Grade 7
Earth Science

Oak Meadow
Teacher Manual

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Grade 7

Observation and Measurement

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Record detailed observations in an outdoor setting.
- ☐ List helpful observation tools and explain their purpose.
- ☐ Demonstrate how volume can change without altering mass.
- ☐ Explain the relationship between volume, mass, and density.
- ☐ Lab Investigation:

  Option 1: Water Clock

  Option 2: Comparing Volume and Mass
- ☐ Optional activities:

  Activity A: Human Clock

  Activity B: Calculating Density
- ☐ Complete lesson 1 test.

Learning Objectives

At the end of this lesson you will be able to:

- Demonstrate good scientific observation skills.
- Record scientific measurements accurately.
- Demonstrate and explain the relationship between mass, volume, weight, and density.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Observation and Change
- Objective Observations and Inferences
- Scientific Argument
- Systems of Measurement
- Mass, Volume, and Density
- States of Matter

Before you begin reading, glance over the length of the reading selections in this week's lesson. You will find quite a bit of reading! You might already be familiar with some of the information, and some of it will probably be new to you. It's a good idea to read one or two sections and then take a break before reading more. That way, you are more likely to remember what you read, rather than just trying to cram it all in at once.

In addition to the reading selections in this coursebook, you are encouraged to learn more about topics you are interested in by visiting the library, reading newspapers and scientific journals, and doing research online. You'll find a list of online resources at oakmeadow.com. Click on the Resources tab, and then click on Curriculum Resource Links. You can use these links to learn more about lesson topics.

Your student may benefit from discussing the reading selections with you to help clarify the information. You can ask questions to prompt a discussion or an expanded explanation. Depending on your student, you may want to suggest that the reading be done in sections rather than all at once.

Assignments

Before you begin your assignments, read them through to get a sense of what you'll be doing and how long it will take. This will help you manage your time better. Just like with the reading, you may want to do a few assignments at a time and then take a break instead of pushing to get them all done at once. You have a full week to complete these assignments, so there's no rush.

1. For your first assignment, you'll be conducting an outdoor observation in a natural setting. This might be your yard, a nearby park, woods, a tree in the middle of the sidewalk, a pond, or a stream. Bring a notebook and pencil, and sit quietly for a few minutes while you observe the natural surroundings. Use as many senses as you can. Look carefully for all the details you can notice, and then close your eyes for a bit to tune into other senses.

   Write down a general description of the area in which you are observing, and then write a detailed description of one part of the area or an object within the area you are observing. Be as specific as you can, and use clear, objective language.

   Let the student make initial judgments about how detailed to get with the descriptions. Look for the use of specific language that is objective (anyone observing this detail would agree on its attributes). If the student is using subjective language (language that conveys personal feeling or judgment), point this out and discuss ways in which the observation can be described objectively.

2. List any tools or instruments that would be useful in making a more detailed analysis of your observation and briefly explain why they would be useful. What would you do with them?

Students might mention any of the following tools and explain how they would be useful: magnifying glass, ruler, watch, thermometer, binoculars, measuring cup, or weight scale. If students have difficultly thinking of tools, you can ask questions to prompt them: How much does that stick weigh? How big is that rock? How quickly did the squirrels race up the tree trunk?

3. Take two pieces of paper of identical size and weight and crumple them into two loose balls of similar size. Demonstrate how you can change the volume of one without changing its mass. Then, tear a piece off one of the papers, and crumple the paper back into a ball so that it matches the size of the second ball. Have you changed its mass or volume?

   If possible, conduct your demonstration in front of someone else, and explain what is happening in scientific terms. Alternately, you can video your demonstration and explanation, or you can put your explanation in writing or in audio form. Make sure to define mass and volume as you are describing what happened.

   Students might change the volume of the paper ball by making it larger (a looser ball) or smaller (a tighter ball). The volume has changed but the mass has not (the paper still weighs the same as it did when it was flat because no matter has been added or taken away). When a piece of the paper is torn off, the paper's mass has decreased. There is not as much "stuff" there as there was in the beginning. The student's demonstration should include definitions of mass and volume, and a clear explanation of what is happening.

4. Explain why it is always true that if two objects have the same volume but one object has a greater mass than the other, the object with the greater mass will also have a greater density. Give an example that is different than the examples in the reading section. You can do a video or audio recording or write down your explanation and example.

   The object with the greater mass has the greater density because it has more matter in the same amount of space (volume). Density is a measure of how tightly the molecules are packed into a space. If, in the same amount of space, one substance has more mass than another, it will also have greater density. Density is calculated by dividing an object's mass (usually expressed as weight on Earth) by its volume or size. Students should provide an example, such as two balls of equal size, but one made out of yarn and one made out of clay. The clay ball has a greater mass and density, even though the balls are the same volume.

Lab Investigation

Choose one of the following lab investigations to complete.

- Option 1 **Lab Investigation: Water Clock**
- Option 2 **Lab Investigation: Comparing Volume and Mass**

All lab investigations are found in the lab manual, *Lab Investigations: Earth Science*. Read through each before making your choice. Assemble all your materials before you begin. Use good scientific habits by taking careful observations and measurements, recording your data in an organized way, and using precise, detailed language.

Lab investigations provide students with an opportunity to develop scientific skills and practice the scientific method. Look for students to follow the procedure with care, take accurate measurements, and record their observations in an organized manner. Summaries and conclusions should include the use of scientific terminology and concepts. See the lab manual for the full description of each lab investigation.

Option 1 Lab Investigation: Water Clock

Water was sometimes used to measure time before clocks and watches were invented. In this investigation, you will make a water timer.

Conclusion

Write a summary of the procedure you followed in this investigation and how successful it was. What worked well? What was difficult? What might you do differently next time in order to make a more accurate or useful water clock?

Look for students to reflect on how well the investigation worked. Ideas for what to change or improve should be specific.

Option 2 Lab Investigation: Comparing Volume and Mass

This investigation explores volume and mass.

Conclusion

1. Answer the following questions:

   a. Look at your drawings of your first two containers. Did the volume of water the container held remain the same when you altered its shape? Did the mass of the clay change? Explain your answer.

   The volume of water the container held probably changed when the shape was altered. The mass of the clay did not change because no clay was taken away or added.

b. Look at your two one-cup bowls. The containers both hold the the same volume of liquid (they are the same size on the inside, even if they are not the same shape). Do the two empty bowls have the same mass? Explain your answer.

The bowls do not have the same mass because one ball of clay was larger than the other, so one bowl has a greater mass even though they both hold the same volume of water (they are the same size on the inside).

2. Write a summary of the procedure you followed in this investigation and what the process demonstrated about mass and volume.

Students should be able to explain the relationship of mass and volume using scientific terminology.

Activities

The following activities are optional, and are offered to give you more ways to explore the lesson material. These activities are not required. Feel free to choose whatever looks interesting to you.

- Option A: Human Clock
- Option B: Calculating Density

The activities in this course are optional. Students are encouraged to choose those that interest them. See the coursebook for the full description of each activity.

Test

Answer the following questions using the knowledge you have gained in this lesson. Use correct terminology and refer to scientific concepts to support your answer whenever possible.

1. Explain the difference between quantitative and qualitative observations and give an example of each.

Quantitative observations are measurable and include numbers such as weight, time, speed, or height. Qualitative observations are descriptions of attributes such as color, texture, smell, or sound.

2. Explain the relationship between mass, volume, and density. You don't have to give the formulas; just explain things in your own words.

Mass is the amount of matter in an object, measured as the pull of Earth's gravity on matter. Volume is the amount of space an object takes up. Density is the amount of matter per volume (the amount of substance in the space).

3. What are the three most common states of matter on Earth? Give an example of each, and explain how they are different.

   The three most common states of matter on Earth are solid (such as a table or eyelash), liquid (such as water or honey), and gas (such as steam or oxygen). Solids have a definite shape and and volume. Liquids have a definite volume, but will assume the shape of the container. Gases will change shape and volume depending on the container.

4. Describe the three steps of a scientific argument.

   The three steps of a scientific argument are 1) make a claim based on research; 2) provide evidence (data) to support the claim; and 3) show your reasoning for how the data support the claim.

5. What is the difference between an observation and an inference?

   An observation is something that is objectively detected or measured. An inference is an explanation about what the data might indicate. Inferences are based on evidence (observations and data) but are not facts; they are logical deductions or conclusions that may explain what happened.

Learning Checklist

This learning checklist can be filled out by either you or the adult who is supervising your work. This checklist will help you keep track of how your skills are progressing and what you need to work on. You or your home teacher can also add notes about where you'd like help.

Here is what the different headings mean:

Developing: You still need to work on this skill.

Consistent: You use this skill correctly most of the time.

Competent: You show mastery of this skill.

Please remember that these skills continue to develop over time so you aren't expected to be able to do all of them yet. The main goal is to be aware of which skills you need to focus on.

SKILLS	Developing	Consistent	Competent	Notes
Describe observations in detail				
Record accurate measurements				
Summarize procedure and what it demonstrated				
Demonstrate and explain the relationship between mass, volume, and density				
Use scientific terminology in explanations				

Grade 7

12 Earth's Structure

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Draw and describe the layers of Earth.
- ☐ Identify minerals used in everyday life.
- ☐ Observe and describe rocks, and try to classify them.
- ☐ Complete sky journal observations and conclusions.
- ☐ Lab Investigation: Sedimentation
- ☐ Lab Investigation: Rock Cycle
- ☐ Activity: Rock Recognition
- ☐ Complete lesson 12 test.

Learning Objectives

At the end of this lesson, you will be able to:

- Describe the layers of Earth's structure.
- Explain how rocks, minerals, and elements are related.
- Name the three basic types of rocks and explain how each was formed.
- Demonstrate the rock cycle.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Earth's Layers
- Rocks, Minerals, and Elements
- Classifying Rocks
- The Rock Cycle

Make sure to check out additional resources related to these topics on the curriculum resource links page at oakmeadow.com.

Assignments

In all assignments in this course, use accurate scientific terminology (such as the highlighted words found in the reading section).

1. Draw a picture and describe in your own words the layers that make up the structure of Earth. Or you can create a model of Earth and all of its layers using modeling clay. Make sure each layer is visible, and label the layers with flagged toothpicks. Add a short description of each layer.

   Each of the layers of the planet should be labeled and described:

   Crust: outer layer of rock under a thin layer of soil; continental crust is where land is, and oceanic crust is under the oceans.

   Mantle: the largest layer, made of molten rock, with a semi-solid upper mantle and a molten lower mantel.

   Core: outer core is molten metals spinning around the solid inner core.

2. List three minerals that are used around your house (make sure to say what items they are found in).

   Students should be able to name several household minerals. The list may include clay (flower pots, dishes, and vases), iron (cast iron pans), fluorite (toothpaste), gold and mica (electronics and computers), quartz (glass), and salt.

3. Find three different rocks that come from three different locations. Observe each rock carefully, and then describe each one in words, including what type of rock you think it is (igneous, sedimentary, or metamorphic), and why you think it falls into that classification of rock.

   Students are not expected to be able to classify rocks with complete accuracy; the goal of this assignment is to closely examine different rocks and use what they know to infer the rock's origin. Look for descriptions that include specific language and terminology.

4. Make your final entries in your sky journal this week—you should have four weeks of data, and have observed one full moon cycle. Return to lesson 9 and answer the questions found in the conclusion section to complete the lab investigation.

   The four-week lab investigation ends this week. The data table should show regular observations, and a good amount of detail. In the conclusion, students are asked to identify patterns in their

data, and should be able to notice regular steady movement of the constellations and moon phases. Using this data, they should be able to predict where the constellations and moon will appear next.

The conclusion should also include a few sentences about the experience of observing the night sky. Hopefully students will express a sense of wonder—scientific study should not cancel out a sense of amazement at the wonders of the natural world.

Lab Investigation

Complete both lab investigations below:

- **Lab Investigation: Sedimentation**
- **Lab Investigation: Rock Cycle**

Use specific language and scientific terminology when writing your conclusions.

Lab Investigation: Sedimentation

This lab demonstrates the sedimentation process, which is the first step in how sedimentary rocks are formed.

Procedure

Check that time increments are carefully noted with the observations.

Conclusions

1. Summarize the results of this investigation. How long did it take before you noticed sedimentation begin to happen? How long for it to be complete?

   Results will vary. Look for specific time measurements and a clear summary of what was observed.

2. Carefully lift the jar without disturbing the contents. Examine the layer of sediment on the bottom of the jar and write a description of what you see.

   Students may note that the sediment on the bottom of the jar has stratified into layers, with the heavier, denser particles sinking to the bottom, and the finer, lighter particles settling on top.

3. Explain how this process demonstrates the first step in the process of creating sedimentary rocks. What else would need to happen in order for the sediment in your glass to turn into sedimentary rock?

   Students should note that this process is going on all the time, and that layers upon layers stack up, creating pressure that eventually, in millions of years, turns the minerals in the sediment into rock.

Lab Investigation: Rock Cycle

Safety note: This lab uses a sharp knife and high heat and should be done with adult supervision.

In this lab, you will simulate how the three types of rock are formed and can change into one another.

Procedure

Check that the student's observations at each stage are written in clear, precise language.

Conclusions

1. Write a brief explanation of how this lab demonstrated the formation of different types of rocks and the rock cycle.

   Students should be able to explain each stage of the lab. Sedimentary rock is demonstrated by packing layers of different pieces (minerals) together. Metamorphic rock is demonstrated by applying heat and pressure to the sedimentary rock, which changes the structure and consistency of the rock. Igneous rock is demonstrated by melting the metamorphic rock and letting it cool until it hardens, once again changing the structure and consistency.

2. Could you predict what would happen or were you surprised by your results?

   Answers will vary.

3. Did this investigation help you better understand the rock cycle?

   If students express some confusion about the demonstration or the rock cycle, it may help to discuss the process.

Activities

Here is an optional activity to extend your exploration of rocks.

Activity: Rock Recognition

See the coursebook for a full description of the activity.

Test

1. Explain the differences between Earth's crust, mantle, outer core, and inner core.

   Students should be able to note identifying characteristics of each layer. Each layer of Earth is exposed to more pressure and heat, the further inward it is located. The inner core and the crust are solid, the outer core and most of the mantle are liquid (the upper mantel is partially solid).

2. How are rocks, minerals, and elements related to one another?

   Rocks are made of minerals, which are made of elements. Elements are the smallest building blocks of matter. Minerals consist of one or more elements. Rocks consist of one or more minerals.

3. Name the three types of rocks and tell how each was formed.

   Sedimentary rocks: formed when layers of rock particles and animal remains form layer upon layer, causing intense pressure which changes the minerals into rock.

   Metamorphic rocks: rocks that are exposed to intense pressure and heat beneath Earth's crust, transforming them into a new substance.

   Igneous rocks: rocks that are turned molten beneath the surface and then are pushed upward or onto the surface and cool.

4. Describe the rock cycle.

   The rock cycle explains how rocks are constantly changing from one form to another. Rocks on the surface are slowly broken down into sediment, that eventually becomes sedimentary rocks, which are slowly buried. Rocks beneath the surface can become metamorphic or igneous, depending on the pressure and heat. These rocks can be moved to the surface from volcanoes and the process begins again.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Classify rocks according to observations				
Differentiate between the three types of rock				
Explain the rock cycle				
Identify patterns in data from long-term observations (sky journal)				
Record accurate measurements in lab investigation				
Use scientific terminology to explain observed phenomena				
Explain concepts demonstrated by lab investigation				

Grade 7

13 Weathering and Fossilization

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Describe different types of fossilization.
- ☐ Identify similarities and differences between different types of geological dating methods.
- ☐ Research a fossil.
- ☐ Find examples of weathering.
- ☐ Optional activities:

  Activity A: Weathering Poem

  Activity B: Mud Detective

  Activity C: Fossil Impressions

  Activity D: Natural History Museum
- ☐ Complete lesson 13 test.

Learning Objectives

At the end of this lesson, you will be able to:

- Identify signs of mechanical and chemical weathering.
- Describe several forms of fossilization.
- Explain the difference between carbon dating and radiometric dating.
- Differentiate between different geological eras.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Weathering
- Fossilization
- Rocks as Clues to the Past
- How Old Is It?
- Geologic Time Periods

Remember to check the online resource links for this course. You'll find extra information to help you understand the lesson topics.

Assignments

1. Describe the difference between petrified fossils, preserved fossils, and fossil impressions.

   Petrified fossils have been turned to stone through a process similar to that which creates sedimentary rocks. Preserved fossils have been kept intact by being frozen in ice or trapped in sap that fossilizes. Fossil impressions are molds in the exact shape of an animal or plant that are left behind after the remains have dissolved.

2. Briefly explain the process of radiocarbon dating and radiometric dating. How are they alike? How are they different? Make sure to explain and use the term *half-life* in your answer.

   Both forms of geological dating measure the half-life of radioactive elements that are naturally occurring in the rocks or organisms. The half-life is the amount of time it takes for a certain element to be cut in half (for half of it to be lost). Radiocarbon dating measures the amount of carbon in an organism, and calculates its age based on the half-life of carbon-14. This is effective to about 45,000 years, at which point the carbon-14 will no longer be measurable. Radiometric dating is useful for much older organisms because it measures the half-life of radioactive elements in the rock around a fossil, some of which have half-lives of millions of years.

3. Find a photograph of a fossil and do some research on the organism. Try to find out what era or period it lived. If possible, find an artist's sketch of what the plant or animal looked like when it was alive. If you can't find a sketch, you can do your own "artist's rendition," making your best guess about what it might have looked like. Include the fossil photo with your findings and sketch (make sure to cite the source of your photo).

   Students will need to do extra research to find a fossil and, if possible, learn about what time period it was from.

4. Go outside and look for examples of physical weathering and chemical weathering. Describe what you find and where it is, and explain why you think it is a particular type of weathering. Describe the processes you think may have caused the weathering. If you'd like, you can draw your observations or take photos to include with your description.

   Signs of physical weathering are rocks that are split in two, such as cracks in a sidewalk caused by plants. Signs of chemical weathering are rocks whose appearance is changed, such as the rough, worn stone of an old monument, statue, or gravestone. Students should be able to explain what they think caused the weathering (plants, animals, wind, freezing and thawing water, or pollution).

Activities

Feel free to choose any of the following optional activities to extend your learning.

- Activity A: Weathering Poem
- Activity B: Mud Detective
- Activity C: Fossil Impressions
- Activity D: Natural History Museum

See the coursebook for full descriptions of each activity. These activities are not required, but can be fun and promote a deeper sense of learning and engagement. Students are encouraged to choose ones that appeal to them.

Test

1. Explain the difference between chemical and mechanical weathering. Give examples of each.

   Chemical weathering changes the chemical composition of rock, such as when water reacts with iron in a rock and creates rust, or when lichen clings to a rock and dissolves the surface. Mechanical or physical weathering changes the rock's structure but not its composition. This happens when water freezes and thaws, causing a crack, or when a plant's roots push through a crack and cause a piece to break off.

2. Is organic weathering a type of physical or chemical weathering? Explain your answer.

   Organic weathering can be either physical or chemical. It is caused by plants or animals, which can either physically break apart a rock or secrete chemicals that change the surface of the rock and cause it to deteriorate.

3. What does a paleontologist do?

   A paleontologist studies fossils.

4. Explain the different ways plants and animals can become fossilized.

   Fossilization can be the result of petrifying (when the minerals in the surrounding soil and air turn the organism to stone), preserving (when plants or animals are trapped in ice or sap), or impressions (when the organism leaves behind a print or shape of itself, after the remains have dissolved).

5. What type of material has to be present in a rock to use radiometric dating? What type of material has to be present in a fossil to use radiocarbon dating?

   A rock needs to have a radioactive element for radiometric dating; the presence of radioactive carbon is necessary for radiocarbon dating.

6. Place the following geological eras in order, from the earliest time to the present: Mesozoic, Precambrian, Cenozoic, Paleozoic.

   Precambrian (oldest), Paleozoic, Mesozoic, Cenozoic (current era)

7. Which type of dating would you use to find the age of a dinosaur from the Mesozoic era? Why?

   Dinosaurs lived during the Mesozoic era, which ended 65 million years ago. Since radiocarbon dating is only effective to about 45,000 years ago, radiometric dating is used to calculate the age of fossilized dinosaur remains.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Identify different types of fossilization				
Differentiate between carbon dating and radiometric dating				
Identify examples of physical and chemical weathering				
Place geological eras in chronological order				

Grade 7

14 Erosion

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Look for signs of erosion.
- ☐ Show how glaciers are formed and shape the land.
- ☐ Write a one-page report on erosion.
- ☐ Complete one lab investigation:

  Option 1 Lab Investigation: Erosion Observations

  Option 2 Lab Investigation: Soil Observations

  Option 3 Lab Investigation: River Observations
- ☐ Complete lesson 14 test.

Learning Objectives

At the end of this lesson you will be able to:

- Discuss the formation, composition, and importance of soil.
- Explain erosion by glaciers, water, and wind.
- Differentiate between weathering and erosion.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Soil Composition
- Layers of Soil
- Types of Erosion

Assignments

1. Choose one of the following:

   Students will choose one of the following field studies to learn about soil and erosion. Look for evidence of good observation skills and clear explanations using precise terminology.

   a. Take a walk in a wooded area and find both a flat area and a steep hill in the same section of forest. Use a stick or shovel to dig down and measure the depth of the top layer of soil in the flat area, then the sloping area. Is there any difference in their depths? If so, what do you think caused the difference? Do you think the depth of the topsoil would be different if there were grass growing on the hill or flat area? Why?

   b. Visit a farm or a forest which has recently been logged. Look for indications of erosion. Do you see exposed soil where vegetation used to be? Do you see places where the surface seems to be cracked or broken? What do you think caused erosion in these instances?

   c. Investigate water erosion in nature immediately after a rainstorm. Try to find at least four examples where something is affected or changed by the rain. Describe what you see and explain what you think happened.

   d. If you live in an area where winds are frequent and strong, take a walk and look for signs of wind erosion. Write a description of what you find and explain how the landforms may have been influenced by the wind.

2. Draw a series of pictures which show the complete process of a glacier's formation, its movement downhill, the formation of moraines, and what is left behind when it melts and recedes. Label each drawing and include any information necessary to make the process easy to understand.

   Glaciers are formed when layers of snow become compressed and turned to ice. Due to gravity, glaciers are constantly moving downhill, grinding rocks and soil beneath them as they move. These rocks and particles are pushed into piles and ridges (moraines) and ground down into minerals and elements, which are then deposited on the soil when the glacier melts or recedes. These minerals sink back into the soil, nourishing new plants and animals.

3. Choose one of the following topics and write a one-page report, focusing on how erosion has influenced the land:

   - Colorado River in the western United States (or a river of your choice)
   - Dust Bowl in the United States

- A national park (NP) in the western United States that has landforms created by wind erosion (such as Arches NP, Death Valley NP, Canyonlands NP, Badlands NP, and Zion NP)

You will need to do additional research for this project; ask for help if you have trouble locating relevant, reliable sources. Take notes in your own words, and then organize your notes into a logical order. Using a graphic organizer (such as an outline, mind map, or idea web) can help you link ideas together in a logical way. Group related ideas into paragraphs, and use topic sentences to introduce the idea for each paragraph. Use your best writing skills to create your rough draft, and then revise and edit your draft to make sure your report reads smoothly and doesn't have any big gaps of missing information. Proofread your final version to catch any errors in spelling, capitalization, or punctuation. Don't just report the information you learn. Using your own words, do your best to make this report interesting!

Students are expected to conduct research on one of the topics above, and write a one-page report that focuses on how this area gives evidence of erosion influencing landforms. This report, although short, should show clear evidence of good organization, paragraphing skills, revising for clarity and completeness, and editing to improve the flow, grammar, and other basic elements of good writing. The final version should be proofread and be relatively free of errors in spelling, capitalization, and punctuation. In addition, students should use their own voice, writing about what they found to be especially interesting.

Lab Investigation

Choose one of the following labs to complete. Read each all the way through in the lab manual before making your choice.

- Option 1 **Lab Investigation: Erosion Observations**
- Option 2 **Lab Investigation: Soil Observations**
- Option 3 **Lab Investigation: River Observations**

Students will choose one of the following labs to complete. Complete instructions are in the lab manual.

Lab Investigation: Erosion Observations

In this lab investigation, you will explore the effects of water on different types of soil.

Conclusions

Study your data table, looking for patterns in your results. Write an explanation of what your results revealed, and how this relates to erosion on a larger scale.

Students should note that the bare soil showed the greatest signs of erosion with the most run-off, and that the water was filled with sediment that had eroded. They should notice a pattern of erosion and run-off that is lessened with each new layer of material on top of the soil. Look for a data table that shows accurate measurements and detailed observations.

Lab Investigation: Soil Observations

You'll look at soil composition up close in this investigation.

Conclusions

Write a description of what you were able to observe about the soil, both with the naked eye and under magnification. How many layers could you see? Were there things in the soil you couldn't identify? Write down your best educated guess about how the soil in this area was formed.

Students will probably be able to notice a difference in composition between the layers of soil. Look for careful observations that include details about the different materials and particles. Students are asked to combine what they've learned and what they've observed to make an educated guess about how the soil was formed. They may mention the rock cycle, erosion by wind and water, gravity, falling leaves and decomposing plants, and other natural forces as they express their ideas.

Lab Investigation: River Observations

Explore a nearby stream or river to learn more about erosion in this lab.

Conclusions

Based on your observations, where do you think the things that make up the stream bed came from? Do you think the stream has changed its shape or altered the surrounding landforms? How?

After answering a series of questions about the river or stream they observed (found in the procedure), students should be able to explain how water erosion deposited sediment that makes up the stream bed. They should give specific examples that provide evidence of how the river may have shaped the surrounding landforms.

Test

1. Explain why soil is an essential Earth resource.

   Soil provides all the minerals and other nutrients needed for living things to thrive. Rich, healthy soil is essential for healthy plants, which nourish animals (including humans).

2. Describe the layers of soil and the soil cycle.

   Soil is composed of a thin layer of humus, which is decaying organic matter, and a nutrient rich layer of topsoil, which is a mixture of organic and inorganic (rock) particles. The subsoil is a hard-packed layer that water and plant roots can't penetrate very well. Beneath that is weathered rock fragments called regolith, and finally large slabs of solid bedrock.

3. What is the difference between weathering and erosion?

   Weathering happens in place, breaking down rocks into fragments and particles. Erosion moves these rock particles to another place, usually downhill, downstream, or downwind.

4. Describe the different types of erosion. Give an example of evidence of each type.

   Water, wind, and ice (in the form of glaciers) all cause erosion. Water erosion is found when water carves soil and rocks away from hills, streambanks, and coastlines. Water erosion can be seen when streambanks or ocean cliffs are undercut and collapse. The soil is washed away, changing the shape of the land and the waterway. Wind erosion occurs when wind blows away tiny particles of rock and deposits them elsewhere, changing the shape of the landforms. This is often seen in the desert where fantastic sandstone structures are carved into arches and towers. Glacial erosion happens when glaciers slowly move, grinding rocks beneath them and carrying the rock particles downhill. Evidence of glacial erosion can be seen in large valleys that were carved by immense, slow-moving glaciers thousands of years ago, and in deposits of rock particles (moraines) that border glaciers.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Explain the layers of soil and soil cycle				
Identify evidence of different types of erosion				
Explain how glaciers influence landforms				
Locate relevant, reliable sources				
Organize information into a paragraph of related ideas				
Use revising and editing skills to improve the quality of the rough draft				
Proofread final version of report				

Grade 7

15 Plate Tectonics

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Research earthquake preparedness.
- ☐ Draw, describe, and demonstrate different seismic waves.
- ☐ Report on one earthquake-related phenomenon.
- ☐ Lab Investigation: Seismic Activity
- ☐ Activity A: Quaking Crossword
- ☐ Activity B: Earthquakes in the News
- ☐ Activity C: Creative Writing
- ☐ Complete lesson 15 test.

Learning Objectives

At the end of this lesson you will be able to:

- Explain what causes earthquakes.
- Identify other natural phenomenon related to earthquakes.
- Explain the movement of Earth's tectonic plates.
- Describe the different types of seismic waves.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Earthquakes
- Tectonic Plates
- Seismology

Make sure to check the curriculum resource links online for some excellent videos that demonstrate the concepts related to plate tectonics.

Assignments

1. Research ways to prepare for an earthquake and what to do during an earthquake. Create a public safety pamphlet, poster, comic, children's book, or presentation. If you give your presentation in front of others, you may want to record it on video.

   Students will need to do additional research for this assignment. Tips for earthquake preparedness include securing bookshelves and other things likely to fall, keeping a supply of food and water, and having a family plan about where to meet in an emergency. Tips for staying safe during an earthquake include moving away from areas where things may fall, taking shelter under a study object, moving away from windows, and staying in place until the shaking stops.

2. Draw and describe the three types of seismic waves, and then find a way to demonstrate each type. Show a friend or relative the difference between the waves.

   P (or primary) waves move the fastest and can move through all the layers of Earth (solid and liquid). They move in a push-pull motion, like a Slinky toy or a coiled spring. They are also called compressional waves.

   S (or secondary) waves are felt after the P waves; since they can only move through solids, they do not penetrate Earth's liquid outer core. S waves move in an S-shape, like shaking one end of a long rope. They are also called shear waves.

   Both P waves and S waves are called body waves because they move through the layers or body of the planet.

   Surface waves are the third type of wave. These are felt last, and they move across the surface of Earth's crust like ripples on a pond. Surface waves are responsible for most of the damage done by earthquakes because they have a much greater wave amplitude (size) than the two types of body waves.

3. Choose one of the following phenomena to investigate:

   - Tsunami
   - Avalanche
   - Mudslide
   - Landslide
   - Liquefaction

   Students will need to do additional research for the topic they choose. Look for a well-organized paragraph and a list of sources.

4. Learn what causes it, what areas are most prone to it, and what kind of damage it might cause. Include anything else you find interesting, including recent instances. Write at least one paragraph and cite your sources.

Lab Investigation

Complete the following:

- **Lab Investigation: Seismic Activity**

Lab Investigation: Seismic Activity

You will demonstrate different types of seismic waves in this lab, using pancakes or clay to represent the movement of Earth's tectonic plates. Read through all the instructions before you begin. You will notice that you will have to apply your knowledge of seismic waves to complete this investigation.

Enrolled students: If possible, please video your demonstration to share with your teacher. Explain what you are doing as you perform the lab.

Conclusion

Explain how you modeled seismic activity along divergent, convergent, and transform boundaries. Describe what happened and why.

Feel free to eat your materials when you have finished!

This lab investigation asks students to apply what they have learned. This means the procedure does not give explicit instructions on how to model each type of tectonic plate boundary. Hopefully students are able to figure this out on their own, but if not, you can guide their investigation using the following information.

To model a divergent boundary, students will pull the two stacks of pancakes apart.

To model a transform boundary, students will slide the two stacks of pancakes in opposite directions. The two halves should still be touching along their edges, but have shifted in two directions.

To model a convergent boundary between two plates of continental crust (two plates of similar density), student will push the two halves together slowly so that they buckle and rise into a ridge in the center (simulating a mountain range).

To model a convergent boundary between ocean crust and continental crust, students will need to push the two stacks of pancakes together in such a way that the layers on one side move under the layers on the other side (demonstrating subduction of the oceanic crust beneath the continental crust).

Activities

Choose one or more of the following activities to further explore the topics in this lesson.

- Activity A: Quaking Crossword
- Activity B: Earthquakes in the News
- Activity C: Creative Writing

Test

1. Draw diagrams that show the difference between convergent, divergent, and transform boundaries of tectonic plates. (Remember, there are two types of convergent boundaries.) Label your diagrams so it is clear what each one shows.

   Diagrams should show that plates spread apart along divergent boundaries, and slide along one another along transform boundaries. Convergent boundaries push together. When two plates of similar density converge, they will crumple and form ridges. When the oceanic crust and the continental crust collide, subduction occurs as the denser oceanic crust pushes under the continental crust.

2. How does a P (primary) wave differ from an S (secondary) wave? Why are they both called body waves?

   P waves travel faster than S waves, and can move through liquid as well as solid. S waves can only move through solids so they don't travel through Earth's liquid outer core the way P waves do. P waves are also called compressional waves because they compress in a push-pull manner. S waves are also called shear waves and move in an S-shape. P waves and S waves are both called body waves because they travel deep underground, through the body of Earth.

3. Which type of seismic wave does the most damage and why?

   Surface waves do the most damage as they travel along the ground close to the surface and they have greater wave amplitude (size) than P waves or S waves.

4. What does the Richter scale measure?

   The Richter scale measures wave amplitude. The scale is from 1 to 10, with each whole number indicating a ten-fold increase in wave magnitude, which translates into over 30 times the force.

5. Explain the theory of plate tectonics. Make sure to include the terms *Pangaea* and *fault*.

   Plate tectonics theorize that Earth's continents were, at one time, one large mass, called Pangaea. This mass was slowly cracked into pieces by Earth's moving mantle of molten rock. These pieces formed into tectonic plates. Tectonic plates meet along faults, which can diverge, converge, or slide along one another. The movement of these plates causes earthquakes.

6. Explain why a rural area might be a safer place to experience an earthquake than a large city.

   One of the greatest dangers of earthquakes is being injured by falling objects, particularly human-built structures, including bridges, buildings, and electrical wires. Fire from burst gas pipes, falling chimneys, and electrical wires is also a serious hazard. A rural area is more likely to have open spaces free from falling debris.

7. What is convective flow and how does it relate to earthquakes?

   Convective flow describes the movement of molten rock in Earth's mantle. As the rock melts and heats, it rises. As it rises, it cools and becomes solid, which causes it to sink until it reaches higher temperatures and pressures, where it melts again. This constant motion or flow under Earth's crust shifts the tectonic plates, causing earthquakes.

8. What is subduction? Where does it happen? What happens to the oceanic crust during subduction? Explain why this happens.

   Subduction occurs when one tectonic plate slides under another. It happens along the coastline where continental crust meets oceanic crust. Oceanic crust is more dense, so it will always sink under the less-dense continental crust, which rises up.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Demonstrate and explain differences in types of seismic waves				
Identify natural phenomena related to earthquakes				
Model different types of tectonic plate boundaries				
Explain theory of plate tectonics				
Identify elements of earthquake safety				
Differentiate between surface and body waves				
Explain relationship between convective flow and earthquakes				

Grade 7

16 Mountains and Volcanoes

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Map the prominent mountains ranges of the U.S. or world.
- ☐ Draw a graph comparing the elevations of mountains.
- ☐ Model, draw, or research phenomena related to mountains or volcanoes.
- ☐ Activity: Appalachian Trail
- ☐ Complete lesson 16 test.

Learning Objectives

At the end of this lesson you will be able to:

- Explain how mountains form.
- Identify the location of mountain ranges and the tallest mountains.
- Describe what causes a volcanic eruption.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Mountains
- Volcanoes
- What Causes a Volcanic Eruption?
- Mountains and Volcanoes Under the Sea

You'll find online links to articles and videos on the curriculum resource links page (oakmeadow.com).

Assignments

1. Draw, trace, or get a blank map of the United States or world. Draw and label the prominent mountain ranges. Identify and mark the location of at least five active or dormant volcanoes. Use an atlas, map, or the internet to help you.

   Students will need to do additional research to complete this assignment. Major mountain ranges of the United States include Appalachian Mountains, Allegheny Mountains, Rocky Mountains, Sierra Nevada Mountains, Adirondacks, Brooks Range (in Alaska), Ozarks, and Cascade Range. Major mountain ranges of the world include the Alps, Andes, Himalayas, Pyrenees, Urals, Great Dividing Range, and Atlas Mountains.

2. Make a graph which compares the elevation of 10 of the highest mountains in the world. You can create a graph that includes visuals, such as small drawings or photos of mountains, or use a standard bar graph. Make sure to title the graph and label the two axes.

   Students will need to do additional research to complete this assignment. The graph should be clearly labeled on both axes, showing the elevation (in feet or meters) and identifying each mountain. The graph should make it clear, visually, the comparative elevations of the mountains, and which is the highest of those included in the graph.

3. Choose one of the following:

   a. Create a model or draw a picture which shows the stages of a mountain's formation. Indicate which type of mountain you are describing.

   b. Create a model of a volcano or draw a picture of a volcano that shows what the inside would look like. Label the different parts of your picture, showing as much information about the volcano as you can. If you choose to create a model, there are directions online for many different types using household materials. You might want to video the eruption while you explain what happens when a real volcano erupts.

   c. Research unique organisms that thrive near hydrothermal vents on the ocean floor. Create a poster, slide presentation, or photo essay describing the unique ecosystem.

   If your student chooses to create a model of the stages of a mountain's formation or of a volcano, have the student explain what the model shows. Pictures should be clearly labeled, and show good detail (artistic ability is not being judged, but rather attention to detail and accuracy). If your student chooses to create a visual presentation of the ecosystem around a hydrothermal vent, additional research will be necessary.

Activities

If you like hiking, you might want to explore this optional activity.

Activity: Appalachian Trail

See the coursebook for a full description of this optional activity.

Test

1. Describe how the following types of mountains are formed:

   a. fold mountains

      Fold mountains are formed when tectonic plates collide along a convergent boundary, causing the land to wrinkle and sometimes fold back on itself.

   b. fault block mountains

      Fault block mountains occur when converging tectonic plates crack into huge chunks of rock that are pushed upwards, creating steep-sided valleys between them.

   c. dome mountains

      Magma that rises up under Earth's crust but doesn't erupt onto the surface can cause bulges to form, resulting in dome mountains.

   d. plateau mountains

      When erosion from water and wind creates deep cuts on the surface, flat-topped plateau mountains are created.

   e. volcanic mountains

      Volcanoes that erupt force rocks and magma to the surface; as the lava cools, it builds up into a mountain of volcanic rock and ash.

2. What is the Mid-Atlantic Ridge?

   The Mid-Atlantic Ridge is the highest mountain range on Earth, and it is found under the Atlantic Ocean.

3. Describe the process of a volcanic eruption.

   As the magma in Earth's mantle heats, it expands and pressure builds. The magma flows toward the crust, pushing through cracks and vents or fissures in the crust. When the pressure builds

to a certain point, the magma forces the crust apart, sometimes in a powerful explosion of rocks, lava, and ash.

4. What is magma? What is the difference between magma and lava?

   Magma is molten rock beneath Earth's crust, in the mantle. When magma erupts onto the surface of the planet, it is called lava.

5. How were the Hawaiian Islands formed?

   The Hawaiian Islands were formed by erupting volcanoes that pushed upward from the ocean floor, building layer upon layer of volcanic rock and ash.

6. Explain the difference between active, dormant, and extinct volcanoes.

   Active volcanoes have erupted in the last 10,000 years (since the last ice age) and are expected to erupt again. Dormant volcanoes have not shown any activity in recent times but are likely to erupt in the future. Extinct volcanoes have not erupted in the last 10,000 years and are not likely to erupt again.

7. Imagine you live in a town near the foot of a volcano. What indications might you look for to predict when the volcano might erupt?

   Some signs of an impending eruption include venting of steam, ash, or gas, elevated ground temperatures, earthquakes or tremors, and a bulge forming under the ground.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Locate and identify prominent mountain ranges				
Create a bar graph with labels				
Describe how different mountains are formed				
Describe the process of a volcanic eruption				
Differentiate between different types of volcanoes				
Explain the warning signs of an imminent volcanic eruption				
Use scientific terminology in descriptions of phenomenon				

Grade 7

17/18

Scientific Inquiry: Modeling Design and Procedure

ASSIGNMENT SUMMARY

- ☐ Research a natural phenomenon and ways to model it.
- ☐ Design your own modeling project and discuss your ideas to refine the design.
- ☐ Create a model and record your procedure in detail.
- ☐ Share the project with others.
- ☐ Reflect on project design and learning experience.

Lesson Objectives

- Research ways to model a natural phenomenon.
- Design and create a model.
- Reflect on project design and learning experience.

For your third scientific inquiry, you will create a model of a natural phenomenon. You might model a landslide, tsunami, earthquake, volcano, crystallization, liquefaction, or any other phenomenon that intrigues you!

Your model may be a static (unchanging) model or it may be a working model (one with moving parts or that has a reaction or changes over time).

See the lab manual for full instructions.

- **Scientific Inquiry: Modeling Design and Procedure**

In this project, you will be designing, creating, and testing a model, and then having someone else create an identical model by following the procedures you have written down. You will need two sets of materials (one set for your initial model, and another for the second model).

Complete the project reflection afterward.

> By now, your student will probably be getting more comfortable with the process of project design and reflection. Review previous project reflections to identify phases the student may need extra help with.

Grade 7

19 Atmosphere

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Draw a diagram of Earth's atmospheric layers.
- ☐ Define prefixes that differentiate the layers.
- ☐ Explain the oxygen, carbon, or nitrogen cycle.
- ☐ Lab Investigation: Oxygen and Fire
- ☐ Optional activity: Atmosphere Poem
- ☐ Complete lesson 19 test.

Learning Objectives

- Describe the structure of the atmosphere.
- Differentiate between what happens in the atmospheric layers.
- Explain the oxygen, carbon, and nitrogen cycles.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Structure of the Atmosphere
- Composition of Air
- Earth's Cycles of Oxygen, Carbon, and Nitrogen

Make sure to check out additional resources on the curriculum resource links page at oakmeadow.com.

Assignments

1. Draw a diagram showing the layers of Earth's atmosphere. Color each layer and write the names of the layers in the diagram. Include at least one relevant bit of information for each layer. Make sure your diagram is clearly labeled.

   Earth's atmosphere has five main layers:

   Troposphere: this is closest to Earth's surface where most weather occurs. The troposphere is thinner at the poles and thickest at the equator. It is cooler at the top than at the bottom near Earth's surface.

   Stratosphere: this layer contains the ozone layer, which protects Earth from receiving harmful amounts of ultraviolet radiation from the sun. It is cooler at the bottom (next to the troposphere) than at the top, where it absorbs radiation. Commercial jets often fly in the lower stratosphere.

   Mesosphere: this layer is about the same thickness as the stratosphere. Like the troposphere, it is cooler in the upper regions than the lower; both temperature and air pressure decrease with height. Meteor showers (falling stars) occur in this layer as fast moving meteors burn up as they enter the mesosphere.

   Thermosphere: the air is very thin here, and intense radiation from the sun causes very high temperatures, which increase with height (like in the stratosphere). The International Space Station and many satellites are orbiting in the thermosphere.

   Exosphere: the outer layer of the atmosphere stretches far into space, with scientists placing the boundary anywhere from 10,000 to 100,000 kilometers above Earth. Gases are very spread out in this layer and the atmosphere is extremely thin.

   Students might also mention the ionosphere, which encompasses the top part of the mesosphere and all the thermosphere, and the magnetosphere, which extends from Earth's core out into space.

2. Look up the prefixes *tropo-*, *strato-*, *meso-*, *thermo-*, and *exo-* and list the meaning of each. Give a brief explanation of why you think each layer was differentiated using its particular prefix.

   Tropo- means *change*; the troposphere has ever-changing weather due to the constant mixing of gases.

   Strato- means *layer*; the stratosphere is relatively still with layers of cold air, warmer air, and ozone.

   Meso- means *middle*; this layer is in the middle of Earth's layers.

   Thermo- means *heat*; this layer is very hot.

   Exo- means *outside*; this layer is on the outer edge of the atmosphere.

3. Choose one of the following:

   The student's work should clearly explain one of the following cycles.

   Oxygen cycle: Animals breathe in oxygen from the atmosphere and release carbon dioxide. Plants take in carbon dioxide and release oxygen through photosynthesis.

   Carbon cycle: Carbon is released into the air when animals and humans breathe, and it is released into the soil when plants and animals decompose. Plants take in carbon from the soil and air, and animals and humans take in carbon from plants (or from animals who eat plants).

   Nitrogen cycle: Nitrogen is abundant in the atmosphere. It sinks into the soil where bacteria break it down into a form that plants can absorb. Animals (and humans) absorb nitrogen by consuming plants (or animals that have consumed plants). When plants and animals decay, nitrogen is released back into the air.

   a. Write and illustrate a short children's book, comic, or poster for kids that tells about the oxygen cycle, carbon cycle, or nitrogen cycle. Try to explain things in a way that a child between the ages of six and ten could understand. Make sure to include visuals to help explain the process.

   b. Write a two-paragraph scientific report on the oxygen cycle, carbon cycle, or nitrogen cycle. Use additional resources as necessary. Make a list of the sources you used, and include at least one visual (graph, image, or illustration).

Lab Investigation

Complete the following lab. Read all the instructions before you begin.

- **Lab Investigation: Oxygen and Fire**

Full instructions for all lab investigations are found in the lab manual, *Lab Investigations: Earth Science*.

Lab Investigation: Oxygen and Fire

This lab explores how oxygen is needed for combustion.

Caution: This activity involves fire and adult supervision is required.

Conclusions

1. Write a brief summary of your results.

   Students should note how long it took the candle flame to extinguish in each of the four trials, and observe the water level rising in the jar after the candle flame goes out. Observations should be written clearly and specific, accurate measurements reported.

2. Explain why the flame went out.

   Fire depends on oxygen to burn. Students should be able to explain that the flame died when all the oxygen was consumed.

3. Considering that water vapor is a gas that is prevalent in the air and it condenses into liquid when the temperature drops, what do you think happened to the water? It's okay if you aren't sure. Just give your best educated guess based on what you know.

   Students may or may not be able to connect what they know about water vapor to this experiment. They are asked to explain what they observed based on what they know.

   Here is the scientific explanation: The water in the pan acts as a seal that keeps gases from entering or escaping the jar. The flame produces heat, warming the air in the jar. When the fire consumes all the oxygen, the flame extinguishes, causing the temperature in the jar to drop. As the temperature drops, the water vapor instantly condenses into water droplets. The water level rises as water vapor is released from the air.

Activities

The following activity is optional.

Activity: Atmosphere Poem

See the coursebook for a full description of this optional activity.

Test

1. List the layers of the atmosphere in order from the ground up to space.

   troposphere, stratosphere, mesosphere, thermosphere, exosphere

2. In which atmospheric layer do you find the ozone layer?

   stratosphere

3. In which layer does most of our weather occur?

   troposphere

4. What is the main feature of the ionosphere?

   The ionosphere is a layer of charged particles (ions) which reflect radio waves broadcast from Earth, allowing communication signals to travel great distances.

5. Draw a diagram or write a description of each of the following:

   a. Oxygen cycle

   b. Carbon cycle

   c. Nitrogen cycle

   See assignment #3 above for a description of each cycle. Diagrams should be clearly labeled and show accurate information.

6. What percent of the air is oxygen and what percent is nitrogen?

   Earth's air is about 78% nitrogen and 21% oxygen.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Draw a diagram using accurate labels and visuals				
Explain difference between Earth's atmospheric layers				
Define prefixes for each atmospheric layer				
Describe oxygen cycle				
Describe carbon cycle				
Describe nitrogen cycle				

Grade 7

20 Climate

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Research and write about glaciers.
- ☐ Optional activities:
  - Activity A: Tree Rings
  - Activity B: Weather Stories
- ☐ Complete lesson 20 test.

Learning Objectives

At the end of this lesson, you will be able to:

- Identify natural factors that affect the global climate.
- Explain different stages of Earth's climate history.
- Identify how climate and environment are connected.
- Identify how humankind has influenced global climate change.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Climate Science
- Natural Factors Influencing Climate
- Earth's Climate History: Snowball Earth and Hothouse Earth
- Global Climate Change

There are many important topics introduced in this lesson. Use additional resources to learn more or to clarify concepts that you are unsure about.

Assignments

1. Write a research report or an expository essay about glaciers. You will need to do additional research for this assignment. Keep a list of your sources and include them at the end of your paper. After you do your research, organize the information you'd like to include in your paper into topics, and write your paragraphs so that the topics follow a logical flow. Write at least five paragraphs.
2. After you write a rough draft, read it over and make any changes to improve the writing or the way you express your ideas. After you make your revisions, proofread the paper a final time to catch any misspellings or errors in punctuation or grammar. This is your only assignment for this lesson (besides the test), so take the time to do your best work.
3. If you write a research report, you will focus more on the facts about glaciers, such as how they form, where they are found today, how large they are, and how they have changed over time. You can focus on one specific glacier or region, or many. If you choose to write an expository essay, you will focus more on the role glaciers play in global climate. For instance, you might explore how the change in glaciers over time gives us information about global climate change, or why scientists are alarmed by the melting of glacial ice sheets. An expository essay is a fact-based analysis of an issue that uses data and examples to back up statements. Expository essays do not include personal opinions, so write about your topic as a scientist would by citing relevant data or current research. Whether you are writing a report or an essay, try to present your information in an interesting way, in your own words.

   Students are required to do additional research for this paper on glaciers. Students may need help with the different steps of the process: locating reputable, relevant sources; taking notes and citing sources; organizing information into paragraphs; and shaping the information to flow in a logical way. Look for attention to detail in the writing, accurate scientific information with specific details to back it up, and clear explanations.

Activities

The following activities are optional.

- Activity A: Tree Rings
- Activity B: Weather Stories

See the coursebook for full instructions on all optional activities.

Test

1. Explain the difference between climate and weather.

   Weather is the atmospheric conditions that are experienced on a day-to-day basis. Climate is prevailing weather patterns over time, particularly over long periods of time.

2. What are some of the natural factors that influence Earth's climate?

   The climate is influenced by many natural elements, including the amount of sunlight and heat absorbed or reflected by the surface of the planet, the amount of carbon dioxide and ozone in the atmosphere, Earth's tilt and orbit around the sun, altitude and geography, wind currents, and ocean currents.

3. How are climate and environment interrelated? Give a specific example with your explanation.

   When the climate changes, the environment responds. As the environment changes, it influences climate. One example of this is deforestation: as the environment is altered by cutting down massive areas of forest, more carbon dioxide stays in the atmosphere, causing a greenhouse effect that heats the planet. Without the trees, the ground absorbs more of the heat, drying out that land and making it less arable, so fewer plants replace the trees, leading to more carbon in the atmosphere and a warmer climate.

4. Where do scientists find clues about what the climate was like throughout Earth's history?

   Clues to climate changes are found in tree rings, coral reefs, glacial ice, sedimentary rock, and sediment on the ocean floor.

5. Explain what is meant by Snowball Earth and Hothouse Earth.

   Snowball Earth refers to periods in Earth's history where the planet was completely covered in ice and snow. Hothouse Earth refers to climate stages where Earth had a tropical climate around the entire globe.

6. What is deforestation? What effects does it have?

   Deforestation refers to when massive tracts of forest are cut down. This increases the carbon dioxide in the atmosphere because the trees are no longer absorbing it and releasing oxygen. Without the trees to provide shade, the ground temperatures rise, drying out the air and causing less rain to fall. Natural habitats are disrupted, and erosion can cause the topsoil to disappear without the natural vegetation to hold it in place.

7. What are fossil fuels?

   Fossil fuels are coal, natural gas, and oil, all of which formed millions of years ago from decomposing plants and animals, which released their carbon into the soil.

8. How is the carbon cycle related to global warming?

   A carbon cycle in balance will keep within healthy limits the amount of carbon dioxide in the atmosphere. When carbon builds up in the atmosphere, it acts as in insulator, keeping the sun's heat near the surface of the planet. This causes a global rise in temperatures over time.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Locate reliable sources for research				
Organize information into paragraphs based on topic				
Accurately explain scientific topic in detail				
Differentiate between weather and climate				
Identify natural factors that affect climate change				
Explain interrelatedness between climate and environment				
Describe climate changes through Earth's history				
Identify how humankind has influenced climate change				

Grade 7

21 Water Cycle

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Choose an option for describing the water cycle.
- ☐ Lab Investigation: Transpiration
- ☐ Lab Investigation: Terrarium
- ☐ Complete lesson 21 test.

Learning Objectives

At the end of this lesson you will be able to:

- Describe the three physical states of water.
- Explain Earth's water cycle.
- Demonstrate the processes of evaporation and condensation.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- The Water Cycle

Assignments

1. Choose one of the following:

   In this assignment, students will use their creativity to describe the water cycle or reflect on the role of water in natural systems. Look for accurate information and terminology. In the water cycle, water is released from the atmosphere in the form of precipitation, where it is absorbed by plants and soil or collected in bodies of water. The sun changes water into a gas (water vapor) by evaporation and pulls it back into the atmosphere. Plants also release water

into the air during photosynthesis through the process of transpiration. Water vapor in the air changes from a gas into a liquid through condensation, which occurs when water vapor cools. Condensed water droplets collect and form clouds, which eventually release the water back toward the ground as precipitation.

a. Write a children's book or comic that describes the complete life cycle of a raindrop, from the time it leaves a cloud to the point at which it becomes a cloud again.

b. Write a poem, draw a picture, choreograph a dance, compose a song, or write a story that describes the phases of water and the water cycle.

c. Find a quiet spot outdoors by a water source, such as a stream, river, pond, lake, swamp, wetlands, or ocean. Sit quietly long enough to observe the natural environment. Look for ways the water influences the environment. Do you see animals or insects on or near the water? What plants are being nourished by the water? Can you see water droplets on leaves, trees, or your skin? Write down your thoughts, opinions, or feelings about water's role in nature.

Lab Investigation

Complete both lab investigations below:

- **Lab Investigation: Transpiration**
- **Lab Investigation: Terrarium**

Full instructions are in *Lab Investigations: Earth Science*. Use specific language and scientific terminology when writing your conclusions.

Lab Investigation: Transpiration

Conclusions

1. Write a brief description of what you observed.

   Look for clear, detailed descriptions of the observations.

2. What formed on the inside of the bag?

   Water droplets should form on the inside of the bag.

3. Where did it come from? Explain the process that caused this to happen.

   The water droplets are condensation that formed when the plant released water vapor into the air through the process of transpiration.

Lab Investigation: Terrarium

This lab investigation takes place over the course of one week. Part of the goal of this investigation is to practice data collection over time, so check that observations have been recorded on the data table for seven days.

Conclusions

1. Summarize the results of this lab investigation.

   Students will summarize their results by reporting what they observed over time. Look for clear, detailed information.

2. Explain how this lab demonstrates the water cycle.

   The water cycle is demonstrated by the interaction of heat and water. When the sun warms the jar, the liquid water evaporates, turning into water vapor. The water vapor condenses into water droplets, which drip down onto the plants and soil as precipitation. The soil and plants absorb the water, and then the plants release water vapor into the air, where it evaporates. The cycle continues.

Test

1. Name the three states of water and give two examples of each.

   solid: ice, snow, sleet, hail

   liquid: salt water, freshwater

   gas: water vapor, steam

2. What is water vapor?

   Water vapor is a gaseous state of water.

3. Explain how water can change between forms.

   Water vapor (gas) changes into liquid when it cools and condenses into water droplets or into a solid when it forms into ice crystals. Ice (solid) changes into a liquid when it melts or into a gas when it evaporates into water vapor. Water (liquid) changes into a gas when it evaporates and into a solid when it freezes.

4. Draw and label a diagram that illustrates the water cycle. Make sure to include arrows that indicate the direction that water is moving as it changes states.

See assignment #1 for a description of the water cycle. Check that the diagram is correctly labeled and that arrows show the direction of movement in the water cycle.

5. How are transpiration, respiration, and perspiration similar? Define each term in your answer.

   All three of these processes release water vapor into the atmosphere. Transpiration happens when plants release water vapor through photosynthesis, and respiration and perspiration happen when animals and humans breathe and sweat.

6. What role does the sun play in the water cycle?

   The sun heats up the water on Earth's surface, causing the water to evaporate. The sun causes the changing states of water as it moves through the water cycle.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Identify examples of three states of water				
Explain how water changes between states				
Describe and illustrate the water cycle				
Model the water cycle				

Grade 7

22 Clouds

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Make a field guide of cloud types.
- ☐ Explain relative humidity and dew point.
- ☐ Choose a cloud assignment.
- ☐ Lab Investigation: Dew Point
- ☐ Optional activity: Raindrops
- ☐ Complete lesson 22 test.

Learning Objectives

At the end of this lesson you will be able to:

- Differentiate between the ten main types of clouds.
- Describe how clouds form different types of precipitation.
- Explain the difference between relative humidity and dew point.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Cloud Formations
- Clouds and Precipitation
- Humidity and Dew Point

If you find any of these topics hard to grasp, please do additional research or ask for help.

Assignments

1. Make a field guide to clouds in poster or booklet form. Photograph, draw, paint, or collect pictures of each of the ten cloud types. Label each type.

   Here are the ten cloud types and basic information (see the coursebook for more detailed descriptions):

   Cirrus: high, wispy clouds

   Cirrostratus: high covering of thin white clouds

   Cirrocumulus: bumpy-looking blanket of clouds

   Cumulus: towering puffy clouds with sharp edges

   Altocumulus: puffy cotton-ball clouds

   Stratocumulus: smaller dark clouds in patches across the sky

   Cumulonimbus: towering clouds with flat top and darkened lower edges (thunder clouds)

   Stratus: lower uniform layer of clouds which is called fog when it touches the ground

   Altostratus: thick gray ceiling of clouds

   Nimbostratus: dark gray cloud cover that brings rain or snow

2. Explain the relationship between relative humidity and dew point. You can create a poster, booklet, or comic, or write a paragraph. Try to explain these concepts in a way that others can easily understand.

   Relative humidity is the amount of water vapor air can hold based on the temperature. Dew point is the temperature at which water vapor condenses into water droplets or dew. Because warm air holds more water vapor than cool air, the higher the dew point temperature, the more moisture there is in the air. Relative humidity is expressed as a percentage; when the dew point and the actual temperature are the same, the relative humidity is 100%. Look for students to use their own words to explain the concepts in a simple way.

3. Choose one of the following:

   a. Interview a meteorologist, and ask him or her questions you have about clouds, precipitation, relative humidity, and dew point. Record the questions you asked and what you learned from the interview.

b. Write a poem or song about water in the atmosphere, such as rain, sleet, snow, fog, or hail. In your poem, feel free to be creative but be sure to include accurate information about precipitation.

c. Go outside for two days this week and observe the sky. On the first day, look for types of clouds, number of clouds, and cloud movement. Record your observations using scientific terminology. On the second day, look at the shapes and movement of the clouds. Do the shapes remind you of anything? Is there a story in the sky? Write down your thoughts and feelings and/or write a story based on the cloud shapes and movement.

Lab Investigation

Complete the following lab investigation:

- **Lab Investigation: Dew Point**

Full instructions about project design and implementation are in *Lab Investigations: Earth Science*. Use specific language and scientific terminology when writing your conclusions.

Lab Investigation: Dew Point

You can demonstrate dew point with this simple lab.

Conclusions

1. At what temperature did condensation begin to form? (Note whether you are using Celsius or Fahrenheit.)

   Answers will vary, depending on the temperature of the air.

2. What is the dew point temperature?

   This number should match the number above (the dew point temperature is the temperature at which condensation begins to form).

3. Explain what happened in scientific terms.

   The ice cooled the water, which cooled the air around the metal can, causing the air temperature to drop. When the air cooled, it reached its saturation point where it could hold no more water vapor. The water vapor condensed into water droplets. This condensation marks the dew point temperature, which is measured by the air temperature at the point where water vapor (gas) is released as a liquid.

Activities

Try this optional activity to examine raindrops.

Activity: Raindrops

See the coursebook for a full description of this optional activity.

Test

1. Explain how clouds form and create different types of precipitation.

   Clouds form when water vapor cools and condenses, creating water droplets. These water droplets can collect around dust and particles in the air, and bump into each other, growing larger. When the droplets are too large and heavy to be supported by air currents, they fall to the ground as rain or snow, depending on the temperature. If rain falls through a layer of colder air, it can freeze and turn into sleet. If there are many layers of warm and cold air, rain can freeze and collect more water droplets and refreeze many times before falling to Earth as hail.

2. Using the chart below, explain how the names of the following cloud types give us clues to their formation, location in the troposphere, or what kind of weather they bring.

   Students will come up with their own explanations of how the Latin roots below are related to the cloud types. One example of how the cloud types match the Latin meanings is given here, but answers will vary. The goal is for students to make a connection between the names and the types.

LATIN ROOT	MEANING
alto	high
cirrus	curl or fringe
cumulus	heap or pile
nimbus	rain
stratus	layer

   a. Cirrus wispy clouds like curls or fringes in the sky

   b. Cirrostratus a layer of wispy clouds

   c. Cirrocumulus a pile of curled clouds

   d. Cumulus a heap of clouds

e. Altocumulus high heap of clouds

f. Stratocumulus layer of piled up clouds

g. Cumulonimbus heap of rain clouds

h. Stratus layer of clouds

i. Altostratus high layer of clouds

j. Nimbostratus layer of rain clouds

3. What can hold more water vapor, warm air or cold air?

   warm air

4. If the relative humidity is at 50%, will it feel more humid on a cool day or a hot day? Why?

   It will feel more humid on a hot day because warm air can hold more moisture than cool air.

5. When the dew point temperature and the actual temperature are the same, what is the relative humidity?

   100%

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Differentiate between cloud types				
Explain how precipitation forms				
Explain the difference between relative humidity and dew point				
Demonstrate dew point				

Grade 7

23

Wind and Atmospheric Pressure

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Draw diagrams to illustrate concepts related to wind patterns.
- ☐ Use the science behind wind patterns in a creative assignment.
- ☐ Predict a result based on air pressure.
- ☐ Lab Investigation: Homemade Barometer
- ☐ Lab Investigation: Expanding Air
- ☐ Complete lesson 23 test.

Learning Objectives

At the end of this lesson you will be able to:

- Draw a diagram showing the relationship between air pressure and wind patterns.
- Explain why wind currents move in a circular pattern.
- Identify how temperature affects air pressure.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Atmospheric Pressure
- Wind Patterns

View additional resources on the curriculum resource links page.

Assignments

1. Scientists often use diagrams to help illustrate different concepts. Draw labeled diagrams or pictures that explain the following statements. Use additional resources to get ideas about how to represent these statements visually.

   The following diagrams should clearly illustrate the statements below. Artistic skill is not necessary. Drawings should be labeled and have arrows indicating direction.

   a. Air has weight and exerts pressure on everything with which it comes in contact.

   b. The atmosphere is like an ocean of air above us, exerting air pressure equally in all directions.

   c. Earth's rotation influences the direction of wind currents.

   d. Atmospheric pressure decreases as altitude increases because warm air molecules expand and rise and cold air molecules condense and sink.

2. Write a story, poem, song, or play which takes place either on an ocean shore, a mountain, or in a valley where air currents behave in a general predictable way. In your story or poem, the wind should play an important role. Include the scientific explanation of what is happening with the wind as part of your story.

   Look for a creative use of the following scientific phenomenon. As the land heats in the morning and the air over it rises, cooler air rushes from water toward land, creating onshore breezes; as the land cools in the evening, the cooler, heavier air over the land moves toward the warmer, lighter air over the water, creating offshore breezes. Similarly, mountaintops warm before valleys, so in the morning, the cooler air in the valley will rush up toward the warm, rising air at the mountaintop, creating a valley breeze; in the evening, the air patterns are reversed, and the cool mountaintop air rushes down toward the warmer valley, creating a mountain breeze.

3. Try to imagine the following, keeping in mind that warm air expands and cool air contracts. What do you think would happen if you poured a few ounces of very hot water into an empty plastic bottle (such as a gallon milk jug or one liter bottle), screwed on the top very tightly, and then allowed the bottle to cool? Can you predict the results? Write down your prediction and then explain the science behind it. If possible, try this experiment after you make your prediction and see what happens. Include your actual results with your prediction and explanation.

   Predicting results is a scientific skill. Some students may struggle with this; if so, help guide them through the process of connecting concepts they have learned to physical phenomenon. Conducting the experiment is highly recommended after predictions have been made as this is

the best way to help students grasp the connections between what they know and what happens in the physical world.

When a plastic bottle is sealed tightly with hot water inside, the expanded state of the gas (air) is confined in its low pressure state. As the water inside cools, the gas contracts. Since the bottle is sealed and the sides are flexible, the bottle will crumple inward, pulled by the higher air pressure of the cooled gas.

Lab Investigation

Complete both of the following labs:

- **Lab Investigation: Homemade Barometer**
- **Lab Investigation: Expanding Air**

Full instructions are in *Lab Investigations: Earth Science*. Use specific language and scientific terminology when writing your conclusions.

Lab Investigation: Homemade Barometer

Barometers are used to measure air pressure. Here's a simple homemade barometer you can make to watch how it works.

Data Table: Barometer Readings

Check that regular readings have been recorded on the data table, and that observations are explained with precise, detailed language.

Conclusions

The weight of the air pushing down on the water makes it climb up the bottle neck. The greater the atmospheric pressure, the higher the water will climb. A rising barometer indicates rising air pressure and predicts fair weather conditions. A falling barometer indicates falling air pressure and predicts rain.

Write a brief summary of your results and whether or not your homemade barometer seemed to match the prevailing weather conditions.

Results will vary but hopefully the student's results will match the statements above, showing rising air pressure during fair weather and falling air pressure during cloudy or stormy weather. Look for precise descriptions, accurate terminology, and logical reasoning.

Lab Investigation: Expanding Air

This lab investigation lets you see the effects of warm air rising and expanding, and cool air sinking and contracting.

Conclusions

1. What did you observe? Summarize your results.

   The summary should be written using objective language. The balloon should have collapsed as the air inside the bottle cooled and expanded as the air inside the bottle warmed.

2. Using scientific terms, explain what happened.

   Warm air expands and rises, pushing up into the balloon and making it expand. Cool air contracts and sinks, drawing back down into the bottle and making the balloon collapse.

3. Predict what would happen if you let the bottle and balloon sit at room temperature for a while. Explain your reasoning.

   Predictions will vary but hopefully students will understand that once the air returns to room temperature, the balloon will be back to the original position, half-filled with air. If students have trouble making a prediction or predict something different, ask them to explain their reasoning. This will help point to areas of confusion. After the prediction is made, encourage students to continue the experiment, letting the bottle return to room temperature to see what happens.

Test

1. What is air pressure?

   Air pressure is the weight of air in the atmosphere pressing down toward Earth.

2. How does the air pressure change as you go up into higher elevations?

   Air pressure decreases as elevation increases.

3. Why is the air pressure of cool air greater than the air pressure of warm air?

   Cool air molecules are close together, condensed into a smaller space, so they are heavier and exert more pressure. Warm air molecules are further apart, expanded into a larger space, so they are lighter and exert less pressure.

4. What does air pressure have to do with wind currents?

   Air pressure is related to wind currents because warm air rises, allowing cooler, denser air to move in beneath it. These changing patterns of pressure based on temperature cause wind currents.

5. Why do the winds on this planet move in circular patterns?

   Earth's rotation on its axis causes winds to move in circular patterns in a phenomenon called the Coriolis effect.

6. Imagine you are in a sailboat. Since you have only the wind to propel your boat, what time of day would it be easiest for you to set sail from shore into the ocean? What time of day would be easiest to return to shore, based on the wind? Explain your answer.

   Evening is the easiest time to set sail from the shore because offshore breezes are pushing cool air from the land toward the warmer sea air. Morning is the easiest time to return to shore because onshore breezes are pushing cool air from the ocean toward the warmer air over land.

7. Describe the difference between a mountain breeze and a valley breeze. Why do these wind currents behave as they do? Include information about related scientific concepts to support your answer.

   As a mountaintop warms, cooler air in the valley will rush up toward the warm, rising air at the mountain top, creating a valley breeze. As a mountaintop cools, the air rushes down toward the warmer valley, creating a mountain breeze. Valley breezes usually occur early in the day as the top of the mountain warms before the valley. Mountain breezes usually occur late in the day as the top of the mountain cools before the valley.

8. If a low pressure air mass was approaching, would you expect rain or sun in the forecast? Why?

   A low pressure systems often predicts rain because low pressure means warm air is rising, collecting lots of moisture as it expands. This warmer, moist air condenses into cloud formations, often bringing rain.

9. Which barometer would you expect to have the higher reading, one at sea level or one at the top of a mountain? Why?

   Sea level, where the full weight of the atmosphere is pressing down, has more air pressure than high elevations, where the air is less dense because there is less of it pressing down from above. Barometric readings are higher at sea level, and generally decrease with elevation.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Define air pressure				
Explain how temperature affects air pressure				
Relate air pressure to wind currents				
Identify causes of offshore and onshore breezes				
Identify causes of valley and mountain breezes				
Use knowledge of air pressure to predict weather				
Diagram concepts related to wind currents and air pressure				

Grade 7

24 Meteorology

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Annotate and explain a weather map.
- ☐ Choose an assignment about meteorology.
- ☐ Lab Investigation: Wind Vane
- ☐ Lab Investigation: Weather Station
- ☐ Complete lesson 24 test.

Learning Objectives

At the end of this lesson you will be able to:

- Explain the relationship between air masses and weather.
- Discuss the nature of warm and cold fronts.
- Make your own weather forecasts.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Meteorology and Weather Forecasting
- Cold and Warm Fronts
- Jet Stream

Assignments

1. Copy or print weather maps from a newspaper or online weather source on three different days this week. Annotate or make notes on each map to show the locations of moving high and low pressure fronts. Label these and point out any other pertinent information on the map. For each map, write a few sentences explaining what the weather is (or is likely to be) in these locations.

   The annotated weather maps (three of them) should clearly show how the markings on the map indicate different types of weather systems. Each map should include a few sentences that interpret the data on the map and put it into plain language about what type of weather to expect.

2. Choose one of the following:

   Follow up with your student on the assignment of choice below. If a survey or interview is done, discuss the results; if a game is created, play the game with your student; if a weather forecast is staged, ask relevant questions; visit a weather station or meteorologist together. Showing an interest in your student's work can help generate more interest and motivation, and spark lively discussions that will benefit the student's overall understanding of the topic.

   a. Gather opinions from at least five people as to how weather affects people's lives. Either you may choose to do an interview with five random people or you can interview five people with occupations that are affected by the weather. You could also choose to create a survey that people would fill in rather than an interview. Compile and summarize your results.

   b. Make a game about the weather. Some game styles are cards, board games, word games, crossword puzzles, theatre games, or active running games. Write a brief description of your game after you play it.

   c. Stage a weather forecast in which you are reporting a large snowstorm or rainstorm coming into your region. Write the script that explains the science behind the weather events and create a weather map to show what is happening. Present your weather forecast to a small audience and videotape it, if possible.

   d. Interview a meteorologist about weather forecasting. Find out what equipment is used and how the data is interpreted. Find out how a meteorologist does the job. Do meteorologists work alone or in teams? Do they work only on computers or do they have weather stations? Write a list of questions beforehand, and afterwards, write a brief summary of the experience.

e. Arrange a visit to a weather station. Find a weather station in your area, and call to ask if they give tours. Write a list of questions you have about the weather station and the people who work there. Write the answers to your questions or a reflection on your visit.

f. Another way to predict the weather is by following ageless folklore. Write a report on weather folklore. Use at least three sources of information or collect weather sayings from at least three different people.

g. Go to a library or bookstore and look at a copy of the Farmer's Almanac for this year. In it, there are predictions of the weather in all locations of the United States for the entire year. These predictions are made over a year before the actual weather happens, yet the Farmer's Almanac has remarkable accuracy in its predictions. Look up the weather predictions that were made for the area in which you live for the week you have been observing the weather. Tell what the prediction was for each day this week, and whether it was accurate or if it was not.

Lab Investigation

Complete both of the following lab investigations (found in *Lab Investigations: Earth Science*):

- **Lab Investigation: Wind Vane**
- **Lab Investigation: Weather Station**

Use specific language and scientific terminology when writing your conclusions.

Lab Investigation: Wind Vane

You can construct a simple wind vane to determine wind direction.

Conclusions

Write down your results. If your senses and the wind vane differed, give an explanation of why this might be.

Results will vary. This activity is a good reminder to students to use their senses as well as weather instruments to study the weather.

Lab Investigation: Weather Station

In this lab, you will make your own weather station, collect weather data for five days, and then use these data to make weather forecasts.

Conclusions

1. Were you able to make any accurate weather forecasts based on your data? Why or why not?

   Students may have been able to use their data to make accurate predictions, but inaccurate predications also provide an important learning experience. Weather forecasting is not an exact science because so many factors are involved and constantly changing.

2. Were there any unusual weather events during the five days you were collecting data?

   Answers will vary.

3. Did you find the clouds tended to move in the same direction as the wind on the ground?

   Answers will vary depending on the movement and height of local air masses and currents, and the height of the clouds.

4. Did you notice any patterns in your data, such as temperatures rising or falling over the course of the five days, or a correlation between changes in the barometer and changes in the temperature?

   Answers will vary, depending on the weather patterns during the time data was collected.

Test

1. What is a cold front? What is a warm front?

   Fronts are colliding air masses of different temperatures, and are named based on the air mass that is moving the fastest. A cold front occurs when a fast-moving cold air mass meets a slower-moving warm air mass. A warm front occurs when a fast-moving warm air mass meets a slower-moving cold air mass.

2. Describe the type of weather you would expect for each type of front.

   A cold front will move quickly, often causing gusty winds and sudden storms that pass by quickly. A warm front moves more slowly, often starting with fog or steady rain and then lifting into clearing skies.

3. What are jet streams? How are they formed and how do they influence weather?

   A jet stream is a fast-moving current of air in the troposphere that forms at the boundary of a cold and warm front. The greater the difference in temperature between the two air masses, the greater the speed of the jet stream. The jet stream can push air masses, influencing the weather.

4. Define meteorology.

   Meteorology is the study of weather.

5. What instruments do meteorologists use to forecast the weather?

   Meteorologists use many tools, including a thermometer, barometer, anemometer, weather satellites, and computer models.

6. Why do jet streams move from west to east?

   Jet streams move from west to east because of the rotation of the planet and the Coriolis effect.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Differentiate between cold fronts and warm fronts				
Interpret weather maps				
Collect weather data				
Use weather data to forecast the weather				
Identify patterns in data				
Explain the movement of a jet stream				

Grade 7

Extreme Weather

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Choose an assignment related to extreme weather.
- ☐ Complete lesson 25 test.

Learning Objectives

At the end of this lesson you will be able to:

- Describe what causes thunder and lightning.
- Differentiate between a hurricane, typhoon, and cyclone.
- Identify problems created by a thermal inversion.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Thunderstorms and Tornadoes
- Hurricanes, Typhoons, and Cyclones
- Other Extreme Weather Events

Remember to check out the additional online resources on the curriculum resource page.

Assignments

1. Choose one of the following:

   Look for clear accurate information, including safety measures that can be taken during weather-related emergencies.

   a. Create a pamphlet, poster, or informational booklet about a weather-related emergency of your choice. Examples are hurricanes, flash floods, tornadoes, heat waves, cyclones, mud slides, lightning storms, or ice storms. Explain how the storm develops, list safety guidelines, and create an emergency plan for others to follow.

   b. Research thunderstorms, tornadoes, hurricanes, or blizzards. Write a children's book, song, story, or play about the storm and how to keep safe during this type of extreme weather.

   c. Write a journal from the perspective of a person who lives on the Atlantic shore just as a hurricane is about to hit. Write a series of journal entries which describe the impact and characteristics of the hurricane, and then describe the damage and recovery efforts after the storm. Do some research and include factual information about storm preparation, damage, and recovery.

Test

1. Explain the difference between a hurricane, a cyclone, and a typhoon.

   All three terms refer to violent circular storms that revolve around a center, and have winds of at least 74 miles per hour. Hurricanes form over the Atlantic Ocean or Northeast Pacific Ocean, typhoons form in the Northwest Pacific, and cyclones form in the South Pacific or Indian Ocean.

2. What conditions cause lightning to form?

   Lightning occurs when ice particles develop an electrical charge. Positively charged particles move to the top of the cloud and negatively charged particles move to the bottom. When the charge builds up, sparks arc between the positive and negative particles, causing lightning.

3. What causes the sound of thunder?

   When lightning arcs through a cloud, it heats the air around it to an incredibly high temperature. The rapidly expanding super-heated air causes the sound of thunder.

4. Describe a thermal inversion, and explain how this phenomenon is related to air pollution.

   A thermal inversion happens when a warm layer of air covers a cool layer and the air becomes still. This still air traps pollution close to the ground, causing health problems for many people.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Explain how lightning forms				
Define thunder				
Identify characteristics of a blizzard				
Differentiate between a hurricane, typhoon, and cyclone				
Explain the relationship between pollution and thermal inversion				

Grade 7

Scientific Inquiry: Controlled Experiment

ASSIGNMENT SUMMARY

- ☐ Design and conduct a controlled experiment.
- ☐ Repeat the experiment.
- ☐ Draw conclusions from your results.
- ☐ Reflect on project design and learning experience.

Lesson Objectives

- Identify influencing factors and set up a controlled environment.
- Conduct experiment and replicate results.
- Draw conclusions based on results.
- Reflect on project design and learning experience.

Assignments

Scientists often study phenomena and relationships between events by conducting controlled experiments. In this double lesson, your task is to set up a controlled experiment.

See the lab manual for full instructions.

- **Scientific Inquiry: Controlled Experiment**

In this project, you will be designing, conducting, and repeating an experiment, carefully recording your results.

Complete the project reflection afterward.

Designing and conducting a controlled experiment is very challenging. Students are just learning how to recognize and account for the many variables that may influence experiment results. This is a learning experience first and foremost; the results are less important than how the student records and interprets the data. Encourage your student to discuss the different phases of the experiment, from set-up to conclusions, and take notice of where some guidance may be helpful. Students are asked to repeat the experiment at least once.

Grade 7

28 Earth's Resources

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Identify the costs associated with natural resources.
- ☐ Explain how the sun is connected to energy sources.
- ☐ List ten household items that run on electricity.
- ☐ Make a list of ways to conserve energy.
- ☐ Chart how energy gets from its source to the end user.
- ☐ Research and write about a renewable energy resource.
- ☐ Optional Activity: Conservation Challenge
- ☐ Complete lesson 28 test.

Learning Objectives

At the end of this lesson you will be able to:

- Describe the difference between renewable and nonrenewable energy sources.
- List renewable and nonrenewable fuels humans use for energy.
- Explain some of the environmental issues connected with various energy sources.
- Identify ways to conserve energy.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Earth's Cycles
- Natural Resources
- Energy Sources
- Energy Use and Conservation

Assignments

1. Air, water, soil, animals, and plants are all essential to sustain human life. What are some of the costs of using natural resources? How is the value of a natural resource determined?

   Using natural resources may involve monetary costs, costs of labor to harvest it, and costs to the environment. There are also costs related to extraction and production to turn the resource into usable energy. Environmental costs may include pollution, habitat loss, clean-up, and restoration.

2. Explain how the sun is responsible for all the various renewable and nonrenewable energy sources (except geothermal energy). Feel free to use a diagram to illustrate this statement.

   The sun is the source of almost all energy on Earth, so all natural resources that are used for energy are based on the sun's energy, except geothermal energy which is powered by Earth's hot core. Students may draw a diagram that shows how various natural resources originated from the sun's energy.

3. Most of the energy used in homes is in the form of electricity. List ten common household items that run on electricity.

   Answers will vary, and may include phone, computer, stove, refrigerator, washer and dryer, water heater, lights, and small appliances.

4. List five things that can be done to curb wasted energy. List five additional things that can be done to conserve or save energy.

   Students will have varied responses which may include the following: To curb wasted energy, turn off lights and computers, unplug electronic devices and appliances, and only run the dishwasher or clothes washer when full. To conserve energy, walk, bike, or use public transit instead of driving, grow your own food, wear sweaters to keep warm, and hang out laundry instead of using a dryer.

5. Draw a flow chart or web which shows the process energy moves through to heat your home or to fuel a car. Begin your chart at the natural source of the energy supply. Show what has to happen to that source before it gets to the end user (you).

   Responses will vary depending on the energy source described. The illustration should clearly show the natural resource (such as wind, oil, or solar), a power generator or power plant, transportation method (trucks, wires, pipes, etc.), and the end use (home or car).

6. Choose one renewable energy source to research. Write a one page paper on this natural resource. Use at least three references and list them at the end of your paper.

   The paper should list sources and provide accurate information. Look for information to be conveyed in an organized way in the student's own words.

Activities

The following activity is optional.

Activity: Conservation Challenge

See the coursebook for a full description of this optional activity.

Test

1. Explain the difference between renewable and nonrenewable energy resources, and why the current consumption of nonrenewable energy is cause for concern.

   Renewable sources (such as wind, solar, and water) are those which are not consumed in the process of creating energy. Nonrenewable sources (such as fossil fuels) are consumed, and usually take a very long time to regenerate. For this reason, nonrenewable sources are considered finite and once they are gone, there will be no more. The major concern of fossil fuels is the damage done to the environment from harvesting, producing, and consuming them.

2. What is the source of all energy on Earth?

   the sun and Earth's hot core

3. What are natural resources?

   Natural resources are naturally occurring materials that are necessary for human survival or can be used for economic gain.

4. List at least five natural resources.

   Answers will vary and may include general materials such as soil, water, air, and sun, or may include specific materials such as trees, animals, oil, iron, and gold.

5. List the various kinds of renewable and nonrenewable fuels humans use for energy.

   The most common renewable energy sources are solar, wind, water (hydroelectric), and geothermal. Biomass and nuclear energy may be listed as renewable resources. Nonrenewable energy sources include natural gas, coal, and oil.

6. Explain why conserving energy is important.

   Answers will vary. Students may note that it is important to use only what we need so there is enough for everyone, or that conserving energy allows us to take better care of the planet.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Explain the sun's relationship to energy sources				
Identify ways to conserve energy				
Chart how energy moves from natural resource to end user				
Differentiate between renewable and nonrenewable energy sources				
Define and identify natural resources				

Grade 7

29 Water Sources

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Identify the source of your tap water.
- ☐ Research an estuary, marsh, or swamp.
- ☐ Lab Investigation: Groundwater Filtration
- ☐ Complete lesson 29 test.

Learning Objectives

At the end of this lesson you will be able to:

- Explain the sources of water on Earth.
- Differentiate between different types of aquatic ecosystems.
- Describe the process of groundwater filtration.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Water: Earth's Most Precious Resource
- Groundwater

See the curriculum resource links for additional resources.

Assignments

1. Determine the source of your tap water. Is it from groundwater, a spring, or a reservoir, or does it come from another source? How close is the nearest water reservoir? What is done to the water to make it safe to drink? You will probably need to do additional research to find this information.

   Students may need help determining local sources of tap water if your household is on a city water system. This information can be found online or by calling the water company.

2. Choose one of the following to learn more about: estuaries, marshes, or swamps. You can research one specific place or explore many places where this type of water source is found. Write a short essay or create a photo essay with captions for each photo.

   In addition to this assignment, students can be encouraged to learn more about a local estuary, marsh, or swamp, and to visit it.

Lab Investigation

Complete the following lab investigation (found in *Lab Investigations: Earth Science*):

- **Lab Investigation: Groundwater Filtration**

Use specific language and scientific terminology when writing your conclusions.

Lab Investigation: Groundwater Filtration

This lab lets you see how water is filtered through soil and rock. **Note:** This lab won't produce drinking quality water.

Read through the lab procedure before you begin. The amount of materials you will need depends on the size of the plastic bottle you use.

Conclusions

Write a summary of what you observed.

Students should notice a marked difference in the clarity of the water as it is filtered repeatedly.

Test

1. What is a groundwater aquifer?

   A groundwater aquifer is a natural underground reservoir in rock that stores water.

2. Where is most of Earth's freshwater stored?

   Over 60% of the world's freshwater is stored in frozen ice caps and glaciers.

3. Explain how groundwater is purified.

   Groundwater is naturally filtered by trickling through pores in rock and soil that capture particulates in the water.

4. What is the difference between an estuary and a wetland?

   An estuary is where a river meets the sea, and is subject to tides. Wetlands are found wherever water covers the soil for most of the year. Wetlands can be salt water or freshwater.

5. What is most of the water humans collect used for?

   Approximately 70% of fresh water humans use goes to agriculture, either growing crops or raising livestock.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Identify local water sources				
Model how groundwater is filtered				
Identify where most freshwater is stored				
Differentiate between estuary and wetlands				

Grade 7

30 Earth's Oceans

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Map the five oceans and the Gulf Stream current.
- ☐ Trace a local water source to its final drainage.
- ☐ Choose a marine research activity.
- ☐ Lab Investigation: Salinity and Density
- ☐ Optional Activity: Aquarium Scavenger Hunt
- ☐ Complete lesson 30 test.

Learning Objectives

At the end of this lesson you will be able to:

- Explain the forces that cause ocean currents.
- Name the five oceans on Earth.
- Describe the topography of the ocean floor.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Oceans and Marine Life
- Ocean Currents

Assignments

1. Make a map of Earth's five major oceans, labeling each one. Draw simple outlines of the continents and label them. Add the equator, Tropic of Cancer, and Tropic of Capricorn. Using arrows, show the Gulf Stream current.

   Check the student's map for accuracy. The Arctic, Atlantic, Indian, Pacific, and Southern Oceans should be labeled as well as the continents (Africa, Australia, North America, South America, Europe, Asia, and Antarctica). The Tropic of Cancer is located at 23.5° N and the Tropic of Capricorn is located at 23.5° S. The Gulf Stream should be shown as an ocean current that flows from the Caribbean Sea up the east coast of North America, across the Atlantic, down the coast of Northern Europe to Africa and then sweeping across the Atlantic again to the Caribbean. Arrows should indicate the direction of flow.

2. Using a printed or online map, locate a stream which flows near your home. (Feel free to explore it on foot, as well!) Use your finger to trace the path of the stream until it meets the larger body of water it feeds into. See if you can follow that larger body of water all the way to its final drainage. Does it end at the ocean? Draw a simple map showing the journey of the water from the stream near you to its end.

   Students will need a local map (print or online) for this assignment. Tracing the route of a local stream may be quite challenging. If your student is unable to follow the stream on the map, you might choose a more prominent river nearby to follow. The goal is for students to understand that many streams flow into rivers, which flow into the sea. Some will flow into lakes or disappear underground.

3. Choose one of the following:

   Each of the following activities requires additional research. Discuss your student's work and ask questions; this not only shows an interest in what your student is learning but also encourages the student to communicate this new knowledge clearly.

   a. Research a type of animal that lives in the ocean and write a short report or photo essay. Choose a sea creature that you are not very familiar with. Include a description of the marine animal and its habitat. Include a drawing or photograph.

   b. Research waves and write a short report or photo essay. Here are some questions you might explore: Why are some waves small and some large? How are waves classified? Where in the world do you find the best waves for surfing?

   c. Learn about current underwater research and write a short report. Include information on where the research is happening, what the scientists are studying, and how the research is being conducted.

d. Interview an oceanographer, a person who works at an aquarium, a boat captain, a fisherman, or some other person who may live or work on the ocean. Find out about their experiences. What have they learned about the ocean by working with it? What ocean issues are they aware of? Make a list of questions ahead of time. You can tape record the interview or write it out. Then write a summary of the interview and what you learned. Include your original list of questions.

Lab Investigation

Complete the following lab investigation (found in *Lab Investigations: Earth Science*):

- **Lab Investigation: Salinity and Density**

Use specific language and scientific terminology when writing your conclusions.

Lab Investigation: Salinity and Density

In this investigation, you will demonstrate how salinity affects the density of water.

Conclusions

Summarize your results and explain the science behind what happened. Use the term density in your explanation.

Students should note the egg floated in the salt water and sank in the freshwater because the salt water has a higher density. The colored freshwater, if poured carefully enough, should have stayed separate, clearly showing a difference in layers with the denser salt water on the bottom and the less dense freshwater on top.

Activities

The following activity is optional.

Activity: Aquarium Scavenger Hunt

See the coursebook for a full description of this optional activity.

Test

1. List the following ocean floor features in order as you move from the coast into the deep ocean: continental slope, abyssal plain, continental shelf, continental rise.

   continental shelf, continental slope, continental rise, abyssal plain

2. Which is more dense, saltwater or freshwater?

   saltwater

3. Name the five oceans of the world.

   Arctic, Atlantic, Indian, Pacific, Southern

4. Explain what influences the formation of ocean currents.

   Ocean currents are influenced by the temperature and salinity of water, both of which affect its density. They are also influenced by the gravitational pull of the sun and moon (in the form of tides), Earth's rotation on its axis, and surface wind.

5. What is the Gulf Stream and how does it affect the climate in Northern Europe?

   The Gulf Stream is an ocean current that brings warm water circulating past Northern Europe, giving the region a warmer climate than other regions at the same latitude.

6. List two ways the salinity of ocean water can increase, and two ways the salinity of ocean water can decrease.

   Water can increase in salinity through freezing and evaporation. Salinity can decrease through the melting of glaciers and icebergs and through precipitation.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Identify and map Earth's five oceans				
Draw the route of the Gulf Stream current				
Trace a local water source to its drainage				
Identify factors influencing ocean currents				
Label ocean topography				
Explain factors affecting the salinity of water				

Grade 7

31

Human Population Growth

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Write a five-paragraph essay on the environmental impact of population growth.
- ☐ Choose an activity related to population growth.
- ☐ Optional activity: Story of Population Growth
- ☐ Complete lesson 31 test.

Learning Objectives

At the end of this lesson you will be able to:

- Describe human population growth over time.
- Recognize how population growth is related to the availability or scarcity of natural resources.
- Explain the importance of environmental sustainability.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Human Population Growth
- Population as an Environmental Issue

See the online resource links for an interactive map and video about human population growth over time.

Assignments

1. No one really knows the number of people Earth can sustain. Write a five-paragraph essay explaining why population growth is of concern to environmentalists. What is the environmental impact of exponential human population growth? Could Earth support more people if we used our resources differently?

   This is a major paper and students are expected to show their best work. In addition to accurate research and citations, students are asked to use their own words to illuminate the topic. This is a very complex topic and students will benefit from discussing what they've learned before they organize their thoughts and write their paper.

2. Choose one of the following:

   a. Make an original drawing, painting, poster, or sculpture of a timeline of human history, noting the population size and significant events of the times.

   b. Demonstrate exponential population growth in graphic form (such as a cartoon, illustration, or graph).

   c. Go outdoors, and find three examples of human-caused changes to the environment. Explain the benefits of each change. Explain any harmful effects of each change.

   d. Interview an elder who has lived in your area for at least three decades. Ask some questions which will give you an idea of how the town changed and developed over the years. Record this interview. Write down your reaction to what you learned from this conversation.

   e. Draw your family tree as completely as possible. Has the population maintained itself within your family (meaning each person brings an average of one child into the world), or has it increased or decreased?

Activity

This optional activity explores population growth in a creative way.

Activity: Story of Population Growth

See the coursebook for a full description of this optional activity.

Test

1. List several advances that allowed human beings to become so successful in terms of reproducing.

   Answers will vary. Students might mention advances in medicine, the cultivation of food and breeding of animals, tools and technology that allowed them to more easily utilize natural resources, and the ability to travel and trade over great distances. All of these helped human societies become healthier and wealthier, and better able to reproduce and support a larger population.

2. What are some of the ways human population growth impacts the environment?

   More people means more demand on natural resources. This can lead to depletion of resources, or environmental damage due to more efficient ways of harvesting large amounts of natural resources. Student may have other answers, and should be able to answer this question with specifics because of the five-paragraph essay written on the topic.

3. Explain the concept of exponential growth.

   Exponential growth means that a population increases at an ever-expanding rate. Students may use an example to help them explain the concept.

4. How does the availability or scarcity of natural resources relate to human population growth?

   As population increases, so does the demand on natural resources, which impacts how much or how little is available at any given time. Students should be able to draw a direct correlation.

5. What is environmental sustainability?

   Environmental sustainability refers to a balance in maintaining natural resources so that resources are not depleted faster than they can regenerate.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Identify the environmental impact of human population growth				
Explain how exponential population growth works				
List human advancements that influenced population growth				
Show connections between population growth and availability/scarcity of natural resources				
Define environmental sustainability				

Grade 7

32 Human Impact on the Environment

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Identify ways to reduce your carbon footprint.
- ☐ Draw a diagram showing how pollution contributes to the greenhouse effect.
- ☐ Compare conventional and organic farming methods.
- ☐ Choose an activity related to pollution.
- ☐ Lab Investigation: Acid Rain
- ☐ Complete lesson 32 test.

Learning Objectives

At the end of this lesson you will be able to:

- Explain the main causes of water, soil, and air pollution.
- Explain how global climate change and pollution are related.
- List ways to reduce an individual's carbon footprint.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Water and Soil Pollution
- Air Pollution
- Ozone Depletion
- Reducing Our Carbon Footprint

Assignments

1. List five things you can do to help reduce your carbon footprint. Try to come up with new ideas that are not already on the list in the reading section.

   There is a long list of ideas in the reading section, and students are asked to try to come up with new ideas. This list can be used to discuss the lesson material and to make small changes in lifestyle to benefit the environment.

2. Draw a diagram explaining the role of pollution in the greenhouse effect. Include the layers of the atmosphere. Draw the sun and use arrows to show what happens to the radiant energy that reaches the atmosphere and Earth.

   The diagram should indicate that the sun's UV rays strike the stratosphere (or ozone layer, which is in the stratosphere), where most are deflected back into space. Some of the rays bounce around in the atmospheric layers, while others reach the surface of the planet. Arrows should show that pollution is released from the surface into the atmosphere where particles accumulate, blanketing Earth and holding in additional heat.

3. Learn about how conventional farming methods can damage the soil and explore ways in which organic farming benefits the soil. Visit an organic farm or talk to an organic farmer, if possible, to find out about organic farming methods. Create a brief report or photo essay comparing how conventional and organic farming impacts the soil.

   This assignment will require additional research. Look for students to cite specific details of how conventional farming can damage or deplete the soil and how organic farming can benefit or replenish the soil.

4. Choose one of the following projects:

   a. Conduct a survey of ten people to find out what they know about ozone depletion and its effect on humans. Some questions you may want to ask are: What do you know about the ozone layer? What do you know about the depletion of the ozone? Do you wear sunscreen when you spend time outside on a sunny day? Why or why not? Write a summary of your findings.

   b. Visit a nearby town or city and look for evidence of pollution. Try to discover the causes of the pollution you see. Take notes of your observations or photographs, and write a summary of your findings.

   c. Design a brochure, poster, or presentation that looks at the causes of pollution in the water, soil, and air, and ways to reduce pollution.

Lab Investigation

Complete the following lab investigation (found in *Lab Investigations: Earth Science*):

- **Lab Investigation: Acid Rain**

Use specific language and scientific terminology when writing your conclusions.

Lab Investigation: Acid Rain

In this lab, you will observe the influence of acid rain on plant growth. This project will take approximately ten days, depending on the growing conditions.

Conclusions

1. Was there a difference in how quickly the seeds in the two pots germinated? Did the "acid rain" seem to affect seed germination?

   Answers will vary but hopefully students will notice that the plants watered with juice had a harder time growing. Don't worry if the experiment does not go as expected—that's part of science, too!

2. Did you notice a difference in how the plants in the two samples developed? How would you compare their growth?

   Look for students to use accurate language and clear descriptions when comparing plant growth.

3. What can you conclude from doing this experiment? Can you identify a cause-and-effect relationship? What does this suggest about the environmental consequences of acid rain? Cite your results as evidence when writing your conclusions.

   The results of the experiment should be cited in the conclusions, with students making connections between the experiment and problems with acid rain in nature.

Test

1. Describe the health concerns of pollution for humans, animals, and ecosystems.

   Answers will vary, and may include respiratory problems, sunburn and skin cancer, illness from eating contaminated plants or animals, problems with reproduction, and habitat destruction.

2. Explain the relationship between pollution and global climate change.

   Pollution often finds its way into the air via the water cycle, where pollutants can get trapped in the atmosphere. This contributes to the greenhouse effect, warming the planet and influencing global climate change.

3. How is smog different from fog? How are they alike?

   Fog is a natural phenomenon where water vapor condenses into water droplets near the ground. Smog is air pollution that is trapped near Earth's surface, often causing health problems for humans and other living things. Both smog and fog are found low to the ground, but one is naturally occurring and harmless, while the other is caused by pollution and harmful.

4. What is acid rain? What effect does it have on the environment?

   Acid rain is rain that has elevated acid levels due to contaminants in the atmosphere. Water vapor condenses around these contaminants and falls to the ground where soil, plants, and animals are affected. Some organisms may die or lose the ability to reproduce. Some plants lose the ability to absorb nutrients from the soil and can become diseased or die. Water systems can be damaged as well, affecting the health of plants, animals, and humans.

5. Describe the cause of ozone depletion in the atmosphere.

   The main factors in the depletion of the ozone layer are chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), which are commonly used as coolants in refrigerators and air conditioners, as cleaning solvents, in spray cans, and in other products. These greenhouse gases get trapped in the atmosphere and cause the naturally-occurring ozone to deteriorate.

6. What is a carbon footprint? Why should we try to reduce our carbon footprint?

   A carbon footprint is the amount of greenhouse gases released in the atmosphere as a direct or indirect result of your actions. Greenhouse gases are accumulating in the atmosphere at an alarming rate and raising the global temperature, which has serious environmental consequences. By reducing our carbon footprint, we can help reduce the amount of greenhouse emissions to try to reverse the damage to the planet.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Identify the relationship between pollution and global climate change				
Identify common sources of water, soil, and air pollution				
Compare conventional and organic farming methods				
List ways to reduce carbon footprint				
Explain cause and effects of acid rain				
Explain cause and effects of ozone depletion				

Grade 7

The Living Earth

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Research a threatened or endangered species.
- ☐ Choose an activity related to the health of the planet.
- ☐ Lab Investigation: Biodiversity
- ☐ Optional Activity: Ecosystem Model
- ☐ Complete lesson 33 test.

Learning Objectives

At the end of this lesson you will be able to:

- Explain why biodiversity is important to the health of life on Earth.
- Describe the environmental issue of habitat destruction.
- Identify how the extinction of a species can affect an entire ecosystem.

Reading

Read the following sections (found in Reading Selections at the end of this lesson).

- Biodiversity
- Habitat Loss
- Earth as a Living Organism

Assignments

1. Research a threatened or endangered species that interests you. Determine where they live, their food sources, their predators, who shares their habitat, and why they are endangered. What conservation efforts have been put in place to try to prevent the extinction of these species? What impact does this plant, animal, or insect have on its ecosystem? What impact might the extinction of this living organism have on its ecosystem? Make a book, video, photo essay, or presentation to share what you've learned.

   This project may bring up strong feelings in students as they realize how vulnerable some species are to human encroachment. Go over your student's work and encourage them to share their knowledge and appreciation of the chosen species.

2. Choose one of the following assignments:

   a. Writers use metaphors to explain things more easily. A metaphor is a figure of speech that compares two different things without using a word of comparison such as like or as. For instance, "Stars are candles in space," is a metaphor. Formulate a metaphor for seeing Earth as a whole system rather than the individual parts presented in this course. You may choose to write a poem or song using your metaphor.

   b. Imagine you have come to Earth from another world and you are seeing it for the first time. Write a journal entry about what you have seen. What are the things you like and dislike about what you see?

   c. Write an essay or poem on the following topic: It has become increasingly crucial that the environmental impact of human activities be considered when deciding what actions are important or appropriate.

   d. Write a description that shows what you think life will be like for your grandchildren in about fifty years.

   e. Write to a local, state, or federal representative about any issues that have raised questions or concerns in your mind. Share ideas, beliefs, or opinions concerning this issue that you would like your representative to pay attention to and suggest possible actions to take.

Lab Investigation

Complete the following lab investigation (found in *Lab Investigations: Earth Science*):

- **Lab Investigation: Biodiversity**

Use specific language and scientific terminology when writing your conclusions.

Lab Investigation: Biodiversity

Observing biodiversity in a local environment is the goal of this lab. If you live in an urban area, this observation can be done in a public park.

Conclusions

1. How big was the area you observed?

   Answers will vary.

2. Was the observation area in a rural, suburban, or urban area? Give a brief description of the observation area.

   Answers will vary.

3. Is your observation area typical of the area around it, or is the area around it very different?

   This is important to note since different ecosystems can be side by side. For instance, if observations are taken in an area adjacent to a swamp, river, or ocean, the biodiversity will be very different in the observed area than the adjacent area. Likewise, if observations are taken in a small city park, the adjacent areas may show very little or very different biodiversity.

4. Tally the number of species you observed.

   Answers will vary.

   Plants _____

   Insects _____

   Other animals _____

5. List the species you were able to identify by name:

   Hopefully students will have been able to identify several different types of plants, insects, and other animals. If students only list animals, remind them to include any identifiable plants in their species list.

6. Was there one or more species of plant or animal that you were unfamiliar with but would like to learn more about? Describe it here, reporting observations that are both quantitative (measurements) and qualitative (traits). Include the exact or estimated quantity.

   Look for a clear, objective description of the unfamiliar species, including measurements and approximate quantity. If possible, help your student identify the unfamiliar species and learn more about it.

7. Write a summary of your observations.

   The observation summary should include specific details and be written using clear, concise language.

8. Based on your observations, can you conclude that the area surrounding your observation area is rich in biodiversity or is the biodiversity limited? Explain your answer.

   This conclusion is based on how like or unlike the observation area and adjacent area are. Students should note whether or not is is likely that the biodiversity observed is similar to the surrounding area. Conclusions about the richness of limitations of biodiversity should be supported by results of the observations.

Activities

The following activity is optional.

Activity: Ecosystem Model

See the coursebook for a full description of this optional activity.

Test

1. Define species biodiversity, genetic biodiversity, and ecosystem biodiversity.

   Species diversity refers to the number and type of living organisms. Genetic diversity refers to the variation of traits within a species. Ecosystem diversity refers to the variation and interdependence of species within an ecosystem.

2. Explain why biodiversity is important to the health of life on Earth.

   Biodiversity is essential for maintaining a healthy population that can adapt to changes in the environment.

3. What are some of the major causes of habitat destruction?

   Habitat loss is often due to agriculture, roads, cities, livestock farms, and clear-cutting of forests.

4. How does habitat loss relate to the health and population of species?

   As habitat is lost, species that are unable to adapt will become sick or die. The death of one species often affects the health of other species.

5. How come Earth is often viewed as a single living organism?

   Earth's systems are interconnected in complex ways, very much like a living organism. If one system is damaged, other systems will be affected.

Learning Checklist

Use this learning checklist to keep track of how your skills are progressing. Include notes about what you need to work on.

SKILLS	Developing	Consistent	Competent	Notes
Differentiate between species, genetic, and ecosystem biodiversity				
Recognize importance of biodiversity for overall health of the planet				
Identify major causes of habitat destruction				
Relate habitat destruction to species loss				
Explain the perspective of Earth as a single living organism				

Grade 7

Scientific Inquiry: Scientific Argumentation

ASSIGNMENT SUMMARY

- ☐ Choose a scientific claim to support with scientific evidence and reasoning.
- ☐ Construct a scientific argument.
- ☐ Share and defend your scientific argument.
- ☐ Reflect on project design and learning experience.

Lesson Objectives

- Compile scientific data to support a claim.
- Construct a well-reasoned argument supported by evidence.
- Defend the scientific argument.
- Reflect on project design and learning experience.

Assignments

Studying phenomena and collecting data is an important element of scientific study. Drawing conclusions and making claims based on data, and then supporting those claims with evidence is another important part of science. In this final scientific inquiry for this course, you will construct an argument to defend a scientific claim, and then answer questions and arguments against your claim.

See the lab manual for full instructions.

- **Scientific Inquiry: Scientific Argumentation**

Complete the project reflection afterward.

Scientific argumentation is a complex skill that will be developed over time. The goal of this assignment is for students to understand the elements involved in supporting a claim with scientific reasoning and evidence, and to practice this new skill. When students present their argument and invite comment, point out ways in which the logic or evidence could have been more clear or revealing. Ask questions to help students clarify their reasoning and show connections between their claim and the evidence supporting it.

Grade 7

36 Final Essay and Reflection

ASSIGNMENT SUMMARY

☐ Write a course reflection.

☐ Complete an assignment of choice.

Assignments

1. Take some time to review and reflect on all that you have accomplished in this course. Write a brief essay that contains the following information:
   - Activities you enjoyed the most (what did you enjoy about them?)
   - Information you found to be the most intriguing or surprising (why did you find it interesting?)
   - Concepts or issues which were not included in this course that you would have liked to see addressed (explain why you believe they are important)
   - Lessons or activities you disliked about this course (why did you dislike them?)

   In your concluding paragraph of your essay, give yourself a final grade for the course. Write an evaluation of yourself as a student, and list recommendations that might help you in future studies and in life.

   Use the student's reflection to discuss both accomplishments and skills to develop further in the future.

2. Choose one of the following assignments:

   a. Write a letter to thank Earth for all the things you appreciate about this complex living system of which you are a part.

   b. Create a mural, collage, or mobile that illustrates the Spaceship Earth concept. The collage should present a vision and a feeling of the current state of the human species and of our effects upon the world.

Congratulations! You have completed Oak Meadow's Earth Science Course.