R.E.A.L. SCIENCE ODYSSEY

READ • EXPLORE • ABSORB • LEARN

Earth & Environment

LEVEL ONE
GRADES 1-4

TBYB
COPY

WRITTEN BY **BLAIR H. LEE, M.S.**

Pandia Press, Inc

REAL Science Odyssey Earth & Environment Level One Preview

Try it before you buy it!

This file contains a PDF preview of **RSO Earth & Environment (level one)**:

To purchase complete copies of REAL Science Odyssey courses please visit:
The Pandia Store

Pandia Press offers free previews of all our History Odyssey and REAL Science Odyssey courses. To download another preview please visit Pandia Press.

We recommend using the latest Adobe Reader or Adobe Acrobat version to work with documents contained within this PDF Package. By updating to the latest version, you'll enjoy the following benefits:

- Efficient, integrated PDF viewing
- Easy printing
- Quick searches

www.pandiapress.com

Pandia Press

Pandia Press
R.E.A.L. Science Odyssey

Read ☼ Explore ☼ Absorb ☼ Learn

Earth & Environment
Level One

for Grades 1-4

Written by Blair H. Lee, M.S.

Contributions by Terri Williams

The publisher and author have made every attempt to state precautions and ensure that all activities and labs described in this book are safe when conducted as instructed, but we assume no responsibility for any damage to property or person caused or sustained while performing labs and activities in this or in any RSO course. Parents and teachers should supervise all lab activities and take all necessary precautions to keep themselves, their children, and their students safe.

Written by Blair H. Lee, M.S.
Contributions by Terri Williams

ISBN: 978-0-9977963-6-0

www.pandiapress.com

WHAT'S INSIDE THIS BOOK?

About the Author

Blair H. Lee, M.S., is the founder of Secular Eclectic Academic (SEA) Homeschoolers, a supportive community that advocates for the exclusive use of secular academic materials. Blair is the primary author of Pandia Press's critically acclaimed REAL Science Odyssey (RSO) series, and she is the author of *The Science of Climate Change: A Hands-On Course*. She earned her Bachelor's degree in Biology and Chemistry and Master's degree in Chemistry at the University of California San Diego.

Blair is a passionate advocate of innovative academics using secular materials. Through her speaking and writing, her goal is to empower parents and teachers to dare to be innovative and create something unique and academically rich when handcrafting their student's journey through learning. When teaching at her local community college, Blair found that many of her students were lacking in basic foundational science upon entering college. She believes science can be and should be taught from the beginning of a child's education. She began working with her own son and his friends on methods of teaching science concepts usually reserved for high school or college students. The results of her research and writing are RSO Chemistry, Biology, Astronomy, and Earth & Environment 1—concept-rich, hands-on courses that engage young people's minds and lay a firm foundation of science concepts.

Blair now spends her time writing science for young people. She lives in California with her husband, son, many dogs, and several guinea pigs. When not homeschooling her son and writing textbooks, she loves to ski, cook (most chemists are good cooks), read, and hike. You can contact Blair directly with questions about RSO and SEA Homeschoolers at blair@seahomeschoolers.com.

Science by Blair H. Lee, M.S.

The Science of Climate Change: A Hands-On Course

From Pandia Press:

The Stargazer's Notebook: A Yearlong Study of Night Sky

REAL Science Odyssey Chemistry level 1

REAL Science Odyssey Biology level 2

REAL Science Odyssey Astronomy level 1

REAL Science Odyssey Astronomy level 2

REAL Science Odyssey Earth & Environment level 1

REAL Science Odyssey Earth & Environment level 2 (coming 2019)

A Note from the Author

You may be wondering why Pandia Press is publishing another Earth science course for 1st through 4th grade. *REAL Science Odyssey Earth & Space–Level 1* was originally published in 2005. There have been huge advances in our understanding of Earth science since 2005. This edition incorporates three new thematic elements woven throughout the course.

Scientific modeling is the use of simplified representations to get a better understanding of a real system. Scientific models are an important tool scientists have long used, and many courses include them. This is generally done without explaining the modeling process. This course explains and focuses on modeling. In the labs and activities, students will practice the skill of developing and using simplified models to help understand more complex systems. This approach leads to a more complete understanding of how scientists conduct science and of how science works.

Earth has changed and evolved during its 4.56 billion year history. It is not a static planet. This concept is important for students to understand. By studying how Earth has changed, Earth scientists can understand how Earth is changing now and how it will evolve in the future.

In recent years, **environmental science** has come to be considered an essential topic for inclusion in an Earth science course. Humans are one of the forces changing Earth and the environment. Our planet is facing some serious environmental issues at this time. The first step to solving them is understanding what they are and what causes them. This course includes lessons, labs, and activities centered on these environmental issues and describes some simple things that can be done to help.

I hope you enjoy the course,

Blair Lee
March, 2018

Introduction to Earth & Environment Level 1

Used one to three times a week, this book is a complete, rigorous, and vocabulary-rich Earth science curriculum that needs no supplementation. It is not a collection of random labs with no flow from one to the other, nor is it an overwhelmingly long listing of trivial facts to be memorized and forgotten. This course was designed so that even the parent/teacher with little background in science could pick it up and teach science successfully with no need for further organizing or research. This course is the story of the earth.

This book is a minds-on and hands-on program. If you hate to touch dirt and have no intention of getting gooey and dirty, RUN NOW! Science is about experimentation, and experimentation can be messy. This course has no fear. Are you still here? If so, roll up those sleeves and get ready to delve into the mystery of every rock you encounter.

This book was intended to be used from start to finish, much like a math book; as such, vocabulary and concepts build upon one another. You may encounter words and concepts that you feel the need to review and practice. Feel free to do that if you wish, but understand that vocabulary words are repeated throughout the course, so your students will hear the same words

many times. This approach is intended to help them learn without having to drill. Having said that, review can be good. Anytime you can use a concept to refer to something you see in real life, your student will benefit greatly. Moving rocks in the yard? How about showing your child the different minerals that make up the rock? No need to know what they are, just point out that they are there. Taking a walk in the country? Point out where you see erosion happening from rain or travelers. Use real words for what you see. Science is only a foreign language if it isn't used in real life.

For every notebook page in this book, children will do several lab activities that build upon and reinforce what they have heard. Labs also teach new material, so it is important to try to do all of the labs included. In addition, we have included journaling ideas plus book and website suggestions for a complete indoor and outdoor experience and further opportunity to dig into whatever your student finds most fascinating. You will notice that some of the labs are infused with age-appropriate math. Science is inherently mathematical with measuring, graphing, and calculating. If your student struggles with the math or with writing the results, don't let the lab papers overwhelm the lesson. The idea is to enjoy science. Much of the learning comes from doing and discussing. Read the questions to the pre-writing child and have him or her dictate the answers back to you, or if you both find the questions tedious, skip them altogether.

Getting Started

1. Have fun. That's number one.
2. If you are a computer person, pull out the website list and leave it by your computer so you can look things up as your child shows interest.
3. If you are a book person, pull out the book list and go over it a few weeks before you do any given section. Leave it in your library book bag or by your computer so you can check on the availability of the books you might want to check out.
4. If you are a nervous "Did I teach my student enough stuff" type of person, go over the "What's the Big Idea?" pages in this book. It will tell you what sorts of things your student should know by the end of the course. Use it with a grain of salt. Remember, the keys here are exposure and fun.
5. Look ahead to what material you will need for the upcoming week, or year if you're an über-planner! It could be an inflatable globe, a piece of cardboard, or some soil. All required materials are listed in the Lab Supply List for easy reference. Be prepared. A few items may need to be ordered.
6. Read the "For My Notebook" section to yourself once so you know how to pronounce the new words in it. Pronunciation of some potentially unfamiliar words are included right there so you can read them as you go.
7. Curl up under that weeping willow or in front of the fire and read the "For My Notebook" page to your students, even if they can read by themselves. Pause to do whatever it tells you to—look at a globe, find a rock, and so forth. The notebook pages are written to your child and could be removed from the course and saved in his or her own notebook. They are purposely short so they will spark curiosity without overwhelming with new vocabulary.
8. Follow the lab activities with a day of nature journaling, reading from the extra reading list, or drawing. Drawing is an important skill for many scientists in the field or lab.
9. Did we mention you should have fun?

The Unique Pages in this book

For My Notebook Pages

1. All the student pages have a boxed outline around the material presented. That way it is easy to identify what is for the student and what is for the parent or teacher.
2. The For My Notebook (FMN) pages are the lesson pages that present the majority of new material to the student. They are intended to be read aloud. Students who are good readers may want to read the FMN pages aloud themselves to the parent or class. However orchestrated, these pages are intended to be read aloud and not silently, to encourage discussion and questions.
3. New science words are underlined. You will notice that many of the vocabulary words are not presented with a classic dictionary definition. Instead, the explanation is given in context, so it is "felt" rather than memorized. Formal definitions for the vocabulary words are offered in the Glossary at the back of the book.
4. If you wish, FMN pages can be removed along the perforated binding, three-hole punched, and then placed in a three-ring binder along with completed lab sheets to create an Earth & Environment Notebook.

Lab Sheets

1. The lab sheets are those pages that the student writes on. They also have a boxed outline because they are intended for the student, not the parent/teacher, to complete.
2. The lab sheets not only reinforce the material presented in the FMN pages, but they serve as the vehicle through which this course reinforces and formalizes scientific method. On the lab sheets, students will be making hypotheses based on questions formed during the lesson. Students record observations and lab results, and they make conclusions based on those results. They will also practice sketching details of their lab experiences, an important process that reinforces observation skills.
3. If you are working with a student who isn't writing yet, have him or her dictate the information to be written on the lab sheets. If your student is unable to draw (meaning physically incapable; I'm not referring to artistic abilities), then have him or her describe observations in detail for you to create them on the lab sheet.
4. If you wish, lab sheets can be removed along the perforated binding, three-hole punched, and then placed in a three-ring binder along with completed FMN pages.

The Instructor Pages

1. The instructor pages contain the supply lists for the labs or activities and procedure instructions.
2. These pages are written for the parent/teacher, but the procedure is often written as if for the student. For example, "Complete the hypothesis portion of the lab sheet," is an instruction for the student, not the teacher.
3. Most instruction pages include a prompt to read aloud to students. A great deal of course instruction and new science vocabulary are found in these prompts. If you dislike prompts, then be sure to present the information in your own words.

What's The Big Idea?

Whenever you study a subject, there are main ideas and details to learn. It's true that there is a lot of new material to discover in science. This outline gives you the big ideas that your child should get from each unit, and the small stuff that is an added bonus. If you and your student are timid scientists, just have fun as you try to learn the big ideas. If you and your student have a strong science background, work on learning the small stuff as well as the big ideas. There are many challenging words in this course that are used because they are the right words. After they are heard over and over, they will "sink in." Your student does not need to memorize them first time around. Use difficult words and science concepts gently, not with force, and your student will enjoy the science experience.

BI = BIG IDEA **SS = SMALL STUFF**

UNIT 1: INTRODUCTION TO EARTH SCIENCE

WHAT IS EARTH SCIENCE?

BI = The parts that make Earth can be divided into four spheres: the geosphere, hydrosphere, atmosphere, and biosphere. These four spheres interact with each other.

Environmental science is the science in which you learn about the relationship between living things and the environment they live in.

Scientific models are an important tool in which a simplified representation is used to explain the parts of a complicated system.

SS = The three types of scientific models are visual models, computer models, and mathematical models.

GEOLOGIC TIME:

BI = Earth is 4.56 billion years old.

Earth has changed many times during the past 4.56 billion years.

Earth's surface is always changing.

SS = The name of the timeline used to measure the earth and its changes is called the geologic timescale.

Scientists divide Earth's history into long segments of time called eras.

The geologic timescale is divided by events, not by regular intervals.

The atmosphere, hydrosphere, and biosphere formed after the geosphere.

Life evolved early in Earth's history.

UNIT 2: PLATE TECTONICS

BI = The earth's crust is composed of huge rock slabs, called tectonic plates. These plates move constantly. The theory explaining these ideas is called the theory of plate tectonics.

A scientific theory is an explanation developed by scientists that explains something in the natural world.

Convection is the driving force for plate tectonics.

SS = At this time there are 17 major plates.

The seven continents of today are constantly moving. They have grouped to form one continent several times since they formed.

At their boundaries, plates can move toward each other, away from each other, or slide along each other.

Earthquakes and volcanic eruptions occur because of plate tectonics.

UNIT 3: GEOLOGY

EARTH'S INTERIOR:

BI = The earth is in layers. Some layers are solid and some are not.

The deeper you go toward the center of the earth, the hotter it gets.

SS = The layers of the earth are the crust, mantle, outer core, and inner core.

The crust is thin and solid. The mantle is semisolid. The outer core is liquid, and the inner core is solid.

MINERALS:

BI = Minerals combine to make rocks.

Minerals have properties that can be tested

Minerals form crystals.

We use minerals in almost every part of our daily lives including for our food, clothing, and housing.

SS = Minerals can be identified by their color, streak, luster, hardness, crystal shape, and cleavage.

Minerals are naturally occurring inorganic solids with a definite crystal structure.

Zircon, the oldest mineral found on the earth, is 4.4 billion years old.

ROCKS AND THE ROCK CYCLE:

BI = Rocks are constantly being recycled and reformed into new rocks. This is called the rock cycle.

You can tell rocks apart by their color and texture and by the color, shape, and texture of the minerals that make them up.

SS = The three major rock types are igneous, sedimentary, and metamorphic.

Igneous rocks are melted and cooled.

Sedimentary rocks are pieces of broken rock that have been cemented back into new rock.

Metamorphic rock is rock that has been heated and pressed enough to form a new type of rock.

SOIL:

BI = Soil is made of tiny bits of broken rock, plant and animal material, air, and water.

Without the proper soil, plants cannot grow.

Earthworms are good for the soil.

Without erosion there would be no soil.

SS = There are different types of soil based on the different ingredients and their amounts.

UNIT 4: THE ATMOSPHERE AND HYDROSPHERE

BI = Atmosphere is the layer of air around a planet.

Even though air is invisible, you can test to see if it is there.

There are eight common types of clouds, defined by their location in the atmosphere and their shape.

Sometimes there are molecules in the air that can harm living beings. When that happens, the air is polluted.

SS = Our atmosphere is in layers. Weather occurs in the bottom layer.

Air has volume (it takes up space).

Air has mass (weight).

Some planets have no air.

Without air, there is no weather—no wind, clouds, or precipitation

Air is made mostly of molecules of nitrogen, oxygen, and water.

Clouds float, because water molecules have less mass (weigh less) than the most common molecules that make air.

Only nimbostratus and cumulonimbus are rain clouds.

When things burn, molecules go into the air. Some of these are pollutants, but some are not.

BI = Water occurs on Earth in solid, liquid, and gas forms.

Water is cleaned and recycled in nature. This is called the water cycle.

The water cycle is powered by the sun.

Water in the air is called water vapor.

An area becomes polluted when something that is harmful for living things gets into that area.

SS = The water on Earth is in three main forms: fresh water, seawater, and polar ice caps.

Although Earth is largely covered with water, most of that water is not suitable for drinking.

The water cycle consists of evaporation, condensation, precipitation, and accumulation.

When humans pollute the environment, they put plans together to clean up the pollution.

Sources of pollution can come from nature as well as from people.

UNIT 5: WEATHER AND CLIMATE

<u>WEATHER</u>

BI = Weather can be measured, compared, and graphed.

Some measurable weather features are temperature, precipitation, wind speed, and wind direction.

Seasons are caused by the angle of Earth relative to the sun.

Uneven heating of the earth causes convection of air and water vapor to make wind and precipitation.

Under the right conditions, the convection of air and water vapor can cause thunderstorms and tornadoes.

SS = Water falling from the sky is called precipitation. Water in the air is water vapor.

Thunderstorms have thunder, lightning, and sometimes tornadoes.

Tornadoes are caused by the rapid convection of air in thunderstorms.

CLIMATE

BI = The temperature on Earth is a balance between how much of the sun's energy is trapped by Earth's atmosphere, hydrosphere, and geosphere and how much escapes back into space.

Greenhouse gas molecules trap the sun's energy, warming Earth.

Humans are responsible for an increased concentration of greenhouse gases in the air.

The increase in greenhouse gases is causing global warming.

Global warming is causing climate change.

There are some simple things people can do to shrink the amount of greenhouse gases they release into the air.

Weather is a short-term measurement.

Climate is a long-term measurement, an average, over 30 or more years.

SS = Warmer temperatures are melting ice sheets, which is causing sea levels to rise.

Carbon dioxide is a greenhouse gas.

Greenhouse gases trap the sun's energy and transfer it to the air in the form of heat.

Your carbon footprint is the amount of carbon dioxide and other greenhouse gases released into the air because of your energy consumption.

The last time the air had as much carbon dioxide in the air as there is today was 3 million years ago.

UNIT 6: EROSION

BI = Water, ice, wind, plants, and animals can cause weathering and erosion.

Weathering is the breaking up of rock into small pieces.

The farther a rock is carried by water, the smaller it gets.

People change the earth's surface too. This often increases erosion at these locations.

SS = What is commonly called erosion is actually weathering, erosion, and deposition.

Weathering breaks rocks apart. Erosion carries the rock parts to a new place.

Deposition occurs when rock parts accumulate in a new place.

After rock pieces are deposited together, they can become new rock.

Weathering and erosion happen over geologic time. As a result, the older something is, like a mountain, the more weathered it is.

Paved surfaces increase the temperature and water runoff at that location.

Lab Supply List

Items are listed in alphabetical order. The amounts listed are totals for the entire course. Most items are common household items. * Means the item requires some explanation. Ordering hints and explanations are given on page 15.

EQUIPMENT / MATERIAL	AMOUNT/SIZE
Adding machine tape	200 cm (6.56')
Aluminum foil	1 roll
Baking pan	1
Baking soda	2 tablespoons
*Balance or gram scale	1
Balloons	8 (6 of them the same size)
Bird feather (real or synthetic) or piece of furry material cut from an old stuffed animal	1
Block of wood	size of a book
Bowl, clear glass	1
Bucket	1
Butter	2 tablespoons
Calculator	1
Cardboard	60 cm x 60 cm (2' x 2')
Cardstock or construction paper	11 sheets
Casserole dish, glass	1
Cheddar cheese, yellow, shredded	1 cup
Cheese grater	1
Chocolate chips	1 ½ cups
Chopped leaves, twigs, grass, and weeds	½ cup
Clear glass jar with lid	1
Clipboard	1
Cloudy days	
Cookie sheet	1
Cooking oil	1 bottle
Cotton balls	1 bag
Crayons or colored pencils	
*Dead insects	a small pile

EQUIPMENT / MATERIAL	AMOUNT/SIZE
Dish soap (Dawn is preferred)	1 bottle
Egg carton	2
Evaporated milk	1 cup
Eye droppers	2
Fine-point marker	1
Flat surfaces (hard floor, table, dirt, light color paved, and dark color paved)	
Floor fan or blow dryer	1
Flour	6-7 cups
Food coloring: blue and red	1 bottle each
Freezer	
Fruit or vegetable	1
Funnel	1
Gallon baggie	1
Glass, clear	3
Glue	1 bottle
Graham crackers	1 box
Grass seeds	1 small package
Hand lens	1
Ice cubes	
*Inflatable globe	1
Jello	1 box
Kitchen knife	1
Lamp (table or desk) with bendable neck	1
Leaf (fresh)	1
Lighter or matches	
Lima bean or corn seeds	6 seeds
Marker	1

EQUIPMENT / MATERIAL	AMOUNT/SIZE
Marshmallows, mini and large	1 bag of each
Masking tape	1 roll
Mason jar or 1-liter bottle	1
Measuring cup	
Measuring spoons	
Metal trash can or sink	1
Metallic items (gold ring, piece of aluminum foil, silver spoon, etc.)	
Meter stick	1
Mozzarella cheese, shredded	1 cup
Newspaper	1
Note pad	1
Orange	1
Outdoor thermometer	1
Outside area with lots of rocks	
Oven	
Oven mitts	
Packing tape, clear	1 roll
Paint brush	1
Paint: red, yellow, blue	20 drops each
Paper	
Paper towels	1 roll
Peanut butter or any type of nut or seed butter	1 cup
Pebbles	7 to 10
Pencil lead	1
Penny	1
Piece of glass or a pocket knife	1
Pillar candles	3 small
Pizza crust	1 large
Pizza pan	1

EQUIPMENT / MATERIAL	AMOUNT/SIZE
Pizza sauce	1 jar
Plaster of Paris	3 cups
Plastic container with lid	1
Plastic drinking cup	1
Plastic jars, large with lids	2
Plastic wrap	1 roll
Plate	1
Plate or small tray	1
Potted plant (optional)	1 small
Potted plants that have not been watered recently	2
Puffed wheat cereal	20 pieces
Pumice (optional)	1 piece
Rock chunks of various kinds 2.5–5.0 cm (1" to 2") in size	several
Rock or small marble	1
Rocks collected	
Rope	1 meter (3')
*RSO rock and mineral kit	1
Ruler, metric	1
Salt, table and coarse kosher	4 cups
Sand	2 cups
Sandpaper	1 piece
Saucepan	1
*Science thermometer	1
Scissors	1
Sink or large bowl	1
Skewer	1
Soil or humus	1 bag
Soil, from a garden	¼ cup
Spatula	1

EQUIPMENT / MATERIAL	AMOUNT/SIZE
Spoon	1
Spray bottle, mister	1
Stacks of books	2 stacks
Steel file	1
Steel nail	1
Sticky notes	
Stir stick	1
Stirring spoon	1
Stove top or other cooking heat source	
*Streak plate or an unglazed kitchen tile	1
String	2-3 meters (9')
Strong magnet	1
Sugar	1 ½ cups
Sunny days	
Tape	1 roll
Timer or watch with a second hand	1
Tomato slice	1

EQUIPMENT / MATERIAL	AMOUNT/SIZE
Tongs	1
Toothpicks	1 box
Tub, small	1
Tweezers	1
Two-liter bottle	1
Vanilla extract	1 teaspoon
Vehicle outside with the engine running	
Vinegar, white	½ cup
Wall or door space	
Water and water access	
Water filter paper (coffee filter)	1
White correction fluid	1 bottle
World map or globe	1
Yarn	3.6 meters (12')

***Ordering Hints and Explanations:**

1. Science thermometer: A good science thermometer goes down on its own, unlike a medical thermometer, which must be shaken down. Some kitchen thermometers will work. You need one to go down to 32° F or 0°C.
2. Inflatable Globe: This globe is used in several labs. It gets tossed around so a regular globe won't work.
3. RSO Rock and Mineral Kit & Streak Plate: If you want to put together your own kit, you will need 1- to 2-inch (2.5–5.0 cm) samples of: talc, magnetite, mica, pyrite, feldspar, quartz crystal, granite, basalt, snowflake obsidian, conglomerate, sandstone, shale, marble, slate, and schist. Plus, you need a streak plate to test mineral streak color. An unglazed kitchen tile (or even a sidewalk) can serve as a streak plate.
4. Dead insects and/or arachnids (flies, ants, bees, beetles, spiders, etc.) are needed for a soil lab. It is a good idea to start collecting these now and store them in a plastic baggie. Good places to find dead arthropods are window sills and porches. Collect any whole specimens you find as well as parts and pieces of specimens.
5. Balance or gram scale: A kitchen scale may be used.

Suggested Weekly Schedule

The following schedule is suggested for those wishing to complete this course in 25 weeks, teaching science twice a week. General supplies needed for each week are listed. Refer to the lesson or supply list for specifics on supplies including quantities. *Refer to ordering hints on page 15.

Week	Day	Lesson / Lab	Supplies Needed for the Week	Dates / Notes
1	Day 1	WHAT IS EARTH SCIENCE Earth Science Lab#1: Earth's Spheres	Crayons or colored pencils, Glass of water, Piece of fruit or vegetable	
	Day 2	Earth Science Lab#2: Modeling Earth's Spheres		
2	Day 1	Earth Science Lab#3: Modeling Earth	2-liter bottle, Moist garden soil or potting soil, Grass seeds, Small potted plant (optional), Water, Mister, Clear packing tape, Calculator	
	Day 2	EARTH IS OLD—REALLY, REALLY OLD! Age of Earth Lab#1: How Big Is a Billion?		
3	Day 1	Earth Science Lab#2: Modeling Earth's Spheres	Construction paper, Scissors, Yarn, Crayons or colored pencils, Tape, Glue, Large hard surface, World map or globe, Cardstock	
	Day 2	CAN YOU FEEL YOURSELF FLOAT? Plate Tectonics Lab #1: Pangaea Puzzle		
4	Day 1	Plate Tectonics Lab #2: Model How Tectonic Plates Move	Peanut butter or any type of nut or seed butter, Spatula, Large flat plate or small tray, Graham crackers, Jello, Boiling water, Baking pan, Spoon, Bowl to make the jello, Large marshmallows, Small marshmallows, Toothpicks, Timer or watch with a second hand, Ruler that measures centimeters	
	Day 2	Plate Tectonics Lab #3: Forces that Shape the Earth–Earthquakes		
5	Day 1	Plate Tectonics Lab #4: Forces that Shape Earth –Volcanoes	Flour, Salt, Water, Casserole dish, Aluminum foil, Mason jar or 1-liter bottle, Sand, Soil, Bowl, Oven and oven mitts, Pebbles, Baking soda, Liquid dish soap, Vinegar, Scissors, Tape or glue, Crayons or colored pencils	
	Day 2	Timeline Lab: Plate Tectonics		
6	Day 1	THE GEOSPHERE: WHAT IS INSIDE EARTH? Earth's Interior Lab: Pizza Crust to Core	Pizza pan, Large pizza crust, Pizza sauce, Shredded mozzarella cheese, Shredded yellow cheddar cheese, Tomato slice, Tablespoon, Crayons, Toothpicks, Sticky notes, RSO rock and mineral kit	
	Day 2	ROCKS ARE MADE OF MINERALS		
7	Day 1	Mineral ID Lab #1: Mineral Color and Streak Mineral Identification	*RSO rock and mineral kit, Coarse kosher salt, Pencil lead, Colored pencils, *Streak plate or an unglazed kitchen tile, Hand lens, Copper penny, Steel nail, Piece of glass or a pocket knife, Steel file, Sandpaper	
	Day 2	Mineral ID Lab #2: Mineral Hardness Mineral Identification		
8	Day 1	Mineral ID Lab #3: Mineral Luster and More Mineral Identification	*RSO rock and mineral kit, Coarse kosher salt, Pencil lead, Metallic items (gold ring, piece of aluminum foil, silver spoon, etc.), Strong magnet, Hand lens, Colored pencils, Tape, Scissors, Glue	
	Day 2	Minerals Lab: Crystal Models Timeline Lab: The Oldest Mineral		
9	Day 1	EARTH RECYCLES ROCK Rock Lab #1: Going on a Rock Hunt	Bucket, Egg carton, Hand lens, Outside area with lots of rocks, Colored pencils	
	Day 2	Rock Lab #2: Make a Rock Cycle Poster		
10	Day 1	Rock Lab #3: Igneous Rock Is from Magma	Baking pan, Foil, Saucepan, Stirring spoon, Stove top, Measuring cup, Measuring spoons, Sugar, Evaporated milk, Butter, Salt, Miniature marshmallows (optional), Chocolate chips, Vanilla, Large plate, Kitchen knife, Hand lens, Crayons, Heat source (bunsen burner, candle, stove), Cheese grater, Block of wood, Oven mitt, Tongs	
	Day 2	Rock Lab #4: Sedimentary and Metamorphic Rock		

11	Day 1	Rock Lab #5: Exploring the Three Types of Rock	*RSO rock and mineral kit, Pumice (optional), Pencil lead, Hand lens, Rocks previously collected, Note pad, Egg carton, Newspaper, White correction fluid, Fine-point marker, Cotton balls, Outside area good for finding rocks	
	Day 2	Rock Lab #6: Start a Rock Collection		
12	Day 1	Rock Lab #7: My Rock–A Closer Look	One rock (your favorite), Colored pencils, *Balance or gram scale, Metric ruler, Hand lens, Colored pencils, Soil from a garden or humus, Hand lens, Tweezers	
	Day 2	SOIL IS GOOD Soil Lab #1: What's the Dirt on Soil?		
13	Day 1	Soil Lab #2: Soil Recipe	Clear tape; Plastic container with lid; Sand; Chopped leaves, twigs, grass, and weeds; *Dead insects and arachnids; Balloon; Water; Clear glasses; Sink or large bowl; Paper	
	Day 2	AIR SURROUNDS THE EARTH Atmosphere Lab #1: Air Takes Up Space		
14	Day 1	Atmosphere Lab #2: Air Has Mass (Weight)	Meter stick, Metric ruler, Balloons of equal size, String, Masking tape, Paper, Matches, Metal trash can or sink, Vehicle outside with the engine running, Scissors, Tape or glue, Crayons or colored pencils	
	Day 2	Atmosphere Lab #3: Detecting Pollution in the Atmosphere Timeline Lab: Atmosphere		
15	Day 1	THE HYDROSPHERE Hydrosphere Lab #1: Earth Is the Water Planet	*Inflatable globe, Crayons or colored pencils, Three people, Meter stick (or metric ruler), Adding machine tape, Colored pencils	
	Day 2	Hydrosphere Lab #2: Water We're Going to Drink?		
16	Day 1	Hydrosphere Lab #3: Cleaning Oil from the Hydrosphere	Small tub, Water, Blue food coloring, Stir stick, Cooking oil, Spoon, Paper towels, Cotton balls, Bird feather (real or synthetic) or piece of furry material cut from an old stuffed animal, Leaf (fresh), Dish soap (Dawn is preferred), Cookie sheet, Drinking glass, Water, Ice cubes, Saucepan, Heat supply (stove, bunsen burner), Stirring spoon	
	Day 2	THE WATER CYCLE Water Cycle Lab #1: Water Can Be Solid, Liquid, or Gas		
17	Day 1	Water Cycle Lab #2: Water Cycle in a Bowl	Glass bowl, Water, Small glass, Food coloring, Salt, Stirring spoon, Plastic wrap, Tape, Small rock or marble, Scissors, Glue, Colored pencils	
	Day 2	Water Cycle Lab #3: Water Cycle Poster		
18	Day 1	The Hydrosphere Floats in the Atmosphere Lab	Colored pencils or crayons, Tape, Scissors, Wall or door space, Cloudy days, Orange, Skewer, Marker, Table lamp	
	Day 2	WEATHER CHANGES Weather Lab #1: The Reasons for the Seasons		
19	Day 1	Weather Lab #2: What Makes Wind and Rain	Glass casserole/brownie dish, Red and blue food coloring, Desk lamp, Ice, Gallon-size baggie, Eye droppers, Pillar candles, Lighter or matches, Colored pencils, Water, Stacks of books, Scissors, Glue	
	Day 2	Weather Lab #3: Stormy Weather		
20	Day 1	Weather Lab #4: My Weather Journal	Clipboard, Scissors, Outdoor thermometer, Watch with second hand, Glue, Colored pencils or crayons	
	Day 2	EARTH IS WARMING UP Climate Lab #1: My Carbon Dioxide Molecule		
21	Day 1	Climate Lab #2: Modeling How CO_2 Warms Things Up	Two or more people; Sunny day or a heat source; Red, yellow, and blue paint; Paint brush	
	Day 2	Climate Lab #3: The Climate is a Grown-up		

22	Day 1	Climate Lab #4: Carbon Dioxide Heats Things Up	*Science thermometer, Clear glass jar with lid, Sunny day, Scissors, Tape or glue, Crayons or colored pencils	
	Day 2	Climate Lab #5: How Am I Going to Shrink my Carbon Footprint? and Timeline Lab		
23	Day 1	THE WEATHER MAKES ROCKS WEATHER Erosion Lab #1: Flowing Water Weathers Rock	Timer or watch, Rough chunks of rock of various kinds, Water filter paper (coffee filter), Funnel, Plastic jars with lids, Hand lens (optional), Small balloon, Water, Plaster of Paris, Bowl, Stirring spoon, Freezer	
	Day 2	Erosion Lab #2: Ice Weathers Rock		
24	Day 1	Erosion Lab #3: Living Things Weather Rock	Lima bean or corn seeds, Plastic drinking cup, Water, Potting soil, Plaster of Paris, Masking tape, Large piece of cardboard, Floor fan or blow dryer, Puffed wheat cereal, Meter stick or yard stick, Flat surface, Rope	
	Day 2	Erosion Lab #4: Wind Causes Erosion		
25	Day 1	Erosion Lab #5: Why the Oldest Mountains Are the Shortest	Volcano from pervious lab, Spray bottle, Water, Measuring cup, *Science thermometer, Timer, Potted plants that have not been watered recently, Bowl, Clear measuring cup, Access to water, Three flat surfaces (dirt, light color paved, and dark color paved), Scissors, Tape or glue, Crayons or colored pencils	
	Day 2	Erosion Lab #6: Changing Surfaces in the Geosphere Timeline Lab: Erosion		

Further Reading and Exploring

RESOURCES FOR GENERAL SCIENCE INFORMATION

The Kingfisher Science Encyclopedia

The Usborne Internet-linked Science Encyclopedia

The Usborne Illustrated Dictionary of Science

UNIT 1: INTRODUCTION TO EARTH SCIENCE

The Earth and Sky (Scholastic: A First Discovery Book)–Jean-Pierre Verdet and Gallimard Jeunesse

Hands-on Earth Science Activities for Grades K-8–Marvin N. Tolman

How the Earth Works (Reader's Digest)–John Farndon

Janice VanCleave's Earth Science for Every Kid–Janice VanCleave

How the World Works: A Hands-on Guide to Our Amazing Planet (Explore the Earth)–Christian Dorian

How We Learned the Earth Is Round–Patricia Lauber

The Librarian Who Measured the Earth–Kathryn Lasky

The Adventures of Earth–Dan Green

If you are interested in a study of different biomes, we highly recommend the *One Small Square* series. Some of the titles include *Seashore*, *Swamp*, *Pond*, *Cave*, *Backyard*, *Arctic Tundra*, *Woods*, *African Savannah*, *Cactus Desert*, *Coral Reef*, and *Tropical Rain Forest*

GEOLOGIC TIME

Earthsteps: A Rock's Journey Through Time–Diane Nelson Spickert

The Pebble in My Pocket: The History of the Earth–Meredith Hooper

Bang! How We Came to Be–Michael Rubino

Diary of a Time Traveler–Nicholas Stevenson

Dinosaurs–Discovery Kids

UNIT 2: PLATE TECTONICS

Hottest, Coldest, Highest, Deepest–Steve Jenkins

Earthquakes (Let's-Read-and-Find-Out series)–Franklyn Branley

Janice VanCleave's Earthquakes–Janice VanCleave

Volcanoes (Let's-Read-and-Find-Out series)–Franklyn Branley

The Magic School Bus Blows Its Top–Joanna Cole

Hill of Fire–Thomas P. Lewis

Janice VanCleave's Volcanoes–Janice VanCleave

How Mountains Are Made (Let's-Read-and-Find-Out series)–Kathleen Weidner Zoehfeld

How the Earth Works: 60 Fun Activities for Exploring Volcanoes, Earthquakes, Fossils, and More–Michelle O'Brien-Palmer

UNIT 3: GEOSPHERE

How to Dig a Hole to the Other Side of the World–Faith McNulty

The Magic School Bus Inside the Earth–Joanna Cole

MINERALS

Janice VanCleave's Rocks and Minerals–Janice VanCleave
Rocks and Minerals (Eyewitness Explorers)–Steve Parker
Rocks and Minerals A Gem of a Book!–Simon Basher and Dan Green

ROCKS AND THE ROCK CYCLE

Learning About Rocks (Dover Little Activity Books)–Sy Barlowe (A tiny sticker book)
Janice VanCleave's Rocks and Minerals–Janice VanCleave
Fossils Tell of Long Ago–Aliki
The Big Rock–Bruce Hiscock
If You Find a Rock–Peggy Christian
Rocks in His Head–Carol Otis Hurst
Let's Go Rock Collecting–Roma Gans
Everybody Needs a Rock–Byrd Baylor
Everything Rocks and Minerals–National Geographic
The Rock Cycle–Wendy Conklin

SOIL

Dirt: Jump Into Science–Steve Tomecek
Dirt: The Scoop on Soil–Natalie M. Rosinsky
Soil Basics–Mari Schuh
Rocks and Soil: Real Size Science–Rebecca Rissman

UNIT 4: THE ATMOSPHERE AND HYDROSPHERE

HYDROSPHERE

The Magic School Bus Wet All Over–Joanna Cole
The Magic School Bus at the Waterworks–Joanna Cole
Water, Water Everywhere: A Book About the Water Cycle–Mervin Berger, Gilda Berger
Water Dance–Thomas Locker (beautiful, poetic book on the water cycle)
A Drop Around the World–Barbara Shaw McKinney
Down Comes the Rain (Let's-Read-and-Find-Out series)–Franklyn Branley
Follow Water from Brook to Ocean (Let's-Read-and-Find-Out series)–Arthur Dorros
Danger–Icebergs! (Let's-Read-and-Find-Out series)–Roma Gans
The Magic School Bus on the Ocean Floor–Joanna Cole
One Well: The Story of Water on Earth–Rochelle Strauss
Basher Science: Oceans: Making Waves!–Simon Basher and Dan Green

ATMOSPHERE

You're Aboard Spaceship Earth–Patricia Lauber
Air Is All Around Us–Franklyn Branley
Feel the Wind (Let's-Read-and-Find-Out series)–Arthur Dorros

UNIT 5: WEATHER AND CLIMATE

WEATHER

Science with Weather (Usborne Science Activities)–Rebecca Heddle and Paul Shipton
How the Weather Works (Reader's Digest)–Michael Allaby
Janice VanCleave's Weather–Janice VanCleave
Cloudy with a Chance of Meatballs–Judith Barrett
The Cloud Book–Tomie de Paola
Snow Is Falling (Let's-Read-and-Find-Out series)–Franklyn Branley
Down Comes the Rain (Let's-Read-and-Find-Out series)–Franklyn Branley
What Will the Weather Be? (Let's-Read-and-Find-Out series)–Lynda Dewitt
The Magic School Bus Inside a Hurricane–Joanna Cole
Weather Words and What They Mean–Gail Gibbons
Flash, Crash, Rumble and Roll (Let's-Read-and-Find-Out series)–Franklyn M. Branley
by Seymour Simons, the following weather titles–*Weather*, *Lightning*, *Tornadoes*, *Hurricanes*
by Seymour Simons, the following seasons titles–*Winter Across America*, *Autumn Across America*
On the Same Day in March: A Tour of the World's Weather–Marilyn Singer
The Reasons for Seasons– Gail Gibbons
Sunshine Makes the Seasons (Let's-Read-and-Find-Out series)–Franklyn Branley
by Ron Hirschi, the following three titles–*Fall*, *Spring*, *Summer*, and *Winter*
What Comes in Spring?–Barbara Savage Horton
How Does the Wind Blow–Lawrence F. Lowery
Basher Basics: Weather: Whipping up a Storm!–Simon Basher and Dan Green

CLIMATE CHANGE AND ENVIRONMENT

The Science of Climate Change: A Hands-On Course–Blair Lee
Basher Science: Climate Change–Simon Basher and Dan Green
The Polar Bears' Home: A Story about Global Warming–Lara Bergen
Why Are the Ice Caps Melting?: The Dangers of Global Warming–Anne Rockwell
Global Warming–Seymour Simon
Human Footprint: Everything You Will Eat, Use, Wear, Buy and Throw Out in Your Lifetime–Ellen Kirk
The Adventures of a Plastic Bottle: A Story about Recycling–Alison Inches
Compost Stew: An A to Z Recipe for the Earth–Mary McKenna Siddals
Why Should I Save Energy?–Jen Green
Recycle! A Handbook for Kids–Gail Gibbons
The Magic School Bus and the Climate Challenge–Joanna Cole

UNIT 6: EROSION

Erosion: Changing Earth's Surface–Robin Koontz
Weathering and Erosion–Torrey Maloof
Cracking Up: A Story about Erosion–Jaqui Bailey

Erosion–Virginia Castleman
Erosion and Weathering–Willa Dee
Erosion–Shirley Duke
Soil Erosion and How to Prevent It–Natalie Hyde
Erosion–Martha Zappa

FIELD GUIDES

Weather (A Golden Guide)–Paul E. Lehr, R. Will Burnell, et. al.
Looking at Rocks (My First Field guide)–Jennifer Dussling
Rocks and Minerals (National Audubon Society First Field Guides)–Edward Ricciuti
A Field Guide to Rocks and Minerals (Peterson Field Guides)–Frederick H. Pough
Rocks, Gems and Minerals (A Golden Guide)–Paul Shaffer

WEBSITE SUGGESTIONS

The site WatchKnowLearn.org is a great site. At no cost to you, it catalogues and offers links to videos by topic and grade.

WHAT IS EARTH SCIENCE

Everything Earth: www.rocksforkids.com/RFK/howrocks.html

Ask a geologist: walrus.wr.usgs.gov/ask-a-geologist

Many Earth topics: www.windows.ucar.edu/tour/link=/earth/geology/rock_cycle.html&edu=elem

GEOLOGIC TIMELINE

Has information about the timescale divisions and what events were happening during each division:
www.fossils-facts-and-finds.com/geologic-time.html

A great resource for information about the geologic timescale and evolution:
www.ucmp.berkeley.edu/help/timeform.php

EARTH'S INTERIOR

Cross section of Earth: www.windows.ucar.edu/tour/link=/earth/interior/how_plates_move.html&edu=elem

MINERALS

Exploration of minerals:
www.windows.ucar.edu/tour/link=/earth/geology/min_intro.html&edu=elem

ROCKS AND THE ROCK CYCLE

Rocks and the rock cycle: www.windows.ucar.edu/tour/link=/earth/geology/rocks_intro.html&edu=elem

Diagram of rock cycle: www.windows.ucar.edu/tour/link=/earth/geology/rock_cycle.html&edu=elem

PLATE TECTONICS

More information about plate tectonics: www.geography4kids.com/files/earth_tectonics.html

Location of plate boundaries and the occurrence of earthquakes and volcanic eruptions: https://florida.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.tectonic/tectonic-plates-earthquakes-and-volcanoes/#.WqVqk2aZM60

Plate tectonics introduction: https://florida.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.plateintro/plate-tectonics-an-introduction/?#.WqVq-maZM60

Convergent, divergent, and transform boundaries: https://florida.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.shake/mountain-maker-earth-shaker/?#.WqVrK2aZM60

SOIL

Lots of soil info: www.blm.gov/nstc/soil/Kids

Solve a soil mystery: www.urbanext.uiuc.edu/gpe/case2/case2.html

The Soil Science Society of America has a nice site for students and teachers: www.soils4kids.org/home

HYDROSPHERE AND ATMOSPHERE

Water introduction: www.geography4kids.com/files/water_intro.html

Hydrosphere introduction: https://kidsgeo.com/geography-for-kids/the-hydrosphere/

Where does rain come from? http://mocomi.com/where-does-rain-come-from/

Convection current videos: https://healthresearchfunding.org/convection-currents-definition-for-kids/
www.youtube.com/watch?v=0mUU69ParFM

Crash Course Kids, hydrosphere and atmosphere: www.youtube.com/watch?v=UXh_7wbnS3A

Makeup and layers of the atmosphere: www.windows.ucar.edu/tour/link=/earth/Atmosphere/overview.html&edu=elem

WEATHER AND SEASONS

Site all about weather: www.weatherwizkids.com

The Young Meteorologist Program: http://youngmeteorologist.org/

THE CLIMATE

This page has lots of supplementary material including games to help learn about climate change and global warming: https://climatekids.nasa.gov/menu/teach/

A video Bill Nye did for the Smithsonian about climate change: www.smithsonianmag.com/videos/category/science/climate-change-101-with-bill-nye-the-science/

EROSION

Water erosion:
https://ca.pbslearningmedia.org/resource/nat08.earth.geol.eros.erosion/nature-water-erosion/#.WqMG2OjwZPY

Weathering, erosion, and deposition:
www.parkcityprep.org/apps/video/watch.jsp?v=172918

Crash Course Kids, weathering and erosion:
https://ru-clip.com/video/R-Iak3Wvh9c/weathering-and-erosion-crash-course-kids-10-2.html

Erosion and weathering:
https://ca.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.erosion/erosion-and-weathering/#.WqMHQ-jwZPY https://vimeo.com/194441817

A short animated film of a rock's journey:
https://video.nationalgeographic.com/video/short-film-showcase/a-rocks-fantastic-imaginary-journey-through-time-and-space

National Geographic images of weathering and erosion:
www.teachertube.com/video/national-geographic-images-weathering-and-erosion-75507

A weathering and erosion quiz:
http://studyjams.scholastic.com/studyjams/jams/science/rocks-minerals-landforms/weathering-and-erosion.htm

Keep a Science Journal

Nature is beautiful and amazing, but it is not a video game. The action in nature is often subtle, but well worth looking and waiting for. Destruction, formation, and other amazing changes are there to be discovered by the observant and patient. Earth science in particular offers some obvious topics for journaling. Keep track of the weather. You will be measuring and studying it in Unit 5. For a satisfying nature experience, grab a journal and a pencil, maybe a hand lens (magnifying glass) and a pair of binoculars, and hit the trail, the backyard, or a park. Sketching and saving samples of the common things you find along the way will fill a journal that you can be especially proud of and will want to cherish your whole life. You don't need to have a plan when journaling, but to get you started, we have provided a few hints on what might go into a nature journal. These are just ideas to get your creative juices flowing. Writing in your journal should be like writing to yourself. Don't worry about spelling, sentence structure, or grammar. Now go out, observe, draw, listen, describe, compare—journal! Remember, the more you put into it, the more you will get out of it.

For each journal entry, remember to put:
•The date •The location •The weather (temperature, clouds, rain, wind, etc.) •Who you went with

AUTUMN:

- Describe everything you can tell about the clouds. Are they puffy or stretched out? Thick or thin? What shapes can you make out? Are they moving quickly or slowly?
- Take some tape and tape a tiny sample of soil (dirt) into your journal. What colors do you see? Is the soil dry or moist? Are the particles in it big or small, sharp or smooth?
- Use your sense of hearing. Close your eyes. What do you hear? What can you hear that comes from nature and is not a human-made sound? Write a factual or fictional story about what you hear.
- Find a rock of any kind. Don't disturb it in any way. Draw it. Describe where it is sitting. What kinds of things in nature could move it from where it is?
- Pick up two different rocks. Describe them. Compare weight, shape, texture, and color. Do they have stripes, spots, or swirls?
- With adult supervision, visit a stream bed or river. Measure from the edge of the water to the edge of where you can see water has been. Is the river full right now or empty? Is it moving quickly or slowly? Remember where you did this and repeat it again in winter and spring. Describe the air: Is it clear, cloudy or smoggy? Is it moving (windy) or still, hot or cool? Take a deep breath. What scent is being carried in the air? How does the air feel, smell, taste, and look?
- Write down all of the ways you know of that animals use rocks or soil. Go outside and find some. Don't forget to observe the little beasties too.

WINTER:

- Gather snow into a measuring cup. Write down how much snow you have and describe its texture. Bring it inside where it will melt. Measure how much you have after it melts. How much water did you really have? How is this possible?
- Make a "rock" band. Place rocks in containers for shaking, brush an old toothbrush against one, and bang a couple together. In your journal, draw the instruments and describe the music you made.
- Finish the sentence "I'm so cold I could . . ." What do you like to do when it is cold outside?
- Describe and sketch the nearest mountains. How far do they go? What are they made of?
- What type of extreme weather do you have where you live? Tornadoes? Hurricanes? Blizzards? What precautions do you have to take to stay safe?
- Never go out in a thunderstorm or sit next to a window when the lightning is close by. On a stormy night, listen to thunder. Use a stopwatch to time how many seconds pass between when you see the flash and when you hear the thunder. Write down this number. This is about how many thousand feet away the lightning is. Watch the lightning. Is it hitting the ground or traveling between clouds? Put your findings in your journal.

- With adult supervision, revisit the same stream bed or river you visited in the fall. Again, measure from the edge of the water to the edge of where you can see water has been. Compare your measurement to the one you did in the fall. Is there more water now, or is there less? Why do you think this might be?

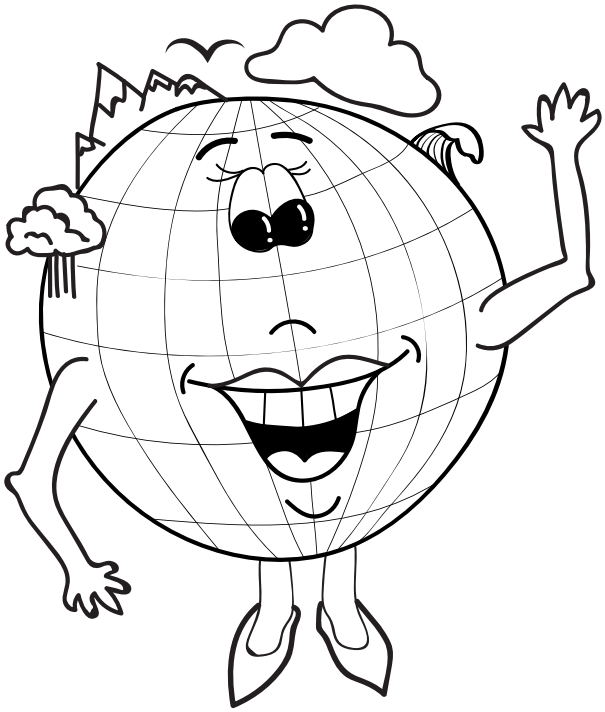
SPRING:

- Find a pond or lake. Are there plants growing on top of the water or just on the edges? Why might that be? If there are plants growing in the water, how are they different than the ones growing in soil?
- Find a plant growing through a crack in the pavement or in a rock. How is its life different than a plant with room to grow? How is the rock affected? Describe how each might feel.
- Dig into the soil very gently. Who is living there? Describe their home. Is the soil moist, dry, loose, or packed?
- Take your weather vane to the beach if you live near one or can visit one. Go very early in the morning. Which way is the wind blowing? How hard? Go again in the evening and do the same thing. Explain what you discovered.
- Sit outside and list everything you can see that humans have made from rocks or minerals, including metals.
- Write a story about what life would be like if we had nothing made of minerals or rocks. Describe how your day would be different.
- Watch birds flying on a windy day. How does the wind help or hinder their progress?
- With adult supervision, revisit the same stream bed or river you visited in the fall and winter. Again, measure from the edge of the water to the edge of where you can see water has been. Compare your measurement to the ones you did before. What pattern have you seen throughout the year? What do you think causes this pattern?

SUMMER:

- Pour a small puddle of water onto the sidewalk. Trace around it with chalk. Draw it in your journal. When you notice it is much smaller than before, draw around it again. Do this several times as the puddle disappears. Finally, copy the puddle "fingerprint" into your journal. Describe where the water went and how.
- Make a sand band. Put sand into different shakers—cans, paper towel tubes, paper sacks. What kind of music can you make? How does it sound? Do the different shakers make very different sounds?
- Find a rock to draw and color. Draw a line, dividing the paper in half. Draw the rock on the top half of the paper as usual. Now, for the fun part—draw the same rock on the bottom half but hold pencil in between your toes!
- Take a straw outside. Blow through the straw onto different types of soil. What type of soil moves the easiest—dry or wet, big or small pieces?
- Finish the thought "I'm so hot I could. . ." What do you like to do when the weather gets hot?
- Describe the soil and rocks in a river or stream. How are they different from those just a few feet away from the water?
- Find an animal path in nature. What animals do you think use it? How worn is it? How have the animals contributed to the erosion? Can you see where water has increased the erosion?
- Build animals from rocks you find. Glue them together and/or paint them. Write a story about them in your journal.
- Did you know that crickets can tell the temperature? Go out in the evening where you can hear crickets. Take a watch with a second hand with you. Single out one cricket and count its chirps for 14 seconds. Write this number down and add 40 to it. The sum is the temperature in Fahrenheit! Try it with several others and see if they agree. Tell how you think they can do this.

Unit 1
An Earthly Introduction

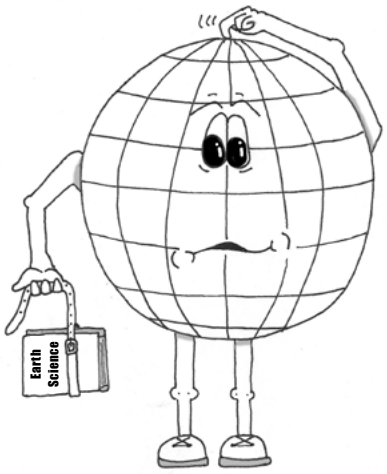


NAME _____ DATE _____

For my notebook

Before beginning, you will need a small amount of clay, enough for students to roll into a ball in their hands.

WHAT IS EARTH SCIENCE?

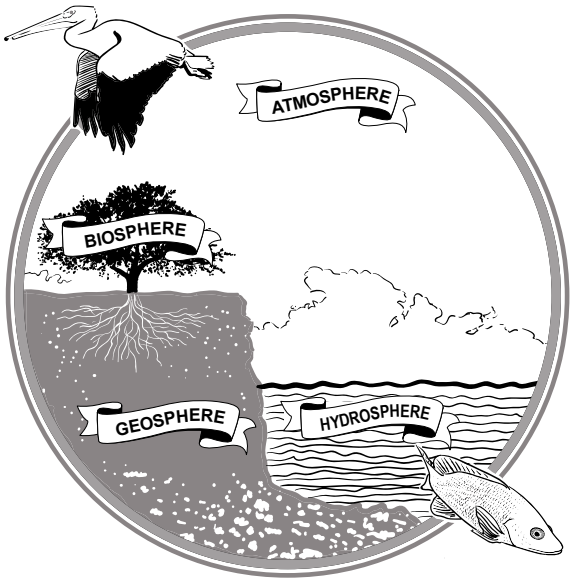


When you study Earth science, you don't just study the part of the earth that you run, dance, and play on. You learn about all the parts that make up Earth, including the part that is under the surface. You learn about the air that surrounds you when you run, dance, and play. You learn about the ocean, rivers, and lakes you swim in. You will study how living things, like trees and animals, affect the earth.

Roll the clay you have in your hand into a round ball. Planet Earth is round like the ball of clay. Of course it is a lot bigger than your clay ball. Because it is so large, Earth does not look round when you look around. Over 2,000 years ago in ancient Greece, Aristotle realized that Earth is a sphere. A **sphere** is a solid round circle. Is the ball you hold in your hand a sphere?

The term sphere is also used by scientists to describe the four parts that make up Earth. The geosphere is the solid part of Earth that you jump, run, and dance on. The hydrosphere is the watery, liquid part of Earth that you swim in and drink. The atmosphere is the air part of Earth that surrounds you when you run, dance, and play. The biosphere is the living part of Earth. You are part of the biosphere.

For my notebook –page 2



When you study Earth science, you also learn about environmental science. The environment is the natural world of land, sea, air, and living things. Environmental science is the study of the relationship between living things and the environment they live in.

The four spheres interact with each other. It is similar to how each member of a family is an individual, but your actions affect each other. When you study environmental science, you investigate how the biosphere affects the geosphere, hydrosphere, and atmosphere.

Earth Science Lab #1: Earth's Spheres–instructions

Materials

- Lab sheet, pencil
- Crayons or colored pencils – brown, green, blue

Aloud: The picture on your lab sheet shows Earth. This picture shows a flat circle for Earth. That is because this simplified model of Earth is drawn on a piece of paper. At the top of the page, fill in the correct word choice to make the sentence correct. Is Earth a circle or a sphere?

The words geosphere, hydrosphere, biosphere, and atmosphere all start with roots that come from the ancient Greek language. Many science words contain Greek or Latin roots. *Geo* means earth, *hydro* means water, *bio* means life, and *atmo* means air. Any time you see these roots in science words, they mean the same thing in English as they did in ancient times. Can you think of any other words that use these roots?

Procedure

1. You will be coloring each of Earth's spheres on the poster. Color the land areas brown for the most common color of soil. Do not color the living things on land. Choose the correct root word that is used for land, write it in the Poster Color Key, and color the corresponding oval brown.
2. Color the ocean areas blue. Do not color the living things in the ocean. To label this, choose the correct root word that is used for water, write it in the Poster Color Key, and color the corresponding oval blue.

Aloud: The circle around Earth on your poster represents the air. Look around you. What color is air? It might look invisible, but it has a huge number of really little particles in it.

3. Make several small dots in the circle around Earth to show that air has particles in it. To label this, choose the correct root word that is used for air, write it in the Poster Color Key, and draw dots in the corresponding oval.
4. Find the living things on the land and in the oceans. Color them green. To label this sphere, choose the correct root word that is used for living things, write it in the Poster Color Key, and color the corresponding oval green.

Answers

Land areas make up the geosphere
Ocean areas are part of the hydrosphere.
Air is part of the atmosphere.
Living things make up the biosphere.

Notes to Educators

- You will find in different publications that clouds (water vapor) are identified as part of the hydrosphere or as part of the atmosphere. Technically, clouds are part of both the atmosphere and the hydrosphere. But precipitation (rain, snow, fog, etc.) is part of the hydrosphere. Do not worry about how, or if, your student chooses to identify clouds on the poster. This will be discussed in the next lab and in Unit 4.
- This poster will be used in the next lab.
- It is a good exercise to brainstorm with students to think of all the words that use these four roots. Other than *atmo*, the roots are so commonly used in science that it is basic literacy to learn them.

Conclusion/Discussion

There are subcategories for each of the four main divisions. What are ways scientists might divide each of the four main categories?

NAME _____ DATE _____

EARTH'S SPHERES POSTER

Earth is a _____ .
(circle or sphere)

Poster Color Key

- ◯ Land areas make up the _____sphere.
- ◯ Oceans are part of the _____sphere.
- ◯ Air is part of the _____sphere.
- ◯ Living things make up the _____sphere.

Root words:
hydro
bio
geo
atmo

Earth Science Lab #2: Modeling Earth's Spheres–instructions

Materials

- Earth's Spheres Poster from the last lab, pencil
- Glass of water
- Piece of fruit or vegetable that the student likes to eat

Read the following as students add to their Earth's Spheres Poster.

Aloud: Do you ever try to solve puzzling questions with answers based on things you know? For example, do you need clouds in the sky for it to rain? A good place to start predicting the answer to that question is to think about all the times it has rained where you live and think about whether there have always been clouds in the sky when it did.

Do you like to build things with Legos? The Lego structures you have built and the prediction you just made about the connection between clouds and rain are both models. Kids make models all the time. Scientists do too. Scientists use and make scientific models. A <u>scientific model</u> describes and predicts something in the real world. Some models show a structure, either by building a small version of it or by drawing a picture of it. These kinds of models are called <u>visual models</u>.

There are other types of scientific models too. <u>Mathematical models</u> use math equations to explain something in science. A mathematical model, for example, is used to explain why the moon stays in orbit around Earth. <u>Computer models</u> use computers to predict what will happen or what has happened. Weather predictions are based on computer models.

The Earth's Spheres Poster that you colored is a simple visual model showing the four main parts of the earth system. From the way the model is drawn, it looks like the four parts do not interact. Your model doesn't yet show what is really going on, but you can fix that! Take a deep breath and have a sip of water as you think about how Earth's four spheres might affect each other.

Draw a small picture of yourself with a glass of water on your Earth's Spheres Poster. Where did you draw yourself? Was it on the geosphere? That is because people live on the rocky part of the earth. We live on the geosphere. Draw an arrow from the geosphere to you. Draw an arrow from the atmosphere to you too, showing that you need air to breathe.

The hydrosphere does not just include salt water. All water is included in it. Even clouds, which are made of water, are a part of the hydrosphere. Draw an arrow from the glass of water to you, showing the interaction between you and the hydrosphere.

Take a bite out of the fruit or vegetable. Which sphere are you interacting with now? You are modeling how the biosphere affects the biosphere! Draw what you are eating. Draw an arrow from it to you.

You have made your scientific model of Earth's spheres more complicated, but it does a better job of showing how the world really works. This is still a simple model, though. Can you think of other ways the fours spheres interact? Brainstorm some ideas and add more to this model using arrows and drawings to show that they affect each other.

[continued]

Other Interactions (not a complete list)

- Biosphere to geosphere: Building with materials from the geosphere such as bricks and dams.
- Hydrosphere to atmosphere and geosphere: Clouds and rain. Draw rain coming from a cloud.
- Plants (biosphere) live in soil (geosphere), draw water (hydrosphere) from the soil, and take in air (atmosphere) through their leaves.

Notes to Educators

- This activity focuses on a major theme of earth and environmental science, that of the interactions between Earth's spheres. Weather and environmental science topics in this course will refer back to these interactions.
- Another major theme in this course is scientific modeling. There is an emphasis in course materials to explain what scientific models are and how they are used and developed.

Earth Science Lab #3: Modeling Earth–instructions

Materials

- Lab sheet, pencil
- 2-liter bottle with top half cut off (and saved)
- Moist garden soil or potting soil
- Grass seeds
- Small potted plant (optional)
- Water
- Mister
- Clear packing tape

Note: This lab takes four to five days to observe the final result.

Aloud: Some visual models are drawings and diagrams. Some, like Legos and clay balls, can be held in your hand. Today, you are going to make a model of the four spheres that has something from each sphere in it. It is still a simple model, but it is more complicated than your drawing of Earth. With this model, you will be able to observe interactions between Earth's spheres.

Before you begin the experiment you need to think of a hypothesis. A <u>hypothesis</u> is a statement about what you think will happen during the experiment. A hypothesis can be an illustration or words telling what you think will happen during the experiment and why.
After making a hypothesis, you will conduct the experiment. During the experiment, you will make scientific <u>observations</u> about what happens. Observations are made with your senses—seeing, hearing, and sometimes smelling, feeling, and tasting. For this experiment you will use your sense of sight to observe what your scientific model looks like after several days. If it looks similar to your drawing, you will have proved your hypothesis. If it looks different from your drawing, you will have disproved your hypothesis.

Procedure

1. Fill bottom of bottle about ¼ full of soil. (See diagram #1.)
2. Plant your small plant, if you have one.
3. Add any other decor you'd like—small rock, bark, etc. Sprinkle grass seeds over the remaining soil and mist lightly with water.
4. Seal the top of the bottle back onto the bottom with tape. (See diagram #2.) Leave it in a place where it will get sunlight but not get too hot. You will have to judge this based on your location and the season in which you do this.
5. For a hypothesis, draw a picture of what you expect the model will look like in 5 to 7 days. Label the geosphere (soil), hydrosphere (water), atmosphere (trapped air), and biosphere (seeds and plant).
6. Check your model in 5 to 7 days and complete the lab sheet.

[continued]

Diagram 1

Diagram 2

Possible Answers

#1. Drawing of container with geosphere, hydrosphere, atmosphere, and biosphere labeled. This is a prediction based on the interactions you have observed your entire life.
#2 Drawing of container after 5 to 7 days with geosphere, hydrosphere, atmosphere, and biosphere labeled.
#3 it has all four spheres in it.
#4 it is much simpler than Earth is.
#5 The plants would not grow. If you planted the plant, the plant would die.
#6 The plants would not have anything to grow in.
#7 The plants would die or never start growing.

More Lab Fun

1. See how long your model will survive without opening it. Do you need to add water? Air?
2. If you see the side misted up, where does the water come from? (Air)

NAME _____ DATE _____

MODELING EARTH

1. **HYPOTHESIS**: After 5 to 7 days I predict my scientific model of Earth's four spheres will look like:

2. **OBSERVATIONS**: After 5 to 7 days my scientific model of Earth's four spheres looked like:

MODELING EARTH–PAGE 2

CONCLUSIONS:

3. This models Earth because _____

_____.

4. This is different from Earth because _____

_____.

5. What would have happened if you had not added water?

6. What would have happened if there was no soil?

7. What would have happened if there was no water?

NAME _____ DATE _____

For my notebook

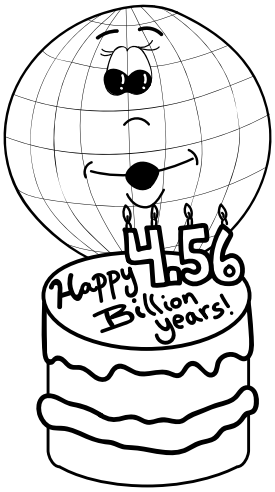
EARTH IS OLD—REALLY, REALLY OLD!

How old do you think planet Earth is? You can start to puzzle out an answer if you give it some thought. Ancient Greeks lived over 3,000 years ago. Earth has to be older than that. Dinosaurs evolved over 230 million years ago. Earth has to be older than that. Can you think of any event that you know of that happened more than 230 million years ago? If you can, Earth has to be older than that. Earth is about 4,560,000,000 (four billion, five hundred sixty million) years old. That's a big number with a lot of zeros! There's an easier way write 4,560,000,000 using a decimal point. Scientists often say, Earth is 4.56 billion years old.

Have you ever noticed the special names people use for the timeline of human growth and development? The first term is baby, then toddler, and the next is child. After child, people use the term tween, teen, or adolescent, and so on up to adult and senior citizen. This timeline is based on changes that people go through as they age. Most of these terms are based on a person's growth and development. People are only babies until they can toddle about. You are an adult much longer than you are a child, even if you add all of the stages together.

For my notebook–page 2

Scientists use a special timeline for Earth based on how it has changed during the 4.56 billion years it has been a planet, called the geologic timescale. Scientists divide the timescale into long segments of time called eras. Just like with people, each era on the geologic timescale marks a dramatic change in Earth's development.



Before going on, there is an important question for you. How big is a billion? Think of something you have a lot of. Do you have close to a billion of whatever it is? How long do you think it would take you to count to one billion? Scientists and mathematicians estimate that it takes almost 32 years of continuous counting to count to one billion. That means it would take 4.56 times, or 145 years, of continuous counting to count to 4.56 billion! That's a long time, isn't it?

Age of Earth Lab #1: How Big Is a Billion?–instructions

Materials
- Lab sheet, pencil
- Calculator

PART 1

Aloud: You won't be surprised to learn that the oldest thing on Earth is Earth! Earth is really old. Mountains, the ocean, and tall trees are all older than you, but they are not nearly as old as the planet. When Earth formed 4.56 billion years ago, the geosphere was so hot it was liquid and melty, kind of like hot peanut butter or chocolate. The planet was so hot that if water did land on its surface, it evaporated right away, the same way water in a pot does when it is boiling hard. The atmosphere was completely different than it is today. And the biosphere did not exist yet. Wow! How could anything change that much? Well, 4.56 billion years is a very long time. Think of the oldest person you know. Earth is a lot older than that. How much older is Earth than you? Just how big is 4.56 billion, anyway?

Procedure
Have students write how old they are below the age of Earth and then subtract their age from the age of Earth. Even students who are comfortable doing subtraction might need help. Subtracting a very small number from a very large number can be confusing.

PART 2
Aloud: Are you fast at counting? Some people think it would take 32 years to count to one billion! How long do you think it would take *you* to count to one billion? It would be impossible to really try it because you would need to take breaks for eating, sleeping, learning, and having fun! A scientific model can be used to help make an <u>estimate</u>. You won't have to actually count to one billion to make an estimate; you only have to count to 100. You worked with visual models. Now you will use a mathematical model to help you estimate how long it would take you to count to one billion.

Procedure
Have students count to 100 with someone timing them as they do it. Make sure the counting is continuous for that student. If the student pauses as they count normally, then continuous for him will include pausing. That is okay. Write the time that it took the student to count to 100. Use the calculator, to determine how long it would take the student to count to one billion.

PART 3
Aloud: Earth is still changing today. Often, but not always, humans cause changes to Earth. Can you think of any ways the geosphere, hydrosphere, or atmosphere has changed recently in the area where you live?

Procedure
Write down your observations of Earth changing.

[continued]

Possible Answers

If it took me 75 seconds to count to 100:

1,000,000,000 ÷ 100 = 10,000,000
10,000,000 × 75 = 750,000,000 seconds to count to one billion
750,000,000 ÷ 31,557,600 = 23.76
It would take me over 23 years to count to one billion.

Notes to Educators

- This activity might seem like a math worksheet, but each activity highlights a thematic element of the course:
  1. Earth is very old.
  2. Earth has changed many times during the past 4.56 billion years.
  3. Recently, humans are responsible for many of these changes.
  4. Scientific modeling is a way to understand complicated science concepts.

- If your student is struggling with counting to 100, have him or her count to 10 and multiply the time it took by 10 to estimate how long it would take to count to 100. Alternatively, you could count to 100 and have your student time you.
- The mathematical model will require help from an instructor and a calculator for most students at this level. It is included so that students see how a simple mathematical model is used. An example of a computer model is used in the section on weather.
- This estimate has its flaws because larger numbers take longer to say than smaller numbers. That is why it is believed that it would take the average person about 32 years of continuous counting to reach one billion. But I think it's perfectly fine if your student believes that he or she could do it faster.
- The number of seconds in a year (31,557,600) accounts for leap years; therefore it is based on an average of 365.25 days in a year. There may be a few motivated students who'll check the math using 365 days and subsequently experience turmoil when their calculation only yields 31,536,000.

NAME _____ DATE _____

HOW BIG IS A BILLION?

PART 1

Earth is 4,560,000,000 years old. I am _____ years old.

How much older is Earth than you are? Write your age on the line below and do the math.

4,560,000,000

– _____

=

Earth is _____ years older than me.

PART 2

Hypothesis: I think it will take me _____ years to count to one billion.

Data

It took me _____ seconds to count to 100.

I would have to count to 100 ten million times to equal one billion (1,000,000,000)

because 1,000,000,000 ÷ 100 = 10,000,000 (ten million)

The math I did on a calculator:

_____ (seconds it took me to count to 100)

× 10,000,000

= (seconds it would take me to count to one billion)

HOW BIG IS A BILLION?–PAGE 2

How long is that in years? The average number of seconds in a year is 31,557,600 (thirty-one million, five hundred fifty-seven thousand, six hundred).

The math I did on a calculator:

_____ (seconds it will take me to count to one billion)

÷ 31,557,600 (seconds in a year)

= years

Conclusion

Therefore, it would take me about _____ seconds or _____ years to count to one billion.

PART 3

Ways that the geosphere, the hydrosphere, and/or the atmosphere have changed recently in the area where I live.

1.

2.

3.

Age of Earth Lab #2: Make a Timeline Model–instructions

Materials
- Timeline label sheets, pencil
- 10 sheets of construction paper, cardstock, or 12" x 12" scrapbooking paper
- Scissors
- Yarn (about 12')
- Crayons, colored markers, or colored pencils
- Tape
- Glue
- Large hard surface (14' table or floor)

Aloud: Earth formed over 4½ billion years ago. As you learned, that is a really long period of time. But what was Earth like at its beginning? Has it changed a lot over the last 4.56 billion years? A geologic timeline is a visual model that scientists use to help picture what has happened on Earth during that time span. Scientists divide Earth's history into long segments of time called eras. The timeline is not divided at regular intervals. Scientists decide on the dates of the divisions between one era and the next based on major changes to the geosphere, hydrosphere, atmosphere, or biosphere. Often, changes have occurred in all four spheres. Today you will begin working on a geologic timeline. You will add events to your timeline throughout this course.

Procedure

1. On a long table or across a hard floor, lay out the sheets of paper in a single row with a slight gap between sheets (landscape orientation if using rectangular-shaped paper). This is your geological timeline, and it should be approximately 9 to 10 feet long. See the sample on the next page.
2. Cut a single piece of yarn the length of your timeline, and lay it across your timeline so that it runs continuously down the middle. Secure the yarn with tape. It helps to tape the yarn at two or three places on each piece of paper. This is the geological date line. See the sample on the next page.
3. It's time to mark the dates. Each piece of paper represents 500 million years, or half a billion. Cut out the provided labels provided on the Timeline Labels sheet, or you can handwrite the dates directly on the timeline. Starting with the first sheet farthest to the right, glue (or write) the label "500 million years ago" along the left side edge, above the yarn. Glue (or write) "1 billion years ago" along the left side edge of the second sheet, "1½ billion years ago" along the left side edge of the third sheet, "2 billion years ago" along the left side edge of the fourth sheet, and so on. The last sheet should be labeled "5 billion years ago." See the sample on the next page.
4. The first sheet needs a few more dates marked. Midway along the date line on the first sheet, glue (or write) the label "250 million years ago." At about 1 ½ inches from the far right edge, label "65 million years ago." As close as you can get to the right edge, glue or write the label "Today." See the sample on the next page.
5. Now it's time to label the eras. You can handwrite the era names or use the provided labels provided on the Timeline Labels sheet page 2. On your timeline below the yarn, make a small mark at 4½ billion years ago and another small mark at 3.8 billion years ago (a little more than half way between the 3½ billion and 4 billion markers). This marks the span of the Hadean era. Use a ruler to create a long rectangle between these two marks and color the rectangle. Glue (or write) the label "Hadean" on the rectangle. Continue to label the rest of the eras using the information in the table provided. See the sample on the next page.

[continued]

Geological Timeline Table:

Era	Years Ago
Hadean	4.5 to 3.8 billion
Archean	3.8 to 2.5 billion
Proterozoic	2.5 billion to 543 million

Era	Years Ago
Paleozoic	543 million to 248 million
Mesozoic	248 million to 65 million
Cenozoic	65 million to today

Aloud: Now that you have done all the hard work of setting up your timeline, you will add four events to the timeline: one from the geosphere, one from the hydrosphere, one from the atmosphere, and one from the biosphere.

On Timeline Labels–page 2, color each of the four badges that go on your timeline and cut them out. The geosphere formed when Earth formed. Glue or tape the badge showing the formation of the geosphere near the beginning of your timeline (below the start of the Hadean era) at 4½ billion years. Shortly after Earth formed, air that was trapped in rocks escaped to form an atmosphere. It wasn't like the air in the atmosphere today, but it was the first atmosphere. Just to the right of the Earth formation badge, place the badge showing that the atmosphere formed.

When Earth first formed, it was so hot that the rocky material making up Earth was melted, similar to how chocolate bars melts on a hot day. About 100 million years after Earth formed, it cooled enough for liquid water to pool on its surface. Glue or tape the badge showing the hydrosphere, just to the right of the Atmosphere badge (at about 4.4 billion years ago). The geosphere, hydrosphere, and atmosphere all formed on Earth during the Hadean era.

The Archean era began with a major change on Earth. Life evolved, or came to be. Until then, the biosphere did not exist. With the evolution of the first organisms, the biosphere began. Glue or tape the badge showing the beginning of the biosphere and the evolution of life and on your timeline, below the start of the Archean era.

Notes to Educators

- If you're familiar with the geologic timeline, you will notice that the only time frame used to divide the timeline is that of era. The other divisions are covered in *REAL Science Odyssey Earth & Environment 2* and in *Biology 2*.
- In this lesson, students will set up the timeline and add something for each one of the four spheres. As students work through the course, they will add events to the timeline at the appropriate points.
- The evolution of life is treated briefly. The timeline badge for the evolution of life is a bacterium, which was not the first organism. Millions of years likely elapsed between the evolution of life and the evolution of single-celled organisms. A bacterial cell is used because students can identify it as an organism.

NAME _____ DATE _____

MAKE A TIMELINE MODEL: TIMELINE LABELS

1 billion years ago

1½ billion years ago

2 billion years ago

2½ billion years ago

3 billion years ago

3½ billion years ago

4 billion years ago

4½ billion years ago

5 billion years ago

500 million years ago

Today

250 million years ago

65 million years ago

NAME _____ DATE _____

MAKE A TIMELINE MODEL: TIMELINE LABELS–PAGE 2

Hadean

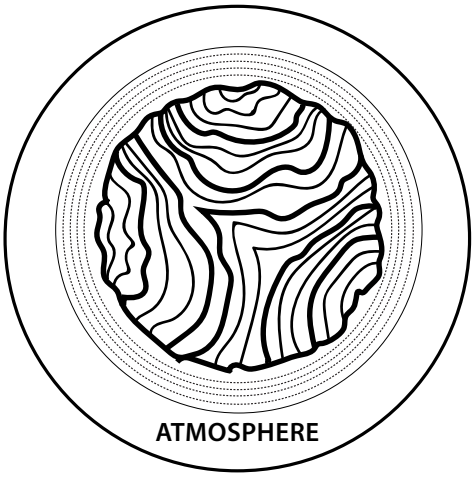
Archean

Proterozoic

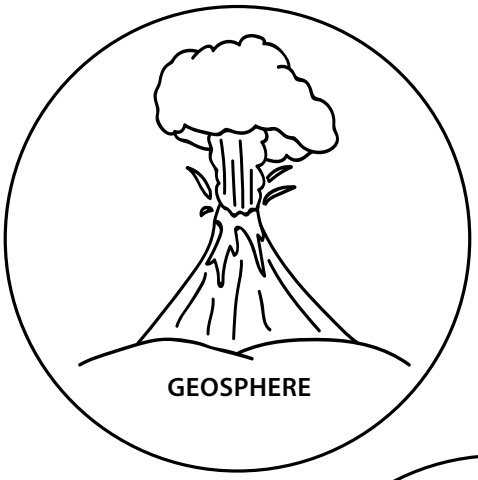
Paleozoic

Mesozoic

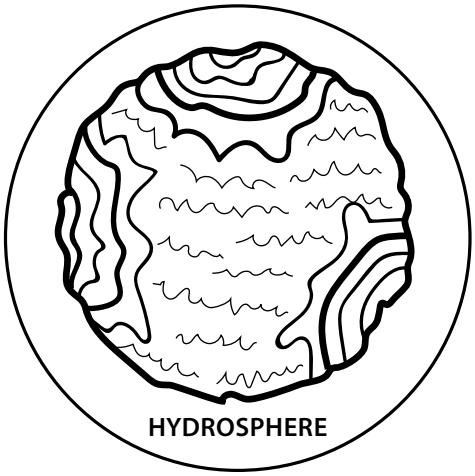
Cenozoic



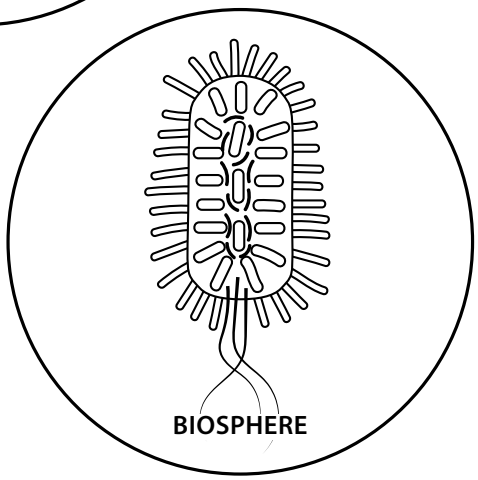
ATMOSPHERE



GEOSPHERE



HYDROSPHERE



BIOSPHERE

Thank you for previewing RSO Earth & Environment 1. We hope you are enjoying the course so far.

To purchase a complete RSO Earth & Environment 1 please visit www.PandiaPress.com

SAMPLE

R.E.A.L. SCIENCE ODYSSEY

READ • EXPLORE • ABSORB • LEARN

Earth & Environment

LEVEL **ONE** covers these topics:

- Scientific Modeling
- Geosphere
- Atmosphere
- Hydrosphere
- Weather
- Climate
- The Environment
- Erosion
- Plate Tectonics
- Geologic Timeline

REAL Science Odyssey is a rigorous and complete science series. Each book in the RSO series provides a curriculum for one school year that is written for use indoors and out. It covers the microscopic as well as the macroscopic, and it is sequential, with each unit building upon the previous one. Each topic of RSO Level One is presented in an entertaining, story-like format that is reinforced with hands-on activities along with background science information, parent/teacher instructions, labs, reading lists, science vocabulary, and learning goals. With RSO your student will be introduced to more science than you ever thought possible in a way that aims to cultivate a lifelong love of science.

Each course in the REAL Science Odyssey series systematically presents important science skills at age-appropriate levels, including:

- Scientific method
- Scientific modeling
- Observation skills
- Analytical skills
- Mathematics

Also available in the REAL Science Odyssey Level One series:

Life (Biology)
Earth & Space
Chemistry
Physics
Astronomy

WELL-TRAINED MIND™
TOP RECOMMENDATION

www.pandiapress.com

ISBN 978-0-9977963-6-0
9 780997 796360