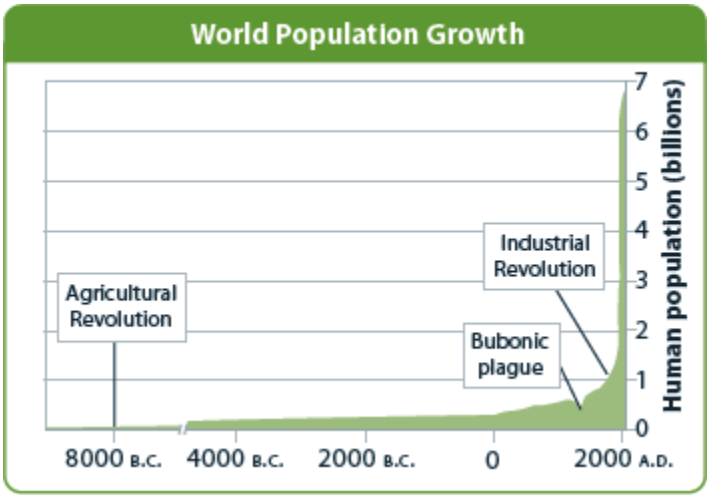
_____

_____

Name _____ Class _____ Date _____

SKILL BUILDER Think Visually

Use the graph below to answer Questions 16 and 17.



16. Which event shown on the graph signaled the biggest change in human population growth? _____

17. Explain how understanding environmental science can help people solve problems related to human population growth.

_____

_____

_____

EXTENSION Choose two different organisms or objects. Think about the relationship they have with other organisms or objects in their environment. Compare their ecological footprints by listing the ways they affect the environment.

1.1 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

18. Why is it important to remember that people are part of the environment, too?

_____

19. Why is natural gas considered a nonrenewable resource? _____

_____

18. Sample answer: Because people interact with, rely on, and affect the health of the environment 19. Because it forms much more slowly than humans use it

Name _____ Class _____ Date _____

1.2 The Nature of Science

Key Concepts

- Science is both an organized and methodical way of studying the natural world and the knowledge gained from such studies.
- The process of science involves making observations, asking questions, developing hypotheses, making and testing predictions, and analyzing and interpreting results—often many times and in many changing orders.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Hypothesis		
Prediction		
Independent variable		
Dependent variable	A variable that depends on the conditions set up in an experiment	I think of how I am dependent on something. For example, what I wear depends on the weather.
Controlled study		
Data		

Name _____ Class _____ Date _____

SKILL BUILDER **Reading Strategy**

Fill in the chart to preview the lesson. Then, on the lines below the chart, write one sentence to explain what you think this lesson will be about.

What is the title of this lesson?	
Which vocabulary words are new to you?	
Which key concept can help you understand the definition of science?	
What do the photos show?	
What do the diagrams show?	

What Science Is and Is Not

1. What are the two components of science?

2. What does the natural world include?

3. What is the goal of science?

Name _____ Class _____ Date _____

4. How do scientists examine the workings of the natural world?

_____

5. Explain the following statement: "Nothing in science can be absolutely proven no matter how much evidence is collected."

_____

_____

_____

The Process of Science

For Questions 6–9, circle the letter of the correct answer.

6. Which of the following statements best describes the process of science?

A. It is mysterious.
B. It is predictable.
C. It proceeds in a linear fashion.
D. It produces knowledge over time.

7. Which of the following plays an especially important role in the early stages of an investigation?

A. making observations
B. gathering data
C. interpreting data
D. making predictions

8. Which of the following is NOT involved in testing ideas?

A. making predictions
B. making observations
C. making policy decisions
D. conducting experiments

9. What must scientists do if a large number of tests refute their hypothesis?

A. repeat each test
B. publish a report
C. reject the test results
D. reject the hypothesis

10. What is the relationship between hypotheses and predictions?

_____

_____

Name _____ Class _____ Date _____

11. What do scientists use models for?

_____

_____

12. Name two methods scientists use to test predictions.

_____

13. What is the difference between an independent variable and a dependent variable?

_____

_____

_____

14. Briefly define *correlation*.

_____

15. Why is it important to control all variables except one when studying cause-and-effect relationships?

_____

_____

16. Why are quantitative data particularly helpful to scientists?

_____

1.2 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page

17. Give an example of a rule of the natural world that a scientist can assume is always true.

_____

18. What activities make up the process of science? _____

_____

19. What is controlled in a controlled study? _____

_____

17. Sample answer: The boiling point of water is always 100°C at sea level. 18. Making observations, asking questions, developing hypotheses, making and testing predictions, analyzing and interpreting data 19. All variables except the one being studied

Name _____ Class _____ Date _____

1.3 The Community of Science

Key Concepts

- The scientific community, through peer review and replication, helps to verify the accuracy of results and contributes to the establishment of scientific theories.
- Environmental ethics explores how environmental science interacts with, and is guided by, a society's morals and principles.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Peer review		
Theory	A broad explanation that applies to a wide range of situations and observations and that is supported by several lines of evidence and broadly accepted by the scientific community	I remember reading about the Big Bang theory in a science magazine.
Ethics		
Environmental ethics		

Community Analysis and Feedback

1. How does peer review benefit the scientific community?

_____

_____

Name _____ Class _____ Date _____

2. What happens to a scientific article that is rejected by a panel of other scientists?

3. Why is the replication of results important?

4. Explain the following statement: "Science is self-correcting."

5. Give an example of a self-correction in science.

6. What is the difference between a hypothesis and a theory?

7. How does popular use of the word *theory* differ from use of the word *theory* in science?

8. Give one reason why an idea is not a theory.

9. Think Visually Fill in the diagram by writing three ways the scientific community reviews scientific results.

Name _____ Class _____ Date _____

Benefits and Outcomes

10. Give an example of how ethics could impact a government's policy on science.

_____

_____

11. Briefly explain the relationship between culture and worldview.

_____

_____

12. What role do a society's beliefs play in an objective process like science?

_____

_____

13. What led to the application of ethical standards to relationships between people and their environment?

_____

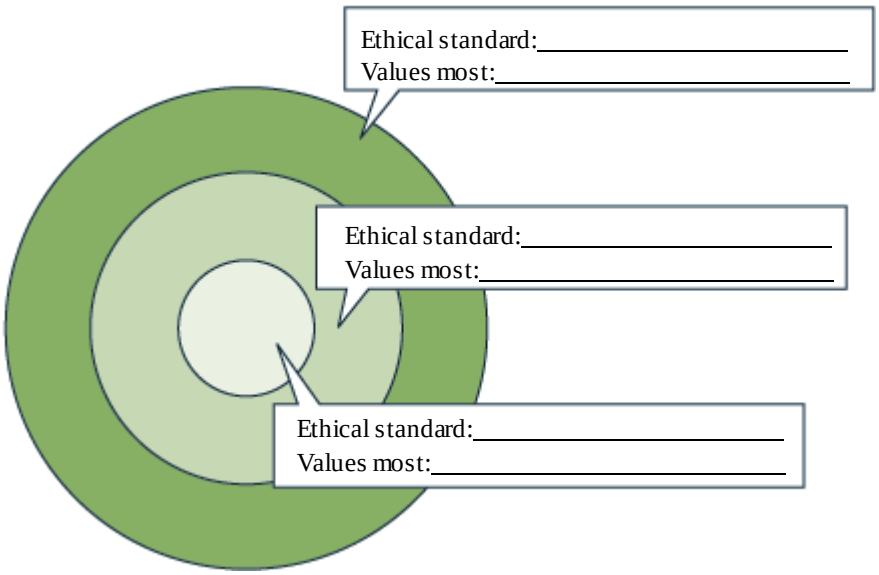
_____

14. What does the environmental justice movement promote?

_____

_____

15. Think Visually *Anthropocentrism, biocentrism,* and *ecocentrism* are ethical standards in environmental ethics. Think about what they mean. Then, label each of the circles below with the name of the ethical standard it represents and a description of what that standard places the highest value on.



Name _____ Class _____ Date _____

SKILL BUILDER Organize Information

16. Write each term from the word bank in the correct column of the table below.

build knowledge	**develop technologies**	**inform policy**
peer review	**replication**	**satisfy curiosity**	**self-correction**

Analysis and Feedback of Scientific Knowledge	Benefits and Outcomes of Scientific Knowledge

EXTENSION Use the Internet to research a group or organization that works for environmental justice. On a separate sheet of paper, write a short report on the group's recent environmental initiatives.

1.3 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

17. How do peer review of scientific articles and replication of test results contribute to the development of scientific theories? _____

_____

18. Give an example of how ethical standards have been applied to a worldwide environmental issue. _____

_____

19. Give an example of an ethical question related to people and their interactions with the environment. _____

_____

20. Name three ethical standards that are applied to environmental issues.

_____

17. Sample answer: Both peer review and replication are forms of testing, and an idea must be rigorously tested before it is accepted as a theory. 18. Sample answer: In 1987, 93 nations signed the Montreal Protocol, agreeing to control the use and production of ozone-depleting substances. 19. Sample answer: Does the present generation have an obligation to conserve resources for future generations? 20. Anthropocentrism, biocentrism, ecocentrism

Name _____ Class _____ Date _____

2.1 Economics

Key Concepts

- Supply and demand and cost-benefit analysis are two economic concepts that greatly contribute to decision making.
- All economies depend on the environment for resources and for management of wastes, but these connections are often overlooked.
- A new trend in economics is the recognition that suppliers of goods and services need to consider how to conserve resources and reduce harm to the environment.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Economics		
Supply		
Demand	The amount of a product people will buy at a given price if free to do so.	When people demand something, they want it and are willing to pay for it.
Cost-benefit analysis		
Ecological economics		
Environmental economics		
Non-market value		

Name _____ Class _____ Date _____

Term	Definition	How I Remember
Market failure		
Ecolabeling		

What Is Economics?

Match each type of economy with the statement that best describes it.

_____ **1.** centrally planned economy

_____ **2.** free market economy

_____ **3.** mixed economy

a. The government decides what is made, how it is made, and who gets what.

b. Both government and individuals play roles in economic decision making.

c. Individuals decide what is made, how it is made, and how much is made.

4. Is economics only about money? Explain your answer.

5. Compare and contrast goods and services.

6. Explain how supply and demand works.

7. On the surface, cost-benefit analysis seems straightforward. What can make this decision-making method both complicated and controversial?

Name _____ Class _____ Date _____

Economics and the Environment

8. Briefly define *natural resources.*

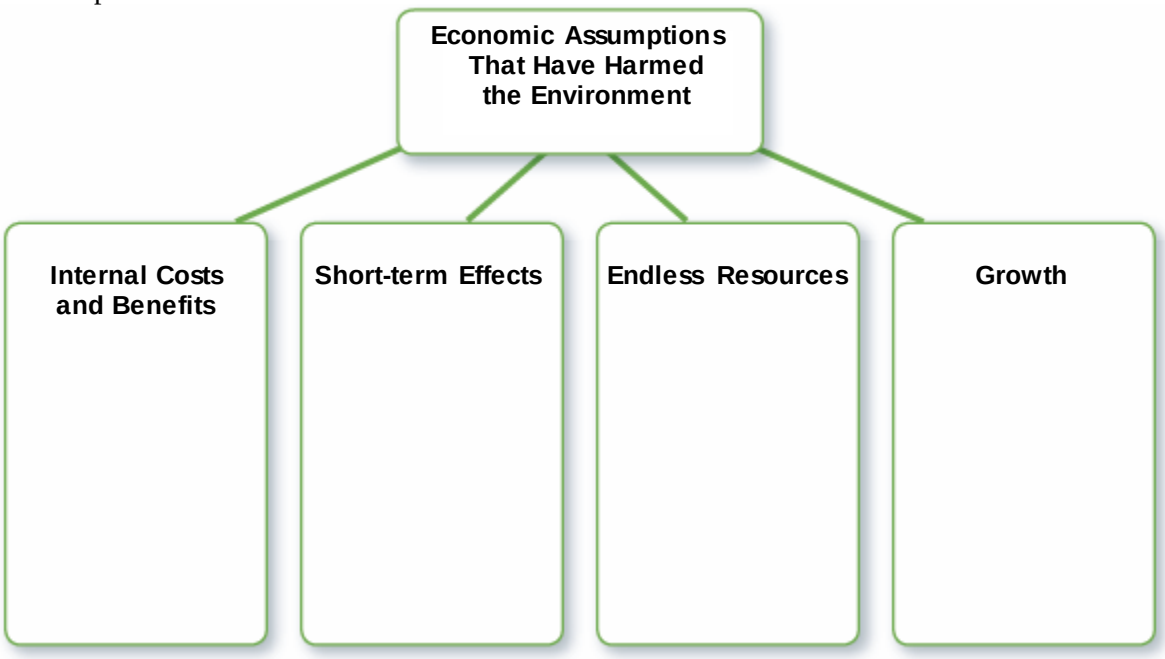
_____

9. What kinds of "services" do ecological systems provide?

_____

_____

10. Organize Information Fill in the diagram with short descriptions of economic assumptions that have harmed the environment.



Economics and Sustainability

11. Complete the following paragraph with terms from the word bank.

ecolabeling **ecological economics** **environmental economics** **market failure** **non-market value**

Many economists in _____ argue that economies must be stable to be sustainable. But economists in _____ think growing economies can become sustainable if they address environmental problems. In particular, these economists are developing ways to include the _____ of ecosystem services in prices. They are also finding ways to avoid _____ by acknowledging the positive effects of the environment on economies and the negative effects of economic activities on the environment and people. _____ helps consumers push companies toward sustainability.

Name _____ Class _____ Date _____

12. How do companies benefit by offering sustainable products and services?

SKILL BUILDER Organize Information

13. Complete the tables below to show how the quantity produced and the quantity purchased change in a typical market. On the lines below the tables, describe what might happen if consumers were willing to pay a high price for a new sustainable product, such as a very energy and water efficient yet expensive washing machine.

Supply	
Price	**Quantity Produced**
Low	
Low	

Demand	
Price	**Quantity Purchased**
Low	
High	

EXTENSION Identify a product that consumers are likely willing to pay high prices for. Then draw a supply and demand graph comparing price to quantity purchased.

2.1 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

14. Which kind of economy do most nations have today? Explain your answer.

15. What are external costs, and how do they relate to market failure?

14. Most nations have a mixed economy because both governments and individuals make economic decisions.
15. External costs involve parties other than buyers and sellers. When buyers and sellers ignore external costs in their decision making, markets do not reflect the full costs of actions and are said to fail.

Name _____ Class _____ Date _____

2.2 United States Environmental Policy

Key Concepts

- Environmental policy makes use of science, ethics, economics, and the political process to solve environmental problems.
- Throughout its history, the United States government has reinvented its approach to the relationship between the nation's goals and the environment.
- Modern U.S. environmental policy reveals lessons learned from past misuses of resources and strives for a sustainable future.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Policy		
Environmental policy		
Environmental Impact Statement (EIS)	A report that evaluates the impact of new construction on the environment	*To impact* means "to affect," so an Environmental *Impact* Statement tells how something will affect the environment

What Is Environmental Policy?

1. Identify three goals of modern-day environmental policies.

_____

_____

2. Name five individuals and groups that help make environmental policies.

_____

3. What role does science play in making environmental policy?

_____

_____

Name _____ Class _____ Date _____

4. How do environmental catastrophes tend to influence environmental policies in state and local governments?

_____

_____

_____

_____

5. Organize Information Fill in the T-chart with short descriptions of how different branches of the U.S. government are involved in environmental policy.

Branch of U.S. Government	Its Role in Environmental Policy

History of U.S. Environmental Policy

For Questions 6–8, write True *if the statement is true. If the statement is false, replace the underlined word to make the statement true. Write your changes on the line.*

_____ **6.** From the 1780s to the late 1800s, people thought the amount of land and resources in the West was limited.

_____ **7.** People overused natural resources in the West from the late 1800s through the mid-1960s.

_____ **8.** The pristine condition of Ohio's Cuyahoga River during the 1950s and 1960s helped make more people aware of environmental issues.

9. How did Rachel Carson's *Silent Spring* help change U.S. environmental policies?

_____

_____

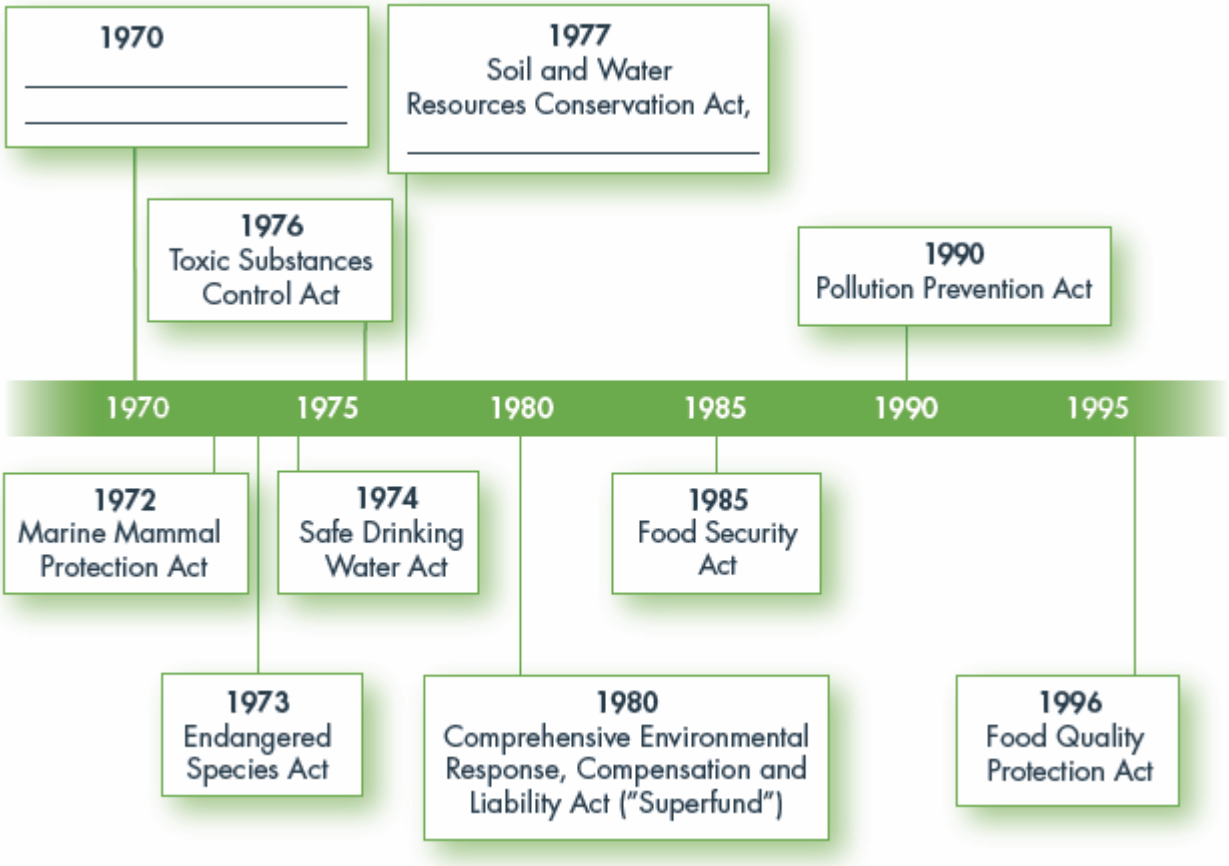
_____

Name _____ Class _____ Date _____

Modern U.S. Environmental Policy

10. **Think Visually** Add labels to the timeline for the following environmental events and laws.

National Environmental Policy Act **Clean Water Act** **EPA formed**



11. After studying the timeline above, what observations can you make about U.S. environmental policy between 1970 and 1996?

_____

_____

_____

12. What is the current direction of environmental policy in the United States? Give examples.

_____

_____

_____

_____

Name _____ Class _____ Date _____

SKILL BUILDER Organize Information

13. Fill in the compare/contrast table with information about the three historical periods of U.S. environmental policy and modern-day U.S. environmental policy.

	First Period (1780s to late 1800s)	Second Period (late 1800s to mid-1900s)	Third Period (mid- to late 1900s)	Modern Day
Policy catalyst				
Policy focus				

2.2 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

14. Describe how an environmental policy becomes law in the United States.

_____

_____

_____

15. Since the late 1800s, how has the United States tried to protect the environment?

_____

_____

_____

14. Sample answer: A policy becomes law when Congress passes a bill and the President signs it into law. Policies and laws also are created at state and local levels of government. 15. Starting in the late 1800s the United States began passing environmental laws. The EPA was created in 1970 to coordinate efforts to protect the environment. Today, the United States is working on conserving energy and developing renewable energy sources—moving toward sustainability.

Name _____ Class _____ Date _____

2.3 International Environmental Policy and Approaches

Key Concepts

- International organizations, laws, and treaties help governments of the world come to agreement on environmental issues.
- Approaches to environmental policy may include direct laws from a government body or policies with economic incentives.
- Steps of the environmental policy process include identifying a problem, finding the cause, proposing solutions, getting organized, gaining access to policymakers, and guiding the solution to law.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Command-and-control approach		
Subsidy		
Green tax	A tax imposed on companies that participate in activities or produce products that are harmful to the environment	I can remember that if a company is not "green," it does not have good environmental practices, so it is taxed.
Cap-and-trade		
Lobbying		

Name _____ Class _____ Date _____

SKILL BUILDER **Reading Strategy**

As you read the lesson, complete the main ideas and details chart.

Main Ideas	Details
International environmental policy	
Approaches to environmental policy	
The environmental policy process	

International Environmental Policy

1. Why must nations sometimes work together to solve environmental problems?

_____

_____

2. Give an example of a transboundary problem.

_____

_____

3. How do international organizations encourage nations to work on environmental issues?

_____

_____

Name _____ Class _____ Date _____

4. Explain the role played by non-governmental organizations in international environmental policy.

_____

_____

For Questions 5–8, match each organization with the statement that best describes the work it is doing to influence international environmental policy.

_____ **5.** United Nations

_____ **6.** European Union

_____ **7.** World Trade Organization

_____ **8.** World Bank

a. Makes current environmental data and analyses available to policymakers in member nations

b. Imposes financial penalties on member nations that do not comply with its directives

c. Promotes research and programs that provide information to international policymakers

d. Funds projects such as dams and irrigation systems

Approaches to Environmental Policy

For Questions 9–12, complete each statement by writing the correct word or words.

9. Using a _____ approach to environmental policy, a government sets rules and threatens punishment for violations.

10. Green taxes let _____ decide how best to reduce pollution.

11. Critics of _____ systems say that giving companies permission to pollute will not solve environmental problems in the long run.

12. A local government that gives rebates to residents who buy water-efficient toilets is using a _____ as a policy tool.

13. How have governments responded to the criticism that free-market competition produces better and cheaper solutions to environmental problems than the command-and-control approach does?

_____

_____

_____

14. Explain how a cap-and-trade system works.

_____

_____

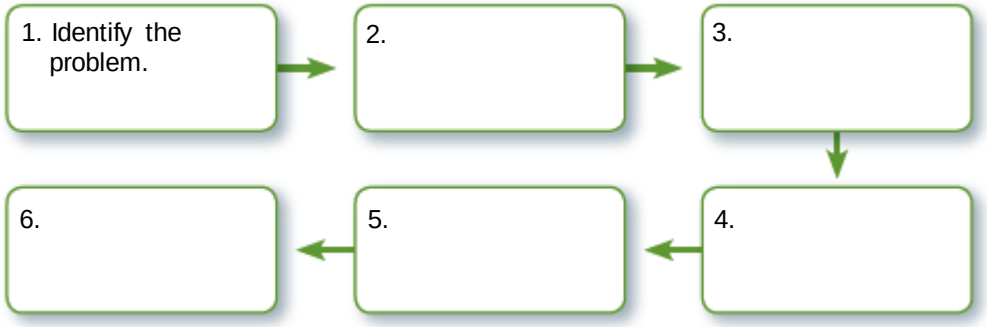
_____

_____

Name _____ Class _____ Date _____

The Environmental Policy Process

15. **Organize Information** Fill in the flowchart with the steps in the environmental policy process. The first step is provided.



16. Describe ways in which science can help identify environmental problems and their causes.

_____

_____

_____

17. Explain a problem an environmental policy might face even after it becomes a law.

_____

_____

2.3 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

18. Governments can use taxes both to encourage compliance with environmental policies and to discourage noncompliance. Give an example of each.

_____

_____

19. How can people who are too young to vote influence environmental policy?

_____

_____

_____

18. Sample answer: Tax breaks encourage environmentally sound actions, and green taxes discourage actions and products that harm the environment. 19. Sample answer: Young people can make a difference by lobbying for changes in their schools environmental policies, joining a local environmental group, or taking part in international meetings.

Name _____ Class _____ Date _____

3.1 Matter and the Environment

Key Concepts

- Atoms and elements are the building blocks of chemistry.
- Proteins, nucleic acids, carbohydrates, and lipids are the building blocks of life.
- Water is a unique compound with several unusual properties that make it essential to life.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Matter		
Atom		
Element		
Nucleus		
Molecule		
Compound		
Hydrocarbon	An organic compound that contains only hydrogen and carbon	The prefix *hydro–* means "combined with hydrogen," so *hydrocarbon* means "carbon combined with hydrogen."

Name _____ Class _____ Date _____

Term	Definition	How I Remember
Solution		
Macromolecule		
Protein		
Nucleic acid		
Carbohydrate		
Lipid		
pH		

Building Blocks of Chemistry

Match each term with the statement that best describes it.

_____ **1.** element

_____ **2.** electron

_____ **3.** compound

a. the negatively charged part of an atom

b. water, for example

c. its properties cannot be broken down any further

4. Write a sentence that shows the relationship between matter and atoms.

_____

5. Give two examples of substances that contain hydrocarbons.

_____

Name _____ Class _____ Date _____

Macromolecules

For Questions 6–8, circle the letter of the correct answer.

6. The characteristic that best defines a macromolecule is its
- **A.** size.
- **B.** function.
- **C.** life cycle.
- **D.** chemical makeup.

7. All of the following macromolecules are polymers EXCEPT
- **A.** lipids.
- **B.** proteins.
- **C.** nucleic acids.
- **D.** carbohydrates.

8. All of the following are part of a carbohydrate EXCEPT
- **A.** carbon.
- **B.** oxygen.
- **C.** hydrogen.
- **D.** phosphorus.

9. Explain how macromolecules are involved in passing traits from parents to offspring.

_____

_____

_____

Water

For Questions 10–12, write True *if the statement is true. If the statement is false, replace the underlined word to make the statement true. Write your changes on the line.*

_____ **10.** Water molecules adhere to each other through <u>covalent</u> bonds.

_____ **11.** Its <u>cohesion</u> allows water to transport nutrients and wastes in plants and animals.

_____ **12.** A solution with a pH less than 7 is <u>basic</u>.

13. How does water resist changes in temperature?

_____

_____

_____

14. Why is water called "the universal solvent"?

_____

Name _____ Class _____ Date _____

SKILL BUILDER Organize Information

15. Fill in the compare/contrast table below with information about the different types of matter.

	O_2	Hydrocarbons	Protein	DNA
Matter type				
Description				
Function				

3.1 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

16. Is water an element? Why or why not?_____

_____

17. Describe the special properties of water that allow it to support life on Earth.

_____

_____

_____

_____

_____

16. No. It is a compound because it is made up of two elements, hydrogen and oxygen. 17. Water sticks to itself, which allows it to carry materials in plants and animals. Water is resistant to temperature change, which stabilizes aquatic systems and their climates. Liquid water is denser than frozen water, which allows ice to float and insulate underwater environments. Water is a universal solvent, which allows it to hold important molecules in solutions.

Name _____ Class _____ Date _____

3.2 Systems in Environmental Science

Key Concepts

- An output of one of Earth's systems is often also an input to that or another system.
- Earth's geosphere, biosphere, atmosphere, and hydrosphere are defined according to their functions in Earth's systems.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Feedback loop		
Erosion		
Geosphere		
Lithosphere		
Biosphere		
Atmosphere		
Hydrosphere	All the water on and below Earth's surface and in the atmosphere	Hydrosphere reminds me of a water *hydrant.*

Name _____ Class _____ Date _____

SKILL BUILDER Reading Strategy

As you read the lesson, complete each statement by writing in the correct word or words.

1. A _____ is a network of parts, elements, or components that interact with and influence one another.
2. Systems receive and process _____ of energy, matter, or information, and produce of energy, matter, or information.
3. Systems do not have well-defined _____, which makes it difficult to decide where one system ends and another begins.
4. Systems may exchange energy, _____, and/or information with other systems.
5. Inputs into Earth's systems can include both _____ energy and geothermal energy.
6. An event that is both a cause and an effect is a cyclical process known as a _____, and can be either positive or negative.
7. A predator-prey relationship in which the two populations rise and fall in response to each other is an example of a _____ feedback loop.
8. _____ feedback loops enhance stability by canceling an action once it reaches an extreme.
9. Erosion is an example of a _____ feedback loop.
10. Positive feedback loops are relatively _____ in nature but _____in environmental systems that people have changed.
11. Scientists divide Earth into spheres, which are often described by their _____ rather than by their location.
12. Earth's geosphere is made up of all the _____ at and below the surface of Earth.
13. The sphere of the Earth that consists of all the planet's living or once-living things and the nonliving parts of the environment with which they interact is the _____.
14. The outermost layer of Earth and the geosphere is known as the _____.
15. The hydrosphere includes all water on Earth, including all forms of liquid, solid, and _____.
16. Earth's spheres both overlap and _____.
17. An earthworm tunneling through the soil is an example of the biosphere interacting with the _____.

Name _____ Class _____ Date _____

Interacting Systems

18. Use the concept of a computer system to explain why it is difficult to determine clear distinct boundaries to a system. Include sample descriptions in your answer.

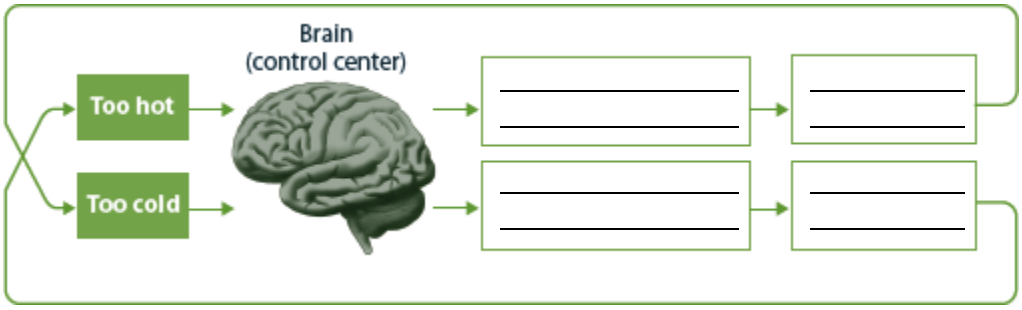
19. Give an example of each type of input into Earth's systems.

20. Explain how a negative feedback loop works. Use a thermostat as an example.

21. Describe the effects of a positive feedback loop.

22. Contrast the two different types of feedback loops in terms of how they affect the stability of a system.

23. Think Visually Write in the boxes to complete the following on how the human body relies on a negative feedback loop to respond to heat and cold.



Name _____ Class _____ Date _____

Earth's "Spheres"

For Questions 24–26, write True *if the statement is true. If the statement is false, replace the underlined word to make the statement true. Write your changes on the line.*

_____ **24.** The lithosphere is part of the geosphere.

_____ **25.** A human being is part of Earth's lithosphere.

_____ **26.** The hydrosphere includes water in Earth's atmosphere.

27. How are Earth's spheres defined?

_____

28. What are the components of Earth's geosphere?

_____

29. What materials make up Earth's biosphere?

_____

30. Give an example of how two of Earth's spheres overlap or interact.

_____

_____

3.2 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

31. Compare negative feedback and positive feedback loops. _____

_____

_____

32. Give examples of each of Earth's spheres from the environment in which you live.

_____

_____

_____

31. Both are cyclical processes in which an event is both input and output. In a negative feedback loop, output moving in one direction acts as input that causes the system to move in the other direction, the one canceling the other and so stabilizing the system. In a positive feedback loop, the input and output do not cancel each other out and stabilize the system; instead they drive it to an extreme. 32. Sample answer: The lake in my neighborhood is part of the hydrosphere; the soil and rock that my school is built on are part of the geosphere; the plants, animals, and people who live in my neighborhood are part of the biosphere; the air I breathe is part of the atmosphere.

Name _____ Class _____ Date _____

3.4 Biogeochemical Cycles

Key Concepts

- Nutrients cycle through the environment endlessly.
- Producers play vital roles in the cycling of carbon through the environment.
- The phosphorus cycle keeps phosphorus availability naturally low.
- The nitrogen cycle relies on bacteria that make nitrogen useful to organisms and bacteria that can return it to the atmosphere.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Law of conservation of matter		
Nutrient		
Biogeochemical cycle		
Primary producer	An organism that produces its own food	Primary producer starts with *P*. So does plants, and plants are primary producers.
Photosynthesis		
Consumer		
Decomposer		
Cellular respiration		

Name _____ Class _____ Date _____

Term	Definition	How I Remember
Eutrophication		
Nitrogen fixation		

Nutrient Cycling

1. What is the law of conservation of matter?

_____

_____

2. Which four nutrients cycle through all of Earth's spheres and organisms?

_____

The Carbon Cycle

For Questions 3–5, write True *if the statement is true. If the statement is false, replace the underlined word or words to make the statement true. Write your changes on the line.*

_____ **3.** Only a <u>producer</u> can use the sun's energy or chemical energy to make food.

_____ **4.** The products of photosynthesis are oxygen and <u>carbon dioxide</u>.

_____ **5.** Bacteria, fungi, and other organisms that break down waste are called <u>consumers</u>.

6. Why is cellular respiration important for life on Earth?

_____

_____

7. What impact do humans have on the carbon cycle?

_____

_____

_____

8. Why do scientists think there is an undiscovered carbon sink somewhere?

_____

_____

Name _____ Class _____ Date _____

The Phosphorus Cycle

9. Why is phosphorus important to living things?

10. Where is phosphorus stored?

11. How do people obtain phosphorus?

12. How does the release of large amounts of phosphorus by humans cause problems?

The Nitrogen Cycle

For Questions 13–17, circle the letter of the correct answer.

13. Most of the nitrogen on Earth is located in the

A. biosphere.
B. geosphere.
C. atmosphere.
D. hydrosphere.

14. Which of the following crops increases the amount of usable nitrogen in soil?

A. corn
B. wheat
C. legumes
D. tomatoes

15. The Haber-Bosch process enabled people to

A. fix nitrogen artificially.
B. create natural nitrogen.
C. clean up nitrogen pollution.
D. acquire nitrogen from plants.

16. Name two ways nitrogen can be fixed naturally for plant use.

17. What happens to nitrogen during the process of denitrification?

Name _____ Class _____ Date _____

SKILL BUILDER Organize Information

18. Fill in the compare/contrast table with information about the different biogeochemical cycles.

	Carbon Cycle	Phosphorus Cycle	Nitrogen Cycle
Role as Nutrient			
Events of Cycle			

EXTENSION Explain how water plays a role in each of these biogeochemical cycles.

3.4 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

19. Describe how photosynthesis and cellular respiration help drive the carbon cycle.

_____

_____

20. Explain how the hydrosphere and geosphere participate in the phosphorus cycle.

_____

_____

19. In photosynthesis, organisms take sunlight, water, and carbon dioxide from the air and transform it into oxygen and carbohydrates. Cellular respiration puts carbon back into the air as carbon dioxide waste. The two processes keep carbon moving through the cycle. 20. Most phosphorus is locked up in rocks in the upper layer of the geosphere (lithosphere). Phosphorus is released when water in the hydrosphere wears away rock. The phosphorus is then available for plants and animals to use until it returns to rock as sediment, again becoming part of the lithosphere.

Name _____ Class _____ Date _____

3.3 Earth's Spheres

Key Concepts

- Earth's geosphere consists of the crust, the mantle, and the core.
- Earth's biosphere and atmosphere are the living Earth and the ocean of gases that supports and protects it.
- Water cycles through the lithosphere, biosphere, and atmosphere endlessly.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Crust		
Mantle		
Core		
Tectonic plate	A large section of lithosphere that moves over Earth's surface	I picture a dinner plate being moved on a tabletop.
Landform		
Deposition		
Evaporation		
Transpiration		

Name _____ Class _____ Date _____

Term	Definition	How I Remember
Precipitation		
Condensation		
Aquifer		
Groundwater		

The Geosphere

1. Complete the following paragraph with terms from the word bank.

asthenosphere **core** **crust** **geosphere** **mantle** **tectonic plates**

The _____ is made up of all the rocks and minerals on or below Earth's surface. The outer part of the geosphere is called the _____, which forms the land we live on as well as the ocean bottom. The hot rock beneath this layer is known as the _____ and includes the uppermost lithosphere as well as the softer _____. As this layer moves, it drags large sections of lithosphere, called _____, across Earth's surface. Earth's center is called the _____ and is made up of molten and solid metals.

2. How does plate tectonics influence the characteristics of Earth's surface?

_____

_____

_____

_____

3. Define the three different types of plate boundaries.

_____

_____

_____

_____

Name _____ Class _____ Date _____

The Biosphere and Atmosphere

4. Why is Earth's biosphere called "the living Earth"?

_____

_____

5. Define ozone and explain its purpose.

_____

_____

6. How do the greenhouse gases in Earth's atmosphere affect our environment?

_____

_____

The Hydrosphere

For Questions 7–12, match each term with the statement that best describes it.

_____ **7.** evaporation

_____ **8.** transpiration

_____ **9.** precipitation

_____ **10.** condensation

_____ **11.** aquifer

_____ **12.** water table

a. the process by which water in a lake becomes water vapor

b. the upper limit of fresh water stored underground

c. the process by which water vapor in the air becomes dew

d. the process by which blades of grass release water vapor

e. rain or snow

f. the place where fresh water collects underground

13. On the lines below, write a paragraph that describes the distribution of salt water and fresh water on Earth.

_____

_____

_____

_____

14. Describe two human activities that can affect the water cycle.

_____

_____

_____

Name _____ Class _____ Date _____

SKILL BUILDER Organize Information

15. Complete the chart by filling in at least two characteristics about each sphere.

Sphere	Characteristics
Geosphere	
Atmosphere	
Biosphere	
Hydrosphere	

3.3 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

16. Describe how organisms in the biosphere affect the atmosphere and vice versa.

_____

_____

_____

17. Give an example of how water moves through the water cycle in liquid, gaseous, and solid forms._____

_____

_____

_____

16. Organisms in the biosphere affect the atmosphere by taking in and expelling gases; and the gases in the atmosphere protect and support organisms in the biosphere. 17. Sample answer: liquid form: plants take up liquid water from soil; gaseous form: plants release water vapor through their leaves (transpiration); solid form: frozen water falls to Earth as precipitation (snow).

Name _____ Class _____ Date _____

4.1 Studying Ecology

Key Concepts

- Ecologists study life at many levels, from individual organisms to the entire biosphere.
- Ecosystems include both biotic and abiotic factors.
- Organisms depend on resources provided by their habitat for survival.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Ecology		
Species		
Population		
Community		
Ecosystem		
Biosphere	All parts of planet Earth that host life, with all of its organisms and environments	I think of *bio,* which means "life" and *sphere,* which is a round object, such as Earth.
Biotic factor		

Name _____ Class _____ Date _____

Term	Definition	How I Remember
Abiotic factor		
Habitat		
Resource		

Levels of Ecological Organization

For Questions 1 and 2, circle the letter of the correct answer.

1. The most basic level of ecological organization is a(n)

A. biosphere.
B. individual.
C. ecosystem.
D. population.

2. The study of living and nonliving components of a system can best be described as a(n)

A. abiotic factor.
B. level hierarchy.
C. ecosystem ecology.
D. organism interaction.

3. Describe how a species is commonly defined. Explain why the common definition for species may be problematic for some organisms, such as bacteria.

4. What is community ecology? Give examples.

Name _____ Class _____ Date _____

Biotic and Abiotic Factors

5. Organize Information Fill in the T-chart with examples of abiotic and biotic factors in an ecosystem.

Abiotic Factors	Biotic Factors

6. Is a fallen, rotting tree considered an abiotic or biotic factor? Explain.

_____

_____

Habitat

For Questions 7 and 8, complete each statement by writing in the correct word.

7. A cloud forest's soil, rocks, leaf litter, humidity, plant life, and seasonal pools of water are all part of a toad's _____.

8. Habitats provide organisms with the _____ they need to live, such as food, shelter, breeding sites, and mates.

9. Compare and contrast an ecosystem and a habitat.

_____

_____

_____

_____

10. Explain the importance of resources and suitable habitats to an organism.

_____

_____

_____

11. Name at least two specific elements of the golden toad's cloud forest habitat.

_____

_____

Name _____ Class _____ Date _____

SKILL BUILDER Organize Information

12. Fill in the table to explain how each concept applies to the golden toad.

Concept	The Golden Toad
Population	
Community	
Ecosystem	
Habitat	
Resource	

Extension On a separate sheet of paper, create another table like the one above. Use the same headings for the left column, but choose a different organism. Write the name of the organism at the top of the table and then complete the rest of the table as it applies to the organism you chose.

4.1 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

13. Explain why organization is important to the study of ecology.

_____

_____

14. Why are dead or decaying organisms still considered important parts of an ecosystem?

_____

_____

15. What makes up an organism's habitat?

_____

_____

13. Ecologists use levels of organization to study how organisms interact with each other and their environment. 14. They are taken in and used as essential materials for living organisms. 15. The specific environment, including biotic and abiotic elements, around an organism makes up its habitat.

Name _____ Class _____ Date _____

4.2 Describing Populations

Key Concepts

- The overall health of a population can often be monitored by tracking how its size changes.
- A population's density is a measure of how crowded it is.
- Populations can be distributed randomly, uniformly, or in clumps.
- Age structure diagrams show the number of males and females in different age groups within a population.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Population size		
Population density		
Population distribution		
Age structure		
Age structure diagram		
Sex ratio	A population's proportion of males to females	I recall that a *ratio* is a proportion between two things and that an organism's *sex* refers to whether it is male or female.

Name _____ Class _____ Date _____

Population Size

For Questions 1–3, complete each statement by writing in the correct word.

1. When a population size _____ or remains steady, this is often a sign of a healthy population.

2. If a population size begins to _____ rapidly, this can be a signal that extinction is coming.

3. Instead of counting each organism individually, ecologists use _____ methods to estimate population sizes.

4. Explain why the passenger pigeon, which was once the most abundant bird in North America, disappeared completely.

_____

_____

_____

_____

5. Describe how you could determine the population size of a specific type of plant in a large forest without counting all of the plants.

_____

_____

Population Density

For Questions 6 and 7, circle the letter of the correct answer.

6. A population's density describes how

A. old the population is.

B. crowded the population is.

C big the population is.

D fast the population is declining.

7. Which piece of information is used along with population size to calculate population density?

A. area

B. weight

C. age

D. location

8. How can high population density be helpful to a population?

_____

_____

9. How can high population density be harmful to a population?

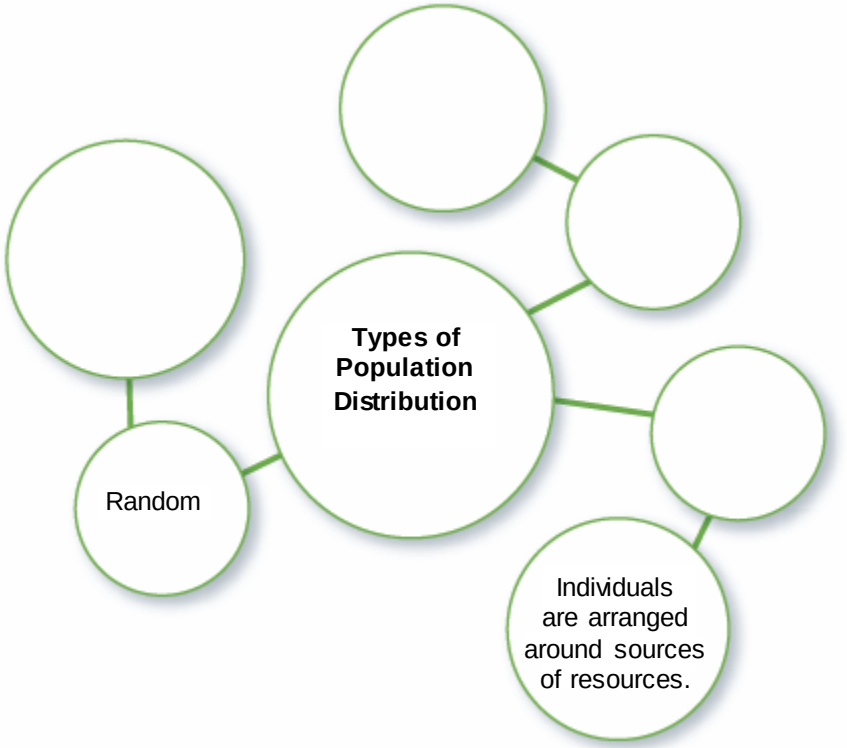
_____

_____

Name _____ Class _____ Date _____

Population Distribution

10. Organize Information Fill in the cluster diagram with short descriptions or drawings of the different types of population distribution.



11. Which type of population distribution is found most often in nature?

_____

Age Structure and Sex Ratios

12. Describe how to use an age-structure diagram to determine how many males and females are in a population.

_____

_____

_____

13. What will happen to a population made up mostly of individuals that are past reproductive age? _____

_____

14. What can you predict about a population with an age-structure diagram shaped like a pyramid? _____

_____

Name _____ Class _____ Date _____

SKILL BUILDER Think Visually

15. Use dots to represent individuals in populations as you contrast the population characteristics in each set below.

A. Population Size

small population

large population

B. Population Density

low density

high density

C. Population Distribution

clumped distribution

random distribution

uniform distribution

3.2 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

16. Which way of describing a population would be more informative in terms of available resources—population size or population density? Explain. _____

_____

_____

17. Describe how you might use population distribution to find the sources of food or other resources used by a species. _____

_____

_____

18. Explain the significance of an age-structure diagram in which the bars are short along one side and long on the opposite side. _____

_____

_____

16. Population density better indicates the quantity of room and resources available, since it indicates how many organisms are living in a specific area. 17. Populations often distribute themselves according to location of resources. In random or uniform distribution, resources may be widely available; however, if a population is distributed in clumps, these clumps will likely indicate the location of available resources. 18. This indicates that the population consists mostly of either males or females. It may also indicate that the population will not be as successful in reproducing.

Name _____ Class _____ Date _____

4.3 Population Growth

Key Concepts

- A population's growth rate is determined by births, deaths, immigration, and emigration.
- Populations can grow exponentially or logistically.
- Limiting factors and biotic potential regulate a population's growth.

SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Survivorship curve		
Immigration	The arrival of individuals from outside a given area	The prefix *im–* reminds me of "in." That helps me remember that immigration is individuals coming into an area.
Emigration		
Migration		
Exponential growth		
Limiting factor		

Name _____ Class _____ Date _____

Term	Definition	How I Remember
Carrying capacity		
Logistic growth		
Density-dependent factor		
Density-independent factor		
Biotic potential		

SKILL BUILDER Reading Strategy

As you read the lesson, complete the main ideas and details chart.

Main Ideas	Details
Important factors determine population growth.	
Populations grow exponentially or logistically.	
A population's growth is regulated by limiting factors and biotic potential.	

Name _____ Class _____ Date _____

Factors That Determine Population Growth

For Questions 1 and 2, complete each statement by writing in the correct word.

1. Populations _____ when more individuals enter the population than leave it.
2. Populations _____ when more individuals leave the population than enter it.
3. Explain how a population would be affected when the birthrate is significantly higher than the death rate and there are no changes due to immigration or emigration.

_____

4. Describe how emigration and immigration affect the size of a population.

_____

_____

_____

5. Explain how migration causes population size to change cyclically over time.

_____

_____

_____

How Populations Grow

6. Describe the shape of a graph curve indicating exponential growth and a graph indicating logistic growth.

_____

7. Explain how the availability of resources in the environment is linked to exponential growth of a species.

_____

_____

8. Describe how you can recognize where the carrying capacity for a population occurs on a logistic growth curve.

_____

9. Compare and contrast exponential growth and logistic growth.

_____

_____

_____

Name _____ Class _____ Date _____

10. Explain how the carrying capacity for a population can change over time.

Limiting Factors and Biotic Potential

11. Circle the factors below that are density-dependent.

climate change disease flood predation

12. Explain why a forest fire is considered to be a density-independent limiting factor.

13. Give two examples of organisms that differ greatly in their biotic potential.

4.3 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

14. List two factors that increase the growth rate of a population and two factors that decrease the growth rate of a population.

15. Describe the effects that limiting factors and biotic potential have on a population's growth.

14. Increase: high birthrates, immigration; decrease: high death rates, emigration 15. Limiting factors slow population growth and determine the maximum amount of growth possible in a population. Biotic potential determines the maximum ability to produce offspring under ideal conditions.