Seventh Grade Science Overview

	First Semester	Second Semester
Science	Variables and controlled experiments Movement of Earth and moon Astronomy Geology Weathering and erosion Plate tectonics Student-led scientific theory	Global climate change Meteorology Water cycle Atmosphere pressure and wind patterns Earth's resources Human population growth Biodiversity and habitat loss Student-led scientific inquiry

Grade 7
Earth Science
Lab Manual

Oak Meadow

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Introduction

Earth is our home, and the more we learn about it, the better we'll be able to care for it. This lab manual lets you actively explore the basic concepts of Earth Science. These lab investigations are designed around Next Generation Science Standards (NGSS).

The labs included in this book can be used as a supplement to any Earth Science course, and are a required part of Oak Meadow Earth Science for grade 7. Students in other grades can also use, enjoy, and benefit from these science explorations.

A complete Materials List is found in the appendix.

Enjoy your explorations of our great home planet, Earth!

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.

Materials

- plastic milk container
- large pan or bucket
- metric ruler
- marker
- clock or watch
- sewing needle or pushpin

Procedure

1. Fill the plastic container with water. Mark the container at the top of the water line. This is your "fill" line.
2. Position it so one corner hangs over the edge of a counter or table. Place the large pan or bucket beneath the container.
3. Use the sewing needle or pushpin to poke a very small hole near the bottom of the container. Start timing the water flow as soon as you make the hole. Make sure the pan beneath it is in the right spot to catch the water!
4. As the water flows, mark the container showing the water level at regular time intervals. This is called calibration. You are determining the amount of water that flows in a certain amount of time. Depending on the size of the drip and amount of water you are using, your water marks might be made every 15 seconds, every 30 seconds, or every minute.
5. When all the water has run out of the container, note how much time it took for all the water to drain out. Write this down, and mark your container to show how much time each interval measures. For instance, if it took 7 minutes for the water to drain out, and you made a mark for

each minute, the top "fill" line would be marked 0, the first minute mark below is marked "1 minute," the next minute mark is labeled "2 minutes," etc., down to the bottom line, which is labeled "7 minutes."

6. Refill the container (you can reuse the water in the pan or bucket). Hold your finger over the hole at the bottom of the container while you are filling it to keep water from spilling out. Place it on the edge of the counter over the bucket and let go of the hole.
7. Do a household activity, such as make your bed, put away the dishes, or go collect the mail. When you finish, come back and look at the water container. How long did the activity take according to your water clock?
8. Bonus challenge: Create a water alarm clock! Can you set up a system so your water clock will make noise when a certain amount of water has fallen into your pan?

Conclusions

1. Write a summary of the procedure you followed in this investigation and how successful it was.

2. What worked well? What was difficult?

3. What might you do differently next time in order to make a more accurate or useful water clock?

4. Based on your lab investigation, do you think a water clock can be an accurate way to measure time? Why or why not?

Lab Investigation: Comparing Volume and Mass

This investigation explores volume and mass.

Materials

- modeling clay
- metric ruler or tape measure
- measuring cup
- towel

Procedure I: Comparing Volume

1. Construct a small round bowl from the modeling clay.
2. On the data table below, draw a simple picture of your bowl, and measure the height, diameter, and circumference of the *inside* of the bowl. This will be tricky, especially if your bowl is small, but do the best you can and write down accurate measurements next to your drawing. Make sure to note what unit you are using for your measurements (centimeters, inches, etc.).
3. Place the bowl on the towel. Fill the bowl with water up to the very brim (do this while the clay is still wet), and then carefully pour the water into a measuring cup to measure the volume of water the bowl holds. Do your best not to spill water, but don't worry if you spill a little. Write down the volume of water the bowl holds next to your drawing of the bowl.
4. Change the shape of the container. You can make it into a larger or smaller bowl, or into a taller or flatter bowl—change it however you like, but keep it hollow so it can hold water, and don't add or remove any clay.
5. Draw a simple picture of your new container, and include the measurements of the inside of the bowl (not the outside). Write down the measurements next to the drawing of the new bowl.
6. Fill the new container with water up to the brim, and then carefully pour the water into a measuring cup to measure the volume. Write this down next to your second drawing.
7. Create a third container, again without adding or removing any clay, and repeat the process.

Data Table: Volume of Water in Bowls of Different Shapes

	Sketch of bowl shape	Measurements of inside of bowl	Volume of water bowl will hold
Bowl 1			
Bowl 2			
Bowl 3			

Procedure II: Comparing Mass

1. Shape the clay into a solid ball and then divide it into two sections, one larger than the other. (You can weigh them if you'd like to be sure they are different.)
2. Shape both pieces into bowls that will hold 1 cup of water each. This will take some time to get it right. Keep reshaping and measuring the volume each holds until you have them equal.
3. Pour out the water once you have finished shaping the bowls to have equal volume.

Conclusions

1. Look at your drawings of the first three containers you made for Procedure I. Did the volume of water the container held remain the same when you altered its shape? Did the mass of the clay change when you altered its shape? Explain your answer.

2. Look at the two 1-cup bowls you made for Procedure II. The containers both hold 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.

3. Explain what these two procedures demonstrated about mass and volume.

4. Can you think of another way to demonstrate mass or volume? If you were teaching someone about the concepts of mass and volume, how might you modify these procedures to make them more effective?

Lab Investigation: Celery Experiment

This investigation tests how quickly water travels through a plant's stem to its leaves (this is called *capillary action*).

Materials

- 4 stalks of fresh celery with leaves
- knife
- 4 jars
- red or blue food coloring
- measuring cup
- 4 paper towels
- timer
- peeler
- metric ruler
- old newspapers or towels

Guiding Question

How long does it take for colored water to be absorbed through a celery stem into its leaves?

Hypothesis

The longer the celery soaks in the colored water the farther up the stem the color will rise.

Procedure

1. Cut each stalk of celery 10 centimeters below where the stalks and leaves meet. It doesn't matter if the tops (leaves) are different sizes or heights as long as the stems are the same length.
2. Put $\frac{1}{2}$ cup of water in each of the 4 jars. Put 20 drops of red or blue food coloring in each jar. (Or you can use 10 drops of red and 10 drops of blue to create purple water.)

3. Label the 4 paper towels in the following way: "1 hour," "2 hours," "3 hours," and "4 hours." Place the paper towels on top of the old newspapers.
4. Place one stalk of celery in each jar.
5. Set a timer for one hour.
6. After one hour, remove one stalk of celery and place it on the paper towel marked "1 hour."
7. Reset the timer for one hour.
8. Using the stalk you removed from the water, carefully peel the stem with a peeler to see how far up the stalk the colored water has traveled. Measure it with the ruler and write down the results in the data table below. Write down how long it was in the water. Be as precise as possible with your measurements. If the stalk was in the water for an extra 5 minutes after the time rang (or before you set the timer), don't write down 1 hour, write down 65 minutes.
9. Repeat the process, removing one stalk each hour, setting it on the correctly marked paper towel, and peeling it to measure how far the colored water traveled up the stalk. When you observe the leaves beginning to change color, record that as well, noting the time (quantitative observation) and the changes you notice (qualitative observation).

Data Table: Celery Experiment

	How long in water	How far dye traveled up stalk	Observations
Stalk 1			
Stalk 2			
Stalk 3			
Stalk 4			

Conclusions

1. Write a summary of your results. What do you observe? How fast did the colored water get absorbed by the celery?

2. Did the rate of absorption (how quickly the water was absorbed) increase or decrease as time went by?

3. Did you observe anything that surprised you? For instance, did the dye help you see the internal structure of the celery more clearly?

4. Write a conclusion explaining whether or not the experiment answered the guiding question. How might you do it differently if you were to repeat this experiment in the future?

Lab Investigation: Earth's Movement

In this investigation, you will model how the Earth's tilt, spin, and orbit combine to create our daily and yearly cycles.

Materials

- orange
- knitting needle or sharpened pencil
- pushpin or thumbtack
- lamp with the shade removed

Procedure

1. The orange will be used as your Earth model. Identify the North and South Poles of your model, and then push the knitting needle through the orange so that it passes through each of these poles, piercing the center of the orange. This represents the Earth's axis.
2. Place a pushpin (or make a mark) on your Earth model to represent your location.
3. Hold the top of the knitting needle so that it is pointing straight up, and then tilt it a little to one side.
4. Place the lamp on a table. This represents the sun.
5. Hold your model so that the pin representing your location faces the lamp.
6. Slowly turn the knitting needle in your hands so that your Earth model spins toward the east.
7. Move your model to show where the Earth is in relation to the sun at sunrise, noon, sunset, and midnight. Make sure you are spinning your model so the sun appears to rise in the east and set in the west.
8. Now move your model in a large elliptical orbit around the lamp. Be very careful to keep the tilt of the model on its axis constant throughout each revolution around the sun. (You can also spin Earth on its axis to represent its rotation, if you want to make it even more realistic.)

9. Watch how your location (the pin) changes throughout the orbit. Stop as you go around the sun in the location of the two equinoxes and two solstices.

Conclusions

Answer the following questions using scientific terminology and complete sentences.

1. If the two points on the globe's surface where the knitting needle passes through represent the North Pole and the South Pole, what does the entire knitting needle represent?

2. What does the tilting of the knitting needle represent?

3. When spinning your model, what does this spinning movement represent?

4. Why does the sun appear to rise in the east and set in the west?

5. When you spin your model to show day and night, how many hours does one rotation represent?

6. Explain how your model demonstrates the difference between the summer solstice and the winter solstice.

Scientific Inquiry: Modeling Design and Procedure

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).

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).

Project Design

Use the guidelines below to help organize your time. Read the description of all the steps before you begin, and then check off each box as you complete that step.

Review: Look back at your project reflection from lesson 10/11 to see what went well and what you might do differently this time to make the project more successful.

Notes on how to make the process go more smoothly this time:

Choose: Decide which natural phenomenon you'd like to model.

Write a list of several possibilities and then circle your favorite.

Research: Your research for this project is twofold: first you'll want to research the phenomenon so you are fully informed, and then you'll want to research ways others have modeled it.

List of research sources:

Notes on modeling ideas you'd like to try:

Design: You are expected to create a model that is your own design. Even if you find one that someone else has done that you really like, make some changes so that your modeling project is not an exact replicate. Look for ways to improve or adapt the procedure by using different materials, a different amount of time, a different order, or different sizes.

Write a general description of your model design.

Materials needed (be specific about sizes, quantities, etc.):

What do you think might present a challenge? How can you prepare for this challenge so it doesn't become an obstacle? For instance, perhaps your model design includes a working motor and you don't have one. How can you get around this? Can you modify the design to use a simple battery instead of a motor? Think about how to address any possible issues before they arise.

Discuss: Talk about your project ideas with a few people and see if you can make adjustments to your design that will help it be more realistic, effective, or unique.

Notes on feedback from others:

Proposed adjustments to model design:

Other than having your partner construct a model based on your procedure, do you plan to share what you've learned in another way? If so, how?

Project planning steps to follow:

Create: Create your model, carefully recording your procedure each step of the way. Write things down as you do them—otherwise, it's too easy to forget small details or the order of steps. Describe your procedure in your own words (do not copy someone else's procedure exactly even if your model is based on theirs). As you create your model, you will probably have to make adjustments or redo parts of it when things don't go as planned. Make sure to correct the procedure so that it reflects the steps you took to produce the final result. Your goal is to write a clear, step-by-step procedure that anyone can follow to produce the same results. Make sure your materials list includes exact amounts or notes on ranges of amounts to use for the different materials.

Share: When your model is complete, you'll want to test it. The best way to find out if you've written clear instructions is to have someone else follow your procedure. If you have a working model (one that moves or does something), you might want to test it before sharing it to make sure it works. When you are ready to share it, assemble the materials and then read the instructions aloud as you watch the person testing your procedure. Take note of where they get confused or ask questions—this will show you areas that you need to clarify or refine in your procedure. If the model doesn't work, don't worry! Just try to figure out what went wrong. If you can, fix it and try again. Make sure to make corrections to the materials list or procedures if you change anything after the first trial run.

Reflect: Think about the process of creating a model and then having someone build one by following your procedure exactly. Complete the project reflection to help you clarify what worked well and what you'd like to change next time.

Project Reflection

After you have finished your project, complete this self-assessment. Consider each question carefully. Take the time to reflect on the experience before answering.

Thinking back on the process of creating your project, what worked out better than expected?

What didn't work out as planned?

Were you able to find enough helpful, reliable resources? Did you use a variety of resources?

Once you began creating your project, did your plans change? If so, how and why?

Did you have enough time to complete your project to your satisfaction? If not, what do you feel you could have done better or differently if you had more time?

Would you like to try planning and implementing a longer project next time?

What might you do differently if you were to do this project again?

What advice would you give other students who undertake a project like this?

Fill in the blanks for the following statements.

The most interesting aspect about this project was

The most difficult part for me was

I'd like to improve my skills in

I'm happy with the way I

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.

Materials

- clear long-neck glass bottle (such as a soda bottle)
- quart glass jar (small-mouth mason jar)
- food coloring
- rubber band
- paper

Procedure

1. Fill the jar about halfway with water.
2. Add a few drops of food coloring and stir it around. (This helps you see the water level more clearly.)
3. Invert the narrow-neck bottle so it is upside down in the jar. The widest part of the bottle should rest on the mouth of the jar. The neck of the bottle should reach down into the water about 2 inches. If there isn't enough water in the jar, add more.
4. Carefully tilt the jar back and forth a little bit to try to let out as many air bubbles from the bottle as possible.
5. Fold or cut the paper so it is about three inches square. Draw a line across the center of the paper. If you'd like, you can draw or color the half above the line with a sun or a picture of a sunny day, and color the bottom half with clouds or a rainy day.
6. Place the rubber band around the jar at the water level. Tuck the piece of paper under the rubber band so it is flat against the jar with the rubber band crossing its center line. This shows the neutral position. Your barometer is now complete.
7. Place the barometer near a window out of direct sunlight.

8. Check the barometer twice a day for the next four days, marking lines on the paper to show if the water level has moved up or down. Note the date and time beside each new line.
9. Use the data table below to keep track of your observations and take note of the weather conditions that correspond to the changes you see in your barometer readings. The height of the water in the bottle neck will correspond to the atmospheric pressure (the higher the water, the higher the pressure).

Data Table: Barometer Readings

Day	Time	Barometer reading (relative to neutral)	Current weather conditions
Day 1			
Day 1			
Day 2			
Day 2			
Day 3			
Day 3			
Day 4			
Day 4			

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.

Lab Investigation: Expanding Air

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

Materials

- plastic bottle
- balloon
- 2 large bowls
- ice

Procedure

1. Fill one bowl halfway with very hot water.
2. Fill the second bowl halfway with cold water and add ice to it. Stir it around with your fingers to get the water as cold as possible.
3. Blow up the balloon about halfway.
4. Place it over the top of the plastic bottle, stretching the balloon's neck tightly over the neck of the bottle. The balloon should be standing up, still about half filled with air.
5. Place the bottle in the ice water, holding it down. Watch what happens to the balloon.
6. Place the bottle in the hot water, holding it down. Watch what happens to the balloon.

Conclusions

1. What did you observe? Summarize your results.

2. Using scientific terms, explain what happened.

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