Grade 7
Earth Science

Oak Meadow
Teacher Manual

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Grade 7

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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

Earth's Moon

ASSIGNMENT SUMMARY

- ☐ Complete the reading selections.
- ☐ Record changes in the moon over one week.
- ☐ Draw a diagram of the moon's phases.
- ☐ Model a solar and lunar eclipse.
- ☐ Explain how the moon influences Earth's tides.
- ☐ Lab Investigation: Moon Moves
- ☐ Optional activities:
  - Activity A: Moon Story
  - Activity B: Moonscape
- ☐ Complete lesson 7 test.

Learning Objectives

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

- Describe the movement of the moon in space.
- Diagram the phases of the moon.
- Model a lunar and solar eclipse.
- Explain the relationship between the gravitational pull of the moon and Earth's tides.

Reading

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

- Earth's Moon
- Moon's Rotations and Revolutions
- Solar and Lunar Eclipses
- How the Moon Influences Tides

Remember to use library books, newspapers, scientific journals, and online research to learn more about any topic that interests you, or to help you better understand topics that you find confusing. Bookmark the curriculum resource links page on oakmeadow.com for easy access to good resources.

Assignments

1. Find out what time the moon rises and sets this week. Try to see the moon every night and make note of its changes. Notice if you can also see it in the daylight hours. Do you see it in the eastern sky (as it is rising) or in the western sky (as it is setting)? When you view the moon at day or night, visualize where the moon, Earth, and sun are in order for you to see the moon in its current phase. (This might be easier after you have done the lab investigation in this lesson). Write a brief description of your moon sightings for one week. Note any changes you noticed in its appearance and when it rises and sets.

   Look for clear descriptions of the moon observations. Students should note that the moon rises and sets later each day.

2. Draw a diagram of the moon's phases, showing the moon's position relative to Earth during its orbit. Make sure to include the location of the sun in your diagram as well. Label each phase of the moon and show the corresponding areas of waxing and waning.

   The diagram should be labeled and easy to understand, and convey the information seen in the diagram in the coursebook.

3. Explain how a lunar eclipse and a solar eclipse occur. Use objects or people to model what is happening during each type of eclipse. You can video your explanation and modeling, or you can write a description.

   A lunar eclipse occurs when Earth is directly in between the moon and the sun. A solar eclipse occurs when the moon is directly in between Earth and the sun. A lunar eclipse happens during the full moon (and is seen at night) and a solar eclipse happens during the new moon (and is seen during the day). The student should demonstrate and explain these phenomena.

4. Make a poster or write a paragraph that explains why we have high tides and low tides and why they happen twice a day. Include information about neap and spring tides.

   The explanation should mention that the moon's gravitational pull on Earth results in the movement of the oceans. As our planet makes one full 24-hour rotation, high tides are experienced by areas that are aligned with the moon, and low tides are experienced by the two "sides" of Earth (the areas at a right angle to the moon). Spring tides occur during every full and new moon, when the moon and sun line up with Earth and we experience the highest high tides and

lowest low tides. Neap tides occur during every first and third quarter moon, when there is the least variation between high and low tides.

Lab Investigation

Complete the following (all labs are found in *Lab Investigations: Earth Science*):

- **Lab Investigation: Moon Moves**

If possible, perform your demonstration in front of an audience (or videotape it) while explaining what is happening. You can answer the questions on video or in writing. Remember to use correct terminology and precise language.

Lab Investigation: Moon Moves

Using modeling, you'll explore the motion of the moon.

Conclusions

1. When simulating the moon revolving around Earth, how long does one complete revolution represent in real time?

   The moon completes on full orbital revolution every 27.3 days. It also completes one full rotation on its axis every 27.3 days.

2. How would the moon look from Earth if the moon did not rotate on its axis? What would we see that is different than what we see now?

   If the moon did not rotate, we would still see all the phases of the moon as it revolved around Earth, but we would also see all sides of the moon rather than just one "face" of the moon.

3. Write a summary of this experience. Did it help you better understand the movement of the moon in relation to Earth and the sun? What areas are still hard to understand?

   Note any areas students are still confused about, and go over the reading, conduct additional research, or do more modeling to help clarify things.

Activities

Choose one of the following optional activities to explore more aspects of the moon.

- Activity A: Moon Story
- Activity B: Moonscape

Test

1. Why does the moon shine?

   Moonlight is a reflection of the sun's light.

2. Why do we only see one side of the moon?

   We only see one "face" of the moon because the moon rotates on its axis at the same speed at which it revolves around Earth.

3. Explain the difference between the far side of the moon and the dark side of the moon. When does the dark side of the moon face Earth?

   The far side of the moon is the side that never faces Earth. The dark side of the moon is the side that is facing away from the sun (nighttime on the moon). The dark side of the moon faces Earth during every new moon.

4. How long is one lunar day (the amount of time it takes for the moon to complete one rotation on its axis)?

   27.3 Earth days

5. How long does it take for the moon to make one revolution around Earth?

   27.3 Earth days

6. Explain the difference between a solar eclipse and a lunar eclipse.

   Both eclipses happen when the moon and sun are in alignment with Earth. A lunar eclipse occurs when Earth is directly in between the moon and the sun, and a solar eclipse occurs when the moon is directly in between Earth and the sun.

7. Why does a lunar eclipse only happen during the full moon and a solar eclipse only happen during a new moon?

   A lunar eclipse only happens during the full moon because the moon has to be directly facing the sun in order for Earth to come between the moon and the sun and have its shadow block out the sunlight. A solar eclipse only happens during the new moon because the moon has to be in between Earth and the sun, which means Earth is directly facing the dark side of the moon (the new moon).

8. How does the moon influence Earth's tides?

   The moon's gravity acts on Earth's oceans by pulling them toward the moon. The areas that are aligned with the moon (both facing the moon and facing away from the moon) experience high tides, while the areas that are sideways to the moon at a 90° angle experience low tides.

9. Why are the tides higher during a full moon and a new moon?

   During the full and new moons, the sun and moon are in alignment, so the sun's gravity is added to the influence of the moon's gravity, resulting in more dramatic variations in the tides.

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
Record changes in the moon's appearance				
Diagram moon's position relative to Earth during its orbit				
Model moon's position relative to Earth during its orbit				
Model the difference between a solar and lunar eclipse				
Explain the moon's influence on Earth's tides				

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				