

9 Environmental Health





Before you read the chapter, answer each question with information you know. After you complete the chapter, re-answer the questions using information you learned.

BIGQUESTION What Is the Relationship Between Environmental Health and Our Own Health?

	What I Know	What I Learned
<p>9.1 What is environmental health?</p>	<p><i>Sample answer: Environmental health is keeping animals and plants safe from pollution.</i></p>	<p><i>Sample answer: Environmental health is the way that different parts of the environment affect our health and the way we live.</i></p>
<p>9.2 How do biological and social factors in the environment affect human health?</p>	<p><i>Sample answer: There are probably many different things in the environment that affect the health of humans.</i></p>	<p><i>Sample answer: Diseases are biological factors that affect humans and populations. Social factors include where you live and the way that you live.</i></p>
<p>9.3 How do chemicals in our environment affect our health?</p>	<p><i>Sample answer: Chemicals can cause harm by polluting drinking water used by humans.</i></p>	<p><i>Sample answer: All chemicals can be hazardous in large amounts. Different types of chemicals pose different types of health hazards.</i></p>
<p>9.4 How can physical events in the environment affect our health?</p>	<p><i>Sample answer: Physical events can be either good or bad for the environment.</i></p>	<p><i>Sample answer: Physical events include different types of natural disasters that can be deadly to even large populations.</i></p>

9.1 An Overview of Environmental Health

Key Concepts

-  Environmental health hazards can be biological, social, chemical, or physical.
-  Epidemiology is the study of disease in human populations, while toxicology is the study of how poisonous substances affect organisms' health.
-  People respond differently to environmental hazards due to individual differences such as age, sex, weight, health issues, and genetic makeup.
-  Risk assessment is the process of measuring the chance that an environmental hazard will cause harm.



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
Environmental health	<i>The study of how the environment affects human health and our quality of life</i>	<i>Accept all reasonable responses for How I Remember. A few samples are provided.</i>
Hazard	<i>A factor in the environment that threatens or is harmful to human health</i>	
Pathogen	<i>A disease-causing agent</i>	
Epidemiology	<i>The study of disease in human populations</i>	<i>I know that many people get sick during epidemics.</i>
Toxicology	The study of how poisonous substances affect an organism's health	I know that <i>toxic</i> means "poisonous" and <i>-ology</i> indicates the study of a subject.
Toxicity	<i>How harmful a substance is</i>	<i>I remember seeing a picture of barrels labeled "toxic waste."</i>
Dose	<i>The amount of a substance an organism is exposed to</i>	<i>When I'm sick, my doctor prescribes a dose of medicine.</i>

Term	Definition	How I Remember
Response	<i>The effect an organism shows as a result of exposure to a substance</i>	
Dose-response relationship	<i>The way that different amounts of a substance cause different responses</i>	
Risk	<i>The probability that a hazard will cause harm</i>	<i>I know that health risks are things that will hurt your body</i>
Risk assessment	<i>The process of measuring risk</i>	



SKILL BUILDER Reading Strategy

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

Main Ideas	Details
Types of hazards	<i>Hazards are factors that threaten or are harmful to humans.</i>
	<i>Biological hazards include pathogens such as bacteria and viruses.</i>
	<i>Social hazards result from where we live, our jobs, or our lifestyles. Smoking or living near pollution are examples of social hazards.</i>
	<i>Chemical hazards include synthetic chemicals and chemicals produced by organisms.</i>
	<i>Physical hazards include natural disasters.</i>
Epidemiology and toxicology	<i>Epidemiologists study how and where diseases occur, as well as how to control them. Epidemiological studies involve studying large groups of people over long periods of time.</i>
	<i>Toxicology is the study of how poisonous substances affect an organism's health. Toxicology depends on what the substance is and how much substance is needed to cause harm.</i>

Main Ideas	Details
The role of the individual	People respond differently to environmental hazards.
	Some people are more sensitive than others to environmental hazards due to health issues, genetic makeup, age, sex, and weight.
	Many diseases have both genetic and environmental factors.
Risk assessment	Risk assessment includes figuring out what a hazard is, how often humans are exposed to it, and how sensitive individuals are to the hazard.
	Risk assessments help scientists decide if a substance is harmful, and they help policymakers decide on policies to protect people and the environment.

Types of Hazards

For Questions 1–3, circle the letter of the correct answer.

- An earthquake is an example of a
 - social hazard.
 - B.** physical hazard.
 - chemical hazard.
 - biological hazard.
- Which of the following is not considered to be a biological hazard?
 - flu virus
 - pet dander
 - C.** cigarette smoke
 - bacterium that causes strep throat
- Environmental health is the study of how environmental factors affect human health and
 - length of life.
 - B.** quality of life.
 - population size.
 - population growth.
- Explain the difference between social hazards such as smoking cigarettes and living near a factory that releases harmful chemicals into the water.

People can make the lifestyle choice of whether or not to expose themselves to the hazards of smoking, but they may have no control over what happens near where they live.

- List three examples of physical hazards.

Sample answer: Tornadoes, fires, UV radiation

Epidemiology and Toxicology

For Questions 6–11, match each term with the statement that best describes it.

- | | |
|--------------------------------|---|
| <u> b </u> 6. dose | a. how harmful a substance is |
| <u> e </u> 7. epidemiology | b. the amount of a substance an organism is exposed to |
| <u> c </u> 8. response | c. the effect as a result of exposure to a substance |
| <u> f </u> 9. threshold dose | d. the study of how poisonous substances affect health |
| <u> a </u> 10. toxicity | e. the study of disease in human populations |
| <u> d </u> 11. toxicology | f. the amount of a substance needed to cause a response |

12. What is a dose-response relationship?

The relationship between different doses of a substance and the responses they generate in an organism.

13. Which two factors does toxicity depend on?

Toxicity depends on what the substance is, and how much of the substance is needed to cause harm.

The Role of the Individual

For Questions 14–16, 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.

- True 14. People respond differently to the same environmental hazards.
- more 15. People with compromised immune systems are often less sensitive to biological and chemical hazards than healthy people.
- both; and 16. Many diseases have either genetic or environmental factors.
17. Explain why someone who eats healthy food and does not smoke may still develop a disease such as cancer.

Although the environment is a large factor in the health of an individual, genetics is also a considerable factor. Some people have genes that make them more prone to certain diseases.

18. Explain why alcohol use may cause damage to a developing fetus even though it may not harm the health of the mother.

Sensitivity can vary with age and weight. Although the alcohol may not harm the mother, the fetus is much smaller and its organ systems are still developing. This causes a fetus to be more sensitive to alcohol and more susceptible to damage.

Risk Assessment

19. What is the process of risk assessment used to determine?

It determines the amount of risk associated with a particular hazard.

20. Describe the steps that a scientist takes when doing a risk assessment for a chemical hazard. ***First, scientists would identify the chemical. Next, they would determine how toxic it is and how much exposure humans would have to it. They may use animal testing to determine the effects of the chemical. They may also investigate the degree of contact between the chemical and humans.***

21. How are risk assessments of environmental hazards useful to policymakers?

Policymakers can use risk assessments to help them shape policies that protect both people and the environment.

9.1 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.

22. What are three examples of pathogens?




23. What are epidemiology and toxicology?

24. Why do people respond differently to environmental hazards?

22. Sample answer: Viruses, bacteria, pet dander 23. Epidemiology is the study of diseases in human populations. Toxicology is the study of how poisonous substances affect organisms. 24. Because they have different genetics and sensitivities, and they live in different environments

9.2 Biological and Social Hazards

Key Concepts

-  Infectious diseases are spread by direct human contact, through contaminated food and water, and by animals.
-  Since new diseases are continually emerging, it is important to know how, where, and to what extent they are spreading.
-  Some social hazards result from lifestyle choices a person makes, while other social hazards cannot be controlled.



SKILL BUILDER Vocabulary Preview


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

Term	Definition	How I Remember
Infectious disease	<i>A disease caused by a pathogen</i>	<i>Accept all reasonable responses for How I Remember.</i>
Emerging disease	A disease that has appeared in the human population for the first time or has existed for a while but is increasing or spreading rapidly	Think of an animal <i>emerging</i> from a jungle.

Infectious Disease

For Questions 1–7, complete each statement by writing in the correct word or words.

1. Infectious diseases are caused by pathogens, which are ***biological*** hazards.
2. Pathogens spread through the human population by humans, water or food, or by ***organisms***.
3. Globally, infectious diseases cause nearly ***18 million*** deaths annually.
4. Organisms such as ticks and mosquitoes serve as ***vectors*** for infectious diseases by carrying pathogens.
5. People who are infected with tuberculosis release bacteria-laden droplets into the ***air*** when they cough, sneeze, speak, and spit.
6. Developed nations greatly reduce the risk of infectious diseases through the use of ***wastewater*** treatment facilities that treat sewage to reduce the incidences of diseases such as cholera.
7. The bacterium that causes cholera is a ***waterborne*** pathogen.

8.  **Organize Information** Fill in the table with details on how each infectious disease is spread.

Infectious Disease	Mode of Transmission
AIDS	Contact with the blood or body fluids of a person infected with the HIV virus
Tuberculosis	Spreads through bacteria-laden droplets in the air, released when infected people cough, sneeze, speak, or spit
Cholera	Water contaminated with human feces that contain the bacterium <i>Vibrio cholerae</i>
Malaria	Transmitted when an <i>Anopheles</i> mosquito picks up the pathogen that causes malaria from an uninfected person and then bites a non-infected person

Emerging Diseases

For Questions 9–14, 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.

- rapidly 9. An emerging disease is a disease that appears for the first time or has existed for a while and is increasing slowly around the world.
- True 10. A pandemic is an outbreak of a disease that becomes widespread and affects a whole region or even the entire world.
- True 11. H1N1 is an example of an emerging disease.
- antibiotics 12. Some diseases, such as tuberculosis, are becoming resistant to pathogens due to natural selection.
- CDC 13. In the United States, the WHO is the primary national center for responding to emerging diseases.
- rise 14. If global temperatures fall, tropical diseases will expand into new, formerly cool areas.

15. Why are emerging diseases a cause for concern?

Emerging diseases are dangerous because vaccines have not been developed and because humans have little to no resistance to the pathogens.

16. Explain how climate change may encourage an increase in the spread of disease.

As global temperatures rise, tropical diseases could expand into areas that used to be cooler.

17. Why is it important that international and local government agencies work together to control the spread of emerging diseases?

Because emerging diseases can surface and spread quickly around the globe

18. Describe ways that the CDC has helped contain the spread of the H1N1 flu virus.

The CDC has worked with states to develop pandemic plans. It has tested the virus and assisted with workshops on various ways to detect the virus. The CDC also has helped develop the vaccine against the H1N1 virus.

Social Hazards

19. Name three examples of social hazards.

Sample answer: Living near a toxic waste site, a job that requires you to work with harmful chemicals, smoking

20. Explain how cigarette smoke can be a hazard to someone even if he or she does not smoke.

Secondhand smoke from someone else who is smoking or from a burning cigarette, pipe, or cigar, can also cause lung cancer and respiratory infections.

21. Describe how the choices you make concerning what you eat can increase or reduce the social hazards you face.

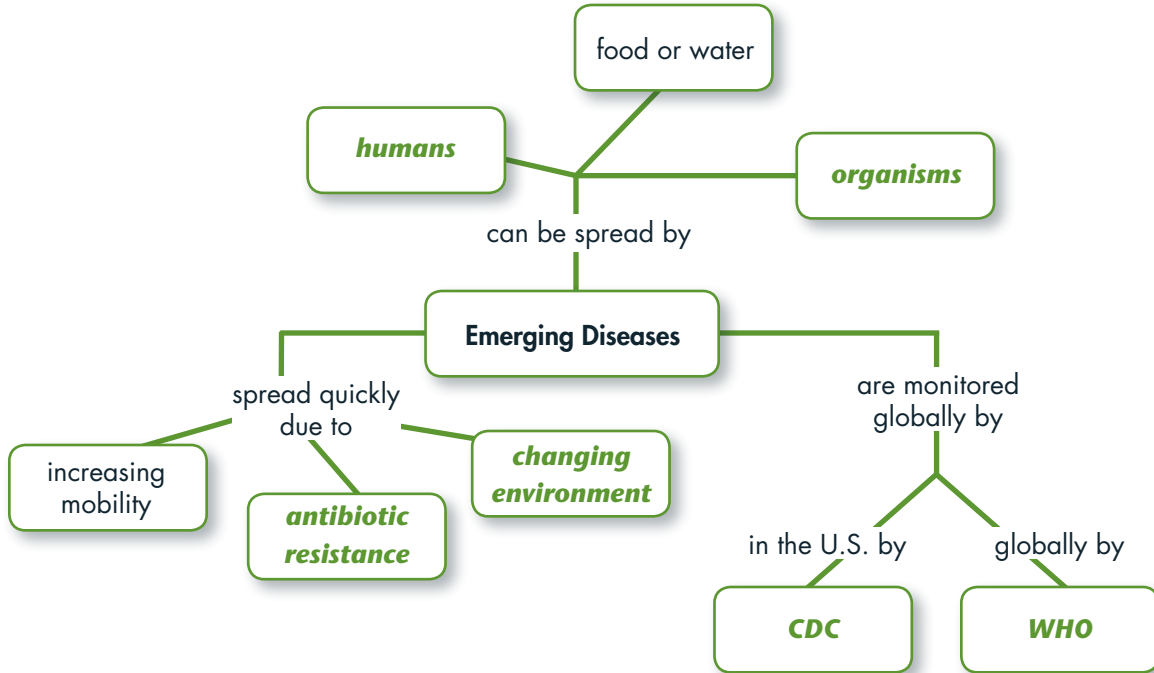
Eating a high-fat diet can put you at risk for a heart attack or stroke. Eating healthy foods and exercising can reduce your risk for obesity, heart disease, and high blood pressure.



SKILL BUILDER Organize Information

22. Fill in the concept map with terms from the word bank.

organisms antibiotic resistance CDC changing environment
 international national humans WHO



Extension Extend the concept map by adding an example to each of the boxes of the “can be spread by” and “spread quickly due to” branches. **Check students' work.**

9.2 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.






23. What are three ways pathogens can spread? _____

24. How do governments and organizations respond to emerging diseases?

23. From one person to another, from drinking contaminated water, through a tick or mosquito bite 24. Monitor world health events, identify emerging diseases, post the information on the World Wide Web, develop and apply disease prevention and control measures, develop vaccines

9.3 Toxic Substances in the Environment

Key Concepts

-  All chemicals can be hazardous in large enough quantities.
-  Chemical hazards can cause cancer, birth defects, and improper functioning of human body systems.
-  Our homes and buildings may contain chemical hazards including asbestos, radon, volatile organic compounds, carbon monoxide, and lead.
-  There are chemical hazards in the air, on land, and in the water.
-  Toxic chemicals accumulate in organisms as they feed on one another.



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
Pollution	Anything that is released into the environment and is harmful	Accept all reasonable responses for How I Remember. A few samples are provided.
Carcinogen	A chemical that causes cancer	Carcinogen and cancer both start with the letters ca.
Teratogen	A chemical that harms a fetus or embryo	
Neurotoxin	A chemical that harms the nervous system	Neuro refers to the nervous system. A toxin is something harmful.
Asbestos	A mineral used for insulation that can harm the lungs	
Radon	A colorless, odorless, and highly toxic radioactive gas that can build up in houses	
Bioaccumulation	The process of building up concentrations of toxic substances in the body	When I accumulate things, I have more than when I began.
Biomagnification	The process of magnifying the concentrations of toxic substances by eating organisms that contain them	I think of a magnifying glass, which makes things look bigger.

Chemical Hazards

1. Define “chemical hazard.”

A chemical hazard is a toxic substance that may harm human health.

2. What is pollution?

Pollution is matter or energy that is released into the environment that has some harmful impact on people and other organisms.

3. Are chemical hazards and pollutants the same thing? Why or why not? Explain.

No. Chemical hazards are not considered pollutants if they do not harm the environment. For example, the chemical in poison ivy harms human health, but it does not harm the environment.

Types of Chemical Hazards

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

carcinogens neurotoxins teratogen

Chemical hazards affect human health in different ways. Some heavy metals act as ***neurotoxins*** that can cause slurred speech or loss of muscle control. Chemicals that cause cancer are known as ***carcinogens***. Some chemicals that do not harm adults are still hazards if they affect the development of human embryos. This type of chemical hazard is known as a ***teratogen***.

5. Why are carcinogens difficult for toxicologists to identify?

Carcinogens are difficult to identify because there may be a long lag time between exposure to the agent and the detectable onset of cancer.

6. Explain what a mutagen is and describe possible effects.

A mutagen is a chemical that causes genetic changes in the DNA of an organism. Some can cause cancer or serious problems. Some cause mutations in sperm or egg cells, which show up as problems in offspring.

7. Describe some common allergens and explain how they harm people.

Allergens include animal proteins, tobacco smoke, antibiotics, mold, and bacteria. Allergens cause harm by activating the immune system when it is not necessary.

8. What is an endocrine disruptor?

An endocrine disruptor is a chemical that interferes with the endocrine or hormone system. Endocrine disruptors cause problems by blocking chemical hormones or by mimicking other hormones to cause a response.

Indoor Chemical Hazards

For Questions 9–13, match each term with the statement that best describes it.

- | | |
|----------------------------------|--|
| <u> c </u> 9. asbestos | a. a gas that can cause headaches, dizziness, fatigue, and eventually death |
| <u> a </u> 10. carbon monoxide | b. can be in air, water, soil, paint, or dust and damages organs of the body |
| <u> b </u> 11. lead | c. used for insulation, can cause cancer |
| <u> e </u> 12. radon | d. contain carbon and are released into the air by products such as plastics |
| <u> d </u> 13. VOCs | e. a colorless, odorless radioactive gas that is released from soil and can cause cancer |

14. Explain why you should not tear down asbestos and simply throw it away if you find it in your home.

When it is disturbed, fibers can be released into the air and inhaled. The fibers can lodge in lung tissue and cause lung disease and cancer.

15. List three types of tests you could do at your house to protect against chemical hazards.

Sample answers: Radon test for radon gas, carbon monoxide detectors for carbon monoxide gas, look or test for lead paint or lead sources in the home

Outdoor Chemical Hazards

16. Explain why citizens of one town might need to be concerned with the chemical hazards in the air of a town many miles away.

Chemical hazards in the air can be a concern for humans and organisms far away because winds can carry chemicals for long distances.

17. Describe how chemical hazards can get into soil and some of the ways that they can cause harm to humans.

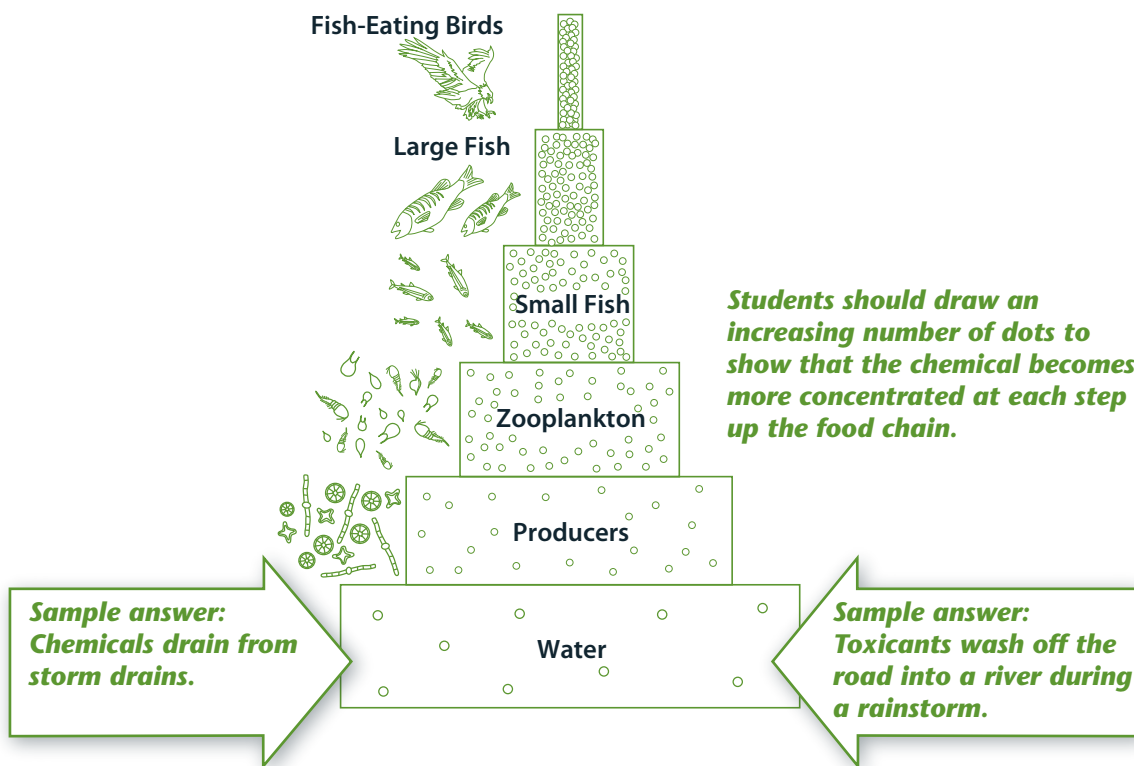
Sample answer: Chemicals can get into soil when pesticides or other chemicals are added to the ground or when materials are disposed of improperly. People can inhale them or ingest them when they eat produce from a contaminated area.

18. The fish in a stream running by a small town are dying in large numbers. Why might chemical hazards be suspected?

Fish and other aquatic animals are indicators of pollution because they drink and absorb water-soluble chemicals into their tissues.

Biomagnification

19. **Think Visually** In each arrow, write one way that a chemical such as DDT can get into waterways. In each block, add dots to represent levels of chemical concentrations and how they change due to biomagnification.



20. How did high concentrations of DDT affect bird populations?

DDT concentrations in bird tissues were so high that it affected their ability to reproduce. For example, their eggshells became too thin and would break in the nest.

Osprey populations began to decline and peregrine falcons were almost wiped out.

21. Explain why a persistent organic pollutant (POP) is a problem that is often handled by international agreements or treaties.

POPs last for a long time in the environment and can travel long distances, meaning that these toxins can cause damage in countries far away from where they were originally released.



SKILL BUILDER Organize Information

22. Complete the T-chart by writing in details and examples of indoor chemical hazards and outdoor chemical hazards.

Indoor Chemical Hazards	Outdoor Chemical Hazards
<p><i>Sample answer: Indoor chemical hazards are important as people spend most of their day indoors.</i></p> <p><i>Indoor air pollutants include asbestos, radon, and VOCs.</i></p> <p><i>Carbon monoxide comes from leaky or unvented stoves, car exhaust, and tobacco smoke.</i></p> <p><i>Lead can be found in lead-based paints, contaminated soil, water, and air.</i></p>	<p><i>Sample answer: Thousands of chemicals have contaminated the air, land, and water.</i></p> <p><i>Outdoor contaminants include antibiotics, detergents, drugs, disinfectants, solvents, and perfumes.</i></p> <p><i>Air contaminants include small particles and sulfur dioxide from volcanoes, carbon monoxide, nitrogen oxide, ozone, and lead from human activities.</i></p> <p><i>Toxic substances in soil include pesticides and lead.</i></p> <p><i>Water contaminants include pesticides and oil.</i></p>

9.3



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.





23. Define the different types of chemical hazards. _____

24. What is biomagnification? _____

23. Carcinogens cause cancer; chemical mutagens cause genetic changes; teratogens harm embryos and fetuses; neurotoxins affect the nervous system; allergens cause an immune response; endocrine disruptors interfere with the hormone system. 24. Biomagnification occurs as organisms feed on other organisms and toxic chemicals accumulate in their bodies. As the levels progress up the food chain, the concentrations of toxic chemicals increase.

9.4 Natural Disasters

Key Concepts

-  The shaking that occurs during an earthquake can destroy natural landforms as well as human-made structures.
-  The molten rock, gas, ash, and cinders released during a volcanic eruption can cause significant damage and loss of life in nearby cities and towns.
-  Tornadoes, hurricanes, and thunderstorms are powerful weather events that can damage property and threaten human lives.
-  An avalanche is a mass of sliding snow that can bury people and places in its path.



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
Earthquake	<i>The shaking of the earth caused by the energy released when tectonic plates move</i>	<i>Accept all reasonable responses for How I Remember. A few samples are provided.</i>
Landslide	<i>Rock and soil sliding down a slope</i>	<i>I think of land coming down a slide.</i>
Tsunami	<i>A large ocean wave</i>	
Volcano	<i>An opening in Earth's crust where molten lava, gases, and ash are ejected</i>	
Tornado	A funnel of rotating air that drops down from a storm cloud	The word <i>twister</i> is another word for <i>tornado</i> and describes its action.
Hurricane	<i>A powerful storm that forms over the ocean in the tropics</i>	
Thunderstorm	<i>A storm that produces thunder and lightning</i>	<i>Notice the word thunder is part of the word.</i>
Avalanche	<i>A mass of snow sliding down a slope</i>	<i>I heard about the dangers of avalanches for mountain climbers.</i>

Earthquakes

For Questions 1–5, complete each statement by writing the correct word or words.

1. Earthquakes are created when large sections of Earth's crust, called **tectonic plates**, move and energy is released.
2. Earthquakes can be strong enough to cause the ground to sink and soil to **liquefy**.
3. Earthquakes can trigger a(n) **landslide**, causing rock and soil to slide down a slope.
4. When an earthquake occurs at the bottom of the ocean, it can create a(n) **tsunami** that can cause massive damage and loss of life if it hits coastal areas.
5. Scientists cannot predict when earthquakes will occur, but in the United States, they occur most often in the states of **Alaska** and **California**.
6. Describe the series of events in Earth's crust that lead up to an earthquake.

Tectonic plates scrape against each other as they float on hot, soft rock. Sometimes the plates get stuck on each other and stress builds up. When the plates finally move, energy is released, which causes the surface to shake, creating an earthquake.

Volcanoes

For Questions 7–9, 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.

- True** _____ 7. Volcanoes are often located near the edges of tectonic plates.
- drop** _____ 8. A volcano can spew clouds of gas, ash, and cinders into the atmosphere, causing global temperatures to rise.
- True** _____ 9. A volcanic eruption can also cause damage by triggering landslides and mudflows.
10. Describe how a volcanic eruption actually creates new rock layers on Earth's surface.

Molten rock may seep out of the volcanic opening or explode out onto Earth's surface. When the rock cools, it hardens to create a new layer of rock.

11. How can scientists help people prepare for a volcanic eruption?

Scientists can monitor volcanoes and try to predict when a volcano will erupt. If scientists can predict an eruption in time to send out a warning, people can evacuate before the eruption.

Storms

For Questions 12–15, match each type of storm with the statement that best describes it.

- | | |
|--------------------------------------|---|
| <u> b </u> 12. storm surge | a. brings with it high winds, heavy rain, and a storm surge |
| <u> a </u> 13. hurricane | b. a dome of water that crashes along the coast |
| <u> c </u> 14. thunderstorm | c. can include lightning, heavy rain, and sometimes hail |
| <u> d </u> 15. tornado | d. takes the form of a funnel of rotating air |

16. Describe the dangers of a tornado and explain what actions people should do to stay safe if a tornado is predicted.

Sample answer: Most people who die in a tornado are struck by flying objects. If you are indoors you should seek shelter in the basement or a low area. If you are in a vehicle or mobile home, you should seek shelter in a sturdy building. If you are stuck outside, you should find a ditch or low spot and lie face down in it.

17. Why was the damage to New Orleans from Hurricane Katrina (2005) so extensive?

Hurricane Katrina hit New Orleans with 201 kilometers per hour winds and at least a 8-meter storm surge. The powerful forces caused the levee system to break, so the city flooded.

18. What are some ways to prepare for a hurricane?

Secure your home before the hurricane hits and evacuate if the local authorities tell you to.

Avalanches

19. Describe the conditions that cause an avalanche.

Avalanches usually occur on steep slopes when there is a layer of hard, strong snow over a layer of soft, weak snow. This makes an unstable snowpack. If the soft layer gives, the snow breaks apart and slides down the slope. Weather conditions such as a heavy snowfall or warm temperatures also influence when an avalanche occurs.

20. Describe some actions that a skier could take if he or she is caught in an avalanche.

Avoid risky slopes as much as possible; if caught in an avalanche, try to stay near the surface and attempt to swim up through the sliding snow; stay calm and conserve air.



SKILL BUILDER Organize Information

21. Fill in the compare and contrast table with information concerning the characteristics of the different types of natural disasters.

	Earthquakes	Volcanoes	Storms	Avalanches
How they start	Pressure from contact of tectonic plates is released into the crust.	Molten rock, ash, and gases are ejected from inside Earth.	High winds create storm conditions on the surface.	An unstable snowpack slides down a slope.
Damage they cause	Strong shaking forces can destroy structures and harm people.	Cover large areas of land, trigger mudflows and landslides, create large ash clouds	Strong winds, rain, hail, and lightning may cause damage.	The snow can bury people and structures.
Safety measures	Take cover under something sturdy, away from windows.	Stay ready to evacuate if an eruption is likely.	Seek shelter or evacuate if possible.	Avoid risky slopes. If caught, try to stay near the surface.

9.4



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.

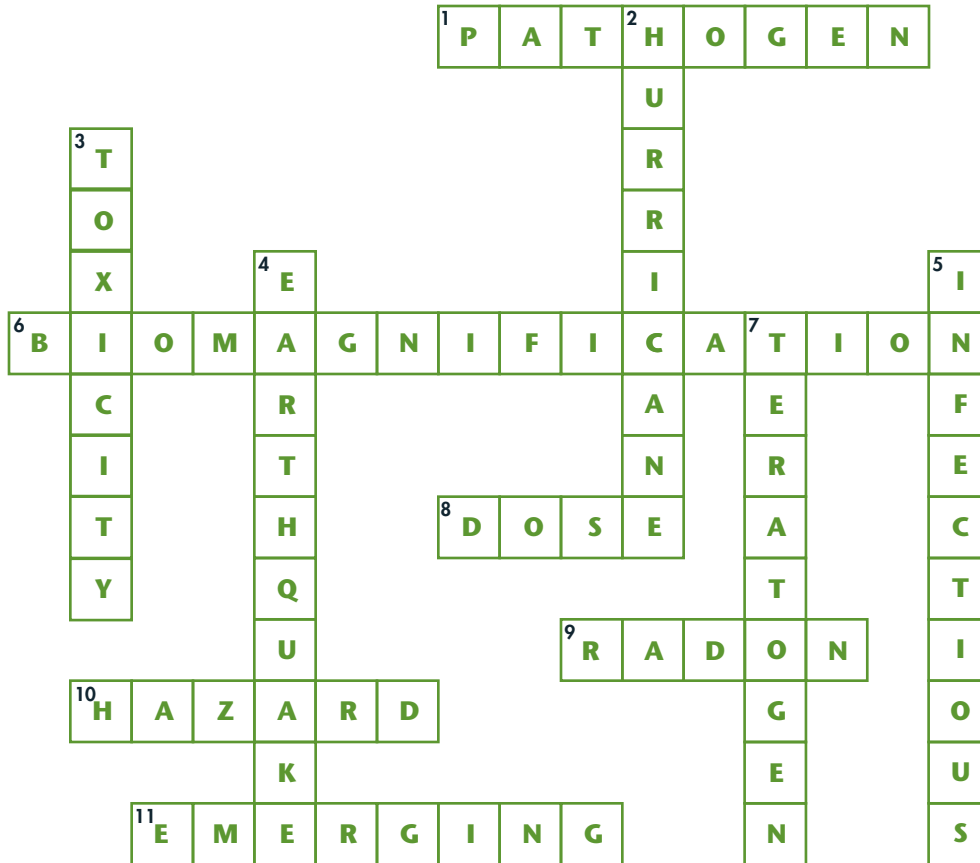
22. How do earthquakes and volcanoes affect humans and Earth's surface? _____

23. Describe the different types of storms that can damage property and threaten human lives.

22. Earthquakes can cause the earth to shake, the ground to sink, and soil to liquefy. They can also trigger landslides and tsunamis that can destroy structures and kill people. Volcanoes erupt molten lava, ash, gas, and cinders that can cover large areas of land where people once lived and farmed. Eruptions also set off dangerous mudflows and fill valleys with thick deposits of ash. They also add layers of rock to Earth's surface. 23. Tornadoes are windstorms in the form of funnels of rotating air. Hurricanes are powerful storms that form over the ocean and can come ashore with very high winds and storm surges. Thunderstorms produce lightning and thunder and sometimes hail.

Chapter Vocabulary Review

Complete the crossword puzzle using the correct vocabulary terms.



Across

1. Disease-causing agent
6. The process of magnifying the concentrations of toxins, with each step up the food chain
8. Amount of substance an organism is exposed to
9. Odorless gas that causes cancer
10. Factor that threatens human health
11. Disease appearing for the first time

Down

2. Forms over tropical oceans
3. How harmful a substance is
4. When Earth shakes due to movement of tectonic plates
5. Describes diseases caused by a pathogen
7. Substance that harms a fetus

EXTENSION On a separate sheet of paper, write a paragraph that correctly uses five or more vocabulary terms from the chapter.



Ecological Footprints



Annual Pesticide Use

In this activity, you will apply population and pesticide usage data to make inferences about the average pesticide use per person.

Organizing Data in a Table

First, read the information below and organize the data in a table.

In 2001, the population of the United States was about 285 million (0.285 billion). The world's population was about 6.1 billion. At the same time, annual pesticide use in the United States was around 1.20 billion pounds. World pesticide use was around 5.05 billion pounds.

1. What two categories of data are being described?

Population and annual pesticide use

2. In 2001, what was the U.S. population and the world population (in billions of people)? What were the amounts of annual pesticide use in each? Write your answers in the table.

Region	Population (billions of people)	Annual Pesticide Use (billions of pounds)
United States	0.285	1.20
World	6.1	5.05

Finding Pesticide Use Per Person

- The calculation for finding the annual pesticide use per person in the United States is modeled below:

$$\begin{aligned}
 \text{pesticide use per person} &= \frac{\text{annual pesticide use in United States}}{\text{population of United States}} \\
 \text{in the United States} &= \frac{1.20 \text{ billion pounds}}{0.285 \text{ billion people}} \\
 &\approx 4.21 \text{ pounds/person}
 \end{aligned}$$

A person in the United States uses about 4 pounds of pesticide per year.

3. Follow the model above to calculate the world's average annual pesticide use in pounds per person.

About 0.83 pounds/person



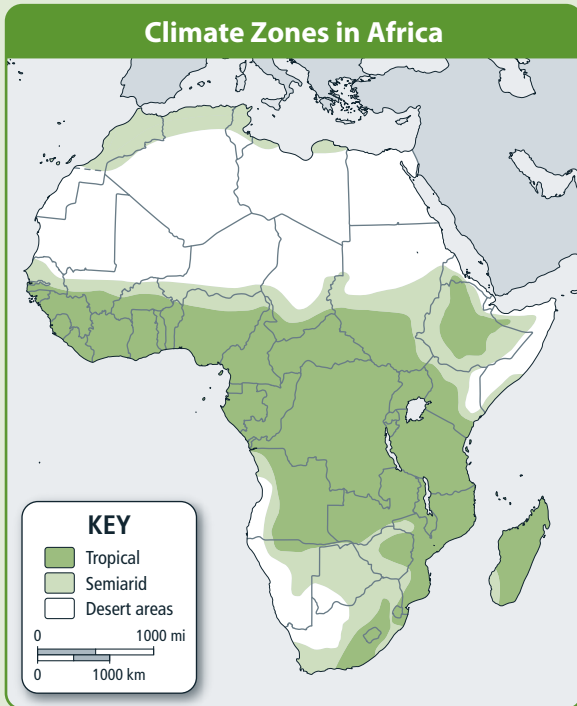
The RISE and Fall — and RISE? — of DDT

Malaria and Climate in Africa

The map on the left shows the general climate of the nations within Africa. Using the information below the maps, color in the nations on the map on the right according to the level of malaria found there. Use one color for nations where malaria is currently a problem. Use a second color for nations

that have had problems in the past. Use a third color for nations that are malaria-free. Be sure to make a key identifying which category each color represents.

Malaria currently dominates the central region of Africa, which corresponds to the tropical zone. Check to make sure students have correctly colored in the nations.



Adapted from World Wildlife Fund, Terrestrial Ecoregions

Malaria Status	Nations
Active malaria transmission	Angola, Benin, Burkina Faso, Cameroon, Chad (south), Congo, Central African Republic, Democratic Republic of Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Ivory Coast, Liberia, Madagascar, Malawi, Mozambique, Nigeria, Rwanda Burundi, Senegal, Sierra Leone, Somalia, Sudan (south), Tanzania, Togo, Uganda, Zambia, Zimbabwe
Past malaria problems have been eliminated	Botswana, Namibia
Malaria-free	Algeria, Chad (north), Egypt, Libya, Mali, Mauritania, Morocco, Niger, South Africa, Sudan (north), Tunisia, Western Sahara

Use the information from **Malaria and Climate in Africa** to answer the questions below.

1. Can you identify any pattern in the map you created of malaria incidence level?

The nations with active malaria tend to be in the center of Africa; the nations with little or no malaria activity are in the north and south.

2. Compare your map to the map of different climates. What difference or similarities do you see?

Sample answer: They are very similar in pattern.

3. Infer what influence climate has on the presence or absence of malaria in a particular nation.

Sample answer: The map on climate shows that the central areas that currently have problems with malaria tend to be wetter and more tropical. The parts of the continent that do not experience malaria tend to be dry.

4. Hypothesize why this connection between climate and malaria may exist.

Answers will vary. Sample answer: It is likely that the mosquito lifecycle is connected to climate conditions. Mosquitoes prefer wet climates in which to live and breed.

5. **BIGQUESTION** Apply the information about climate to the Big Question. Explain how a social factor such as where a person lives in Africa might be connected to the health risks of malaria.

Sample answer: Some locations in Africa have a climate that is more conducive to malaria, while others are less conducive. This affects the risk and probability of contracting malaria and decisions regarding pesticide use.

21st Century Skills

Find out more about the debate on using DDT to combat malaria. Work in small groups to research the opinions presented by organizations such as the World Health Organization (WHO) and the Malaria Foundation International. Then, research opinions by the Pesticide Action Network North America (PANNA). How are the different sides of this issue expressed by these organizations? Write a paragraph explaining which opinions you agree and disagree with, as well as the course of action you support.

*The 21st Century Skills used in this activity include **Critical Thinking and Problem Solving, Information Literacy, Media Literacy, Social and Cross-Cultural Skills, and Leadership and Responsibility.***



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Log on for more information and activities on the Central Case, ***The Rise and Fall — and Rise? — of DDT.***