

SCHOOL LAUNCH • EARTH SCIENCE K-8

KINDERGARTEN EARTH SCIENCE: GOD MADE THE GROUND AND SKY

A year of looking closely at the world God made, from the five smooth stones David chose by the brook and a jar of shaken soil to Noah's rain, the rainbow of promise, the sun's morning walk across the sky, one tree watched through four seasons and the great dinosaur bones in the museum, each one touched, sorted, counted, measured with hands and feet, and drawn in a field notebook at the kitchen table or out in the yard.

First edition

| *"In the beginning God created the heaven and the earth." (Genesis 1:1, KJV)*

COURSE GUIDE

This course takes a young child outside and back in again, eight times over, to meet the ground under our feet and the sky over our heads. The units are **rocks, dirt and mud, water, weather, day and night, the seasons, dinosaur bones** and **caring for the earth**. Along the way the child picks up stones, shakes soil in a jar, follows a puddle after the rain, makes a pinwheel and a prism rainbow, traces a shadow in the morning and at noon, watches one tree all year, and digs “bones” out of a sand box.

Every lesson follows the same path. First comes **a story or a moment**: David by the brook, Noah and the rain, a farmer sowing seed, a hunter in the snow. Then the child **looks**: what color, what shape, hard or soft, smooth or rough, wet or dry? Then the child **counts and measures** with fingers, hands, feet, a cup or a ruler, and **compares**: bigger or smaller, more or fewer, sinks or floats. Last, the child **makes or does** something with real things and draws it in the field notebook, while a parent writes down the words the child says.

The thread of the year is simple: **look closely, then tell what you saw**. A kindergartner cannot yet read a science book, but he or she can notice. By spring the child will sort rocks without being asked, point out clouds by name, know which way the sun comes up, and say why the puddle on the driveway got smaller. Those are the first habits of every scientist, and they last a lifetime.

Underneath it all is the first verse of the Bible: “In the beginning God created the heaven and the earth.” (Genesis 1:1) The ground and the sky are not accidents; they are the works of a good and orderly Maker, and that is why they can be studied. Each unit has one Scripture to hear and remember, chosen because it fits the lesson: David’s smooth stones, the good ground in the parable of the sower, Noah’s rain and the rainbow, the lights God set in the sky, the promise of seedtime and harvest, Behemoth in the book of Job, and the call to tend the garden.

WHO IT IS FOR

Written for children in kindergarten (about ages 5–6), and gentle enough for a younger sibling or an older child who is just starting science. No reading or writing is required of the child: a parent reads every lesson aloud, and the child listens, points, sorts, builds, counts and draws. A parent or teacher leads each session, does any step with heat, glass or sharp tools, and writes the child’s words in the field notebook. Nothing needs to be bought beyond ordinary household things: jars, cups, a flashlight, crayons, a ruler and the yard outside.

HOW TO USE THIS COURSE

The weekly rhythm. The year has 32 lessons, one a week, in eight units of four, plus an optional ninth unit, the **Field Lab**, for extra days outside. Each lesson takes two sessions of 30–40 minutes. Session 1 is the warm-up, the story, the teaching and the picture study. Session 2 is the make-and-do activity, the practice and a page in the field notebook. Short is better than long: stop while the child still wants more.

The ★ quarter path. Ten lessons are marked ★. Families who want a one-quarter version can teach only those ten, one a week; together they touch every unit and keep the core habits of looking, sorting, counting and drawing. The other lessons can be added any time.

The field notebook. Use one plain sketchbook or a stack of paper in a folder for the whole year. Each lesson ends with one page: a drawing, a rock rubbing, a traced shadow, a weather picture, a pressed leaf. The child draws; the parent writes the date and one sentence the child says out loud, such as “My rock is gray and bumpy.” Do not correct the drawing. The goal is careful looking, not pretty pictures.

Experiments and safety. Every activity uses household things, and every one is done with a grown-up close by. The parent handles anything hot (boiling water and steam in Unit 3), anything glass (jars and the prism), and any tool for scratching rocks. Wash hands after digging in soil and mud, never taste dirt, rocks or puddle water, and never look straight at the sun. In Unit 4, thunder means everyone goes indoors.

Worked examples and practice. Each lesson has one very simple worked example to do together, such as counting rocks, comparing a big stone and a small one, reading a picture chart or measuring a footprint with hands or a ruler. Then come five short practice items, mostly said aloud: point to it, sort it, match it, count it, draw it. All numbers stay under 20. Answers are given for the parent, and a child who gets one wrong simply tries again with the real thing in hand.

Unit reviews and unit projects. In the last week of each unit, the parent asks six to eight short questions aloud and the child answers in his or her own words (oral narration). The review is out of 20 points only to help the parent see what stuck; there is no grade. Each unit also has a unit project, such as a sorted rock tray, a soil jar, a weather chart for a whole week, or a drawing of one tree in four seasons. Keep the unit projects together; they make a fine record of the year.

A word about time. The course is written from a Christian view of creation (Genesis 1:1) and of the Flood (Genesis 6-9). Children will still meet deep-time names such as “Jurassic” or “Ice Age” on museum signs, in picture books and at the zoo, so the course teaches them as museum words, so that a child can read any sign or textbook and know what it means. Wherever they come up, a 🕒 **Thinking About Time** box sets out, in a few very simple sentences, what the sign says, what we can see for ourselves, and how Christians read it. The course gives no numbers for the age of any rock, bone or star.

SCOPE AND SEQUENCE

Unit 1: Rocks (1-4)

Picking up rocks and sorting them by color; hard and soft; smooth river stones and rough broken ones; and the five smooth stones David chose from the brook.

Unit 2: Dirt and Mud (5-8)

What soil is made of, seen in a shaken jar; how worms help the soil; sun-dried mud bricks like the ones in Exodus; and a bean planted in good soil and in sand.

Unit 3: Water (9-12)

Water as liquid, ice and steam in the kitchen; where the rain goes after a storm; what sinks and what floats, even a floating rock; and Noah's rain and a toy ark.

Unit 4: Weather (13-16)

Sunny, cloudy, rainy and snowy days on a picture chart; the wind and a pinwheel; the rainbow and God's promise; and thunder, lightning and how to stay safe.

Unit 5: Day and Night (17-20)

Where the sun comes up; shadows traced in the morning and at noon; the moon and stars God set in the sky; and finding the Big Dipper at bedtime.

Unit 6: Seasons (21-24)

Spring, summer, fall and winter: what the sky, the ground, the plants and the animals do in each, with one tree watched and drawn all year and God's promise of seedtime and harvest.

Unit 7: Dinosaur Bones (25-28)

What a dinosaur is; how we know about them from bones found in rock; how big a T. rex footprint is, drawn in chalk on the driveway; and Behemoth in the book of Job.

Unit 8: Caring for the Earth (29-32)

God gave Adam the garden to dress and keep; picking up litter; using water wisely at home; and a thank-you walk to name the good things God made.

Unit 9: Field Lab (optional) (Any time)

Four extra outdoor days to use whenever the weather is fine: a rock hunt, a map of a puddle as it shrinks, a cloud chart and a shadow clock.

MATERIALS

- **Field notebook (a plain sketchbook or paper in a folder):** One for the whole year. The child draws; the parent writes the date and the child's words.
- **Crayons, colored pencils and a few sheets of plain paper:** For drawings, rock rubbings, weather pictures and the one-tree-all-year pages.
- **An egg carton or a muffin tin, and a small bag for collecting:** For sorting rocks, seeds and treasures from walks.
- **Clear jars with lids, plastic cups and a pitcher:** For the soil jar, floating and sinking, rain gauges and the water lessons. A parent handles glass.

- **A ruler, a measuring tape and sidewalk chalk:** For measuring with hands and feet, tracing shadows and drawing the T. rex footprint.
- **A flashlight and a small glass prism (or a glass of water or an old CD):** For shadows, day and night, and making a rainbow indoors.
- **Potting soil, sand, a few dried beans and a tray or shallow box:** For planting, mud bricks and the dinosaur dig.
- **Household things for small projects:** Paper and a pushpin for a pinwheel, a coin and a piece of chalk for the scratch test, a piece of pumice if you have one, toy animals and a shoebox for the ark.
- **Optional: a picture book or museum visit listed in a unit:** Never required. See the list in each unit.

GRADING

Kindergarten science is not graded. A child shows what he or she has learned by telling it back (oral narration), by doing the make-and-do activity, and by keeping the field notebook. The parent uses a simple checklist for each unit instead of a grade.

No letter grades. For each unit, mark each checklist line as “Yes,” “Growing” or “Not yet.” A “Not yet” simply means: do it again another day with the real thing in hand.

- The unit checklist asks: Did the child look closely and name what he or she saw? Sort or compare things (bigger or smaller, hard or soft, sinks or floats)? Count or measure with hands, feet or a ruler? Tell the story or the Scripture back in his or her own words? Add a page to the field notebook?
- The unit review is 20 points only so the parent can see what stuck. Ask the questions aloud, accept any answer that shows the idea in the child’s own words, and let the child point or show instead of saying.
- Do not correct drawings. Praise careful looking: “You saw the stripe in that rock!”
- Keep the field notebook and the unit projects together. They are the record of the year and a joy to look back on.

A NOTE TO PARENTS

You do not need to know any science to teach this course. Read the lesson aloud, go outside or to the kitchen table, and ask three questions over and over: “What do you see?”, “Is it bigger or smaller, more or fewer?” and “What do you think will happen?” Then wait. A five-year-old who is given time to look will notice things a grown-up walks past.

Let the child handle real things. Wet sand, cold rocks, a muddy worm and a shadow on the sidewalk teach more than any picture. The make-and-do activities are meant to be a little messy; put down a towel, keep a grown-up close, and wash hands afterward. If a lesson runs long, stop and finish another day.

Above all, this course hopes to help a little child look up at the sky and down at the ground and say, “God made that.” When the child finds a smooth stone, sees a rainbow, or watches

the first green leaves on the tree he or she has drawn all year, stop and give thanks together. That habit of wonder and thanks is the best science lesson of all.

CONTENTS

Unit 1: Rocks

- 1.1 Picking Up Rocks ★
- 1.2 Hard and Soft
- 1.3 Smooth and Rough
- 1.4 David's Five Smooth Stones

Unit 2: Dirt and Mud

- 2.1 What Is Dirt? ★
- 2.2 Worms in the Soil
- 2.3 Mud Pies and Bricks
- 2.4 Planting in Soil

Unit 3: Water

- 3.1 Water Everywhere ★
- 3.2 Where Rain Goes ★
- 3.3 Floating and Sinking
- 3.4 Noah's Rain

Unit 4: Weather

- 4.1 Sunny, Cloudy, Rainy, Snowy ★
- 4.2 The Wind
- 4.3 Rainbows
- 4.4 Thunder and Lightning

Unit 5: Day and Night

- 5.1 The Sun Rises ★
- 5.2 Shadows ★
- 5.3 The Moon and Stars
- 5.4 Bedtime Sky

Unit 6: Seasons

- 6.1 Spring ★
- 6.2 Summer
- 6.3 Fall
- 6.4 Winter

Unit 7: Dinosaur Bones

- 7.1 What Is a Dinosaur? ★
- 7.2 How We Know
- 7.3 Big and Small
- 7.4 Behemoth

Unit 8: Caring for the Earth

- 8.1 God Gave Us the Earth to Tend ★
- 8.2 Picking Up Litter
- 8.3 Saving Water at Home
- 8.4 A Thank-You Walk

Unit 9: Bonus: Field Lab (optional)

9.1 Rock Hunt

9.2 Puddle Map

9.3 Cloud Chart

9.4 Shadow Clock

★ quarter path ·  Thinking About Time box

ROCKS

“In the beginning God created the heaven and the earth” (Genesis 1:1). The earth God made has rock all through it: under the grass, under the houses, in the mountains and in the pebbles by the driveway. In this unit your child becomes a young geologist. They will go on a rock hunt, wash and look closely at five rocks, and sort them by color.

Next your child will test rocks the way real geologists do. A coin scratches soft chalk but not a hard pebble. Chalk pieces shaken in a jar of water lose their sharp corners, just as stones do in a river. Last of all comes the story of David, who “chose him five smooth stones out of the brook” (1 Samuel 17:40) and went out to meet Goliath trusting in the LORD. Your child will choose five smooth stones of their own and tell the story with them.

Everything in this unit is said, pointed to, sorted, built or drawn. No reading is needed. Keep the rocks from Lesson 1.1 in an egg carton; you will use them again in every lesson and in the final rock collection.

BEFORE YOU BEGIN

- Can count objects up to 10
- Can name common colors: gray, brown, white, black, red and pink
- Can listen to a short Bible story and tell part of it back
- Can hold a crayon and draw simple shapes

MASTERY CHECKLIST

- I can find rocks, look at them closely and sort them by color.
- I can test a rock with a coin to tell if it is hard or soft.
- I can feel whether a stone is smooth or rough.
- I can tell how moving water makes stones smooth and round.
- I can tell the story of David’s five smooth stones and say that God gave him the victory.
- I can say that God made the earth and the rocks in it.

OPTIONAL BOOKS AND RESOURCES

- **Collecting Rocks (U.S. Geological Survey)** (<https://pubs.usgs.gov/gip/collect1/collectgip.html>): Free. A short booklet from the USGS for parents on how to start a rock collection, where to look and how to label your finds.
- **Smithsonian National Museum of Natural History** (<https://naturalhistory.si.edu/>): Free. Browse pictures of rocks, gems and minerals with your child. If you visit Washington, D.C., the Hall of Geology, Gems, and Minerals is free to enter.

1.1 PICKING UP ROCKS ★

OBJECTIVES

- Find five rocks outdoors and look at them closely, the way a geologist does.
- Sort rocks into groups by color and count how many are in each group.
- Say that God made the earth and the rocks in it.

Warm-up. Close your eyes and hold out both hands. Your parent puts a rock in one hand and a toy block or a ball in the other. Feel them. Which one is colder? Which one is heavier? Which one is bumpy? Now guess: which hand is holding the rock? Open your eyes and see if you were right.

Video. Coming soon. Rocks for young children: looking at, collecting and sorting rocks by color (search SciShow Kids, Homeschool Pop (Alternate), Smithsonian National Museum of Natural History, USGS education and nature footage of pebbles and cliffs).

KEY TERMS

rock

A hard piece of the ground. Mountains, cliffs and the stones in your yard are all made of rock.

pebble

A small rock that fits in your hand.

sort

To put things that are alike into the same group.

geologist

A scientist who studies rocks and the ground.

CORE IDEAS

The story. Go outside and look down. Under the grass, under the dirt and under the sidewalk, there is rock. Mountains are made of rock. Cliffs by the sea are made of rock. The little stones in a driveway or a garden bed are rock too. A small rock that fits in your hand is called a **pebble**. Today you will go on a rock hunt. You will pick up five rocks, hold them in your hand and look at them very closely, just like a real scientist.

How they figured it out. A scientist who studies rocks is called a **geologist**. A geologist starts the same way you will. First, look. Then pick the rock up and turn it over. Then ask questions. What color is it? Is it shiny or dull? Does it have spots or stripes? Next, the geologist puts rocks that are alike into the same group. This is called **sorting**. Sorting helps us see which rocks belong together, and it helps us count them.

The big idea. Rocks come in many colors. Some are gray like an elephant. Some are brown like toast. Some are white like milk. Some are pink, red, green or almost black. Some are speckled with many colors, like a cookie with sprinkles. Here is a geologist's trick: dip a rock in water. A wet rock shows its colors much more brightly than a dry, dusty one. When your rocks are sorted by color, you can count each group and tell which group has the most.

God's handiwork. The very first verse of the Bible says, "In the beginning God created the heaven and the earth" (Genesis 1:1). The earth God made has rock all through it, strong enough to hold up hills and houses and you. Every pebble you pick up today is part of the ground God made. When you look closely at a rock, you are looking closely at His work.

PICTURE STUDY



Quarry (Study of a Rock Face), Albrecht Dürer, about 1495 · Watercolor and gouache on paper · British Museum, London, England

Albrecht Dürer was a painter from the city of Nuremberg in Germany. He loved to draw things just as they really are. He painted a young hare and a clump of wild grass, and he drew a pair of praying hands, so carefully that people still study them today.

One day Dürer sat down in front of a rocky place and painted it with watercolors. He did not paint a story or a person. He painted only the rocks: their colors, their cracks, and where the light fell on them. He looked at rocks the way a geologist does.

Look closely

- Find a crack in the rock. Trace it in the air with your finger.
- Point to a gray part. Now can you find a brown part?
- Find a place where the light is shining on the rock, and a place that is in shadow.
- Does this rock look smooth, or bumpy and broken?

Talk about it

1. If you could touch this rock, how do you think it would feel?
2. Which crayons would you use to draw the rocks you found today?
3. Why do you think Dürer wanted to paint plain rocks?

Safety first. Pick up rocks only where a grown-up says it is all right. Collecting rocks is not allowed in national parks, so look but leave them there. Never put a rock in your mouth, keep small pebbles away from babies and toddlers, and wash your hands after the rock hunt.

MAKE AND DO: MY FIRST ROCK HUNT

You will be a geologist in your own yard. You will find five rocks, wash them, look at them closely, and sort them by color.

You will need

- A small bag or bucket
- An empty egg carton or muffin tin
- A bowl of water and an old toothbrush
- An old towel
- Three or four sheets of colored paper (gray, brown, white or any colors that match your rocks)
- Crayons and paper
- A magnifying glass, if you have one

Steps

1. Walk around the yard, a garden bed or a gravel path with your parent. Look down!
2. Pick up five rocks. Choose rocks smaller than your fist. Try to find rocks that do not look the same.
3. Count your rocks into the bucket: one, two, three, four, five.
4. Wash each rock in the bowl of water. Scrub off the dirt with the toothbrush. Watch how the colors get brighter when the rock is wet.
5. Dry the rocks on the towel. Look at each one with the magnifying glass. Is it shiny or dull? Does it have spots or stripes?
6. Lay out the colored papers. Put each rock on the paper that matches its color best. Now your rocks are sorted!
7. Count the rocks on each paper. Which color group has the most?
8. Put your rocks in the egg carton to keep. Draw a picture of each one.

Tips

- If a rock has many colors, decide which color you see the most, or make a “speckled” group.

- Look under bushes and along the edges of paths, where rocks get pushed aside.
- Save your egg carton of rocks. You will use these same rocks in the next lessons.

Check your work

- I found five rocks and counted them.
- I sorted my rocks by color.
- I can tell which color group has the most rocks.

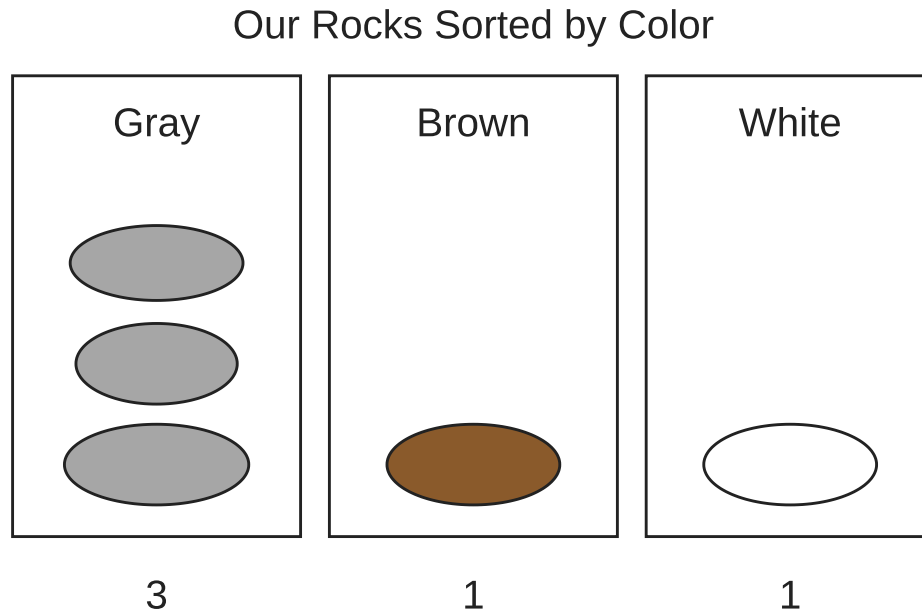
FIELD NOTEBOOK

1. Draw your five rocks in a row, the same size and colors as the real ones. Your parent can write the date at the top.
2. Draw your favorite rock very big, as if you were looking at it with a magnifying glass. Show every spot, stripe and crack.
3. Draw the place where you found your rocks: the yard, the path or the garden bed.

From history. In 1735 a Swedish scientist named Carl Linnaeus wrote a famous book about sorting God's creation. He loved to put things that are alike into groups. He sorted all of nature into three big groups, which he called kingdoms: the animal kingdom, the plant kingdom and the stone kingdom. There is an old guessing game that uses the same three groups: "Animal, vegetable or mineral?" Rocks and minerals belong in the stone kingdom.

WORKED EXAMPLES

Example 1. Look at the rock chart. How many gray rocks are there? How many brown rocks? How many white rocks? Which color group has the most?



Our five rocks sorted by color.

1. Point to the gray column. Touch each gray rock as you count: one, two, three. There are 3 gray rocks.
2. Point to the brown column and count: one. There is 1 brown rock.
3. Point to the white column and count: one. There is 1 white rock.
4. The gray stack is the tallest. The tallest stack has the most.
5. Count all the rocks together: three, four, five. There are 5 rocks in all.

Answer: 3 gray, 1 brown and 1 white. The gray group has the most. There are 5 rocks in all.

PRACTICE

1. **EASY** Walk around your house. Point to something made of rock or stone.
2. **EASY** Hold up one of your rocks. Tell your parent its color. Is it shiny or dull?
3. **MEDIUM** Your parent puts out 2 gray rocks and 4 brown rocks (buttons work too). Which group has more? How many are there in all?
4. **MEDIUM** Why does a geologist sometimes dip a rock in water?
5. **HARD** Draw your five rocks in their color groups. Then tell your parent about one rock: where you found it, its color, and how it feels.

COMMON MISTAKES

- Thinking all rocks are gray. Rocks can be white, pink, red, brown, green, black or speckled with many colors.
- Thinking rocks are only the loose stones lying on top of the ground. There is solid rock under the soil everywhere, even under the grass and the houses.
- Thinking the outside of a dirty rock shows its true color. Dirt and dust can hide the color, so wash the rock or look at a freshly broken side.

Make it a game · I Spy a Rock. Sit outside or at a table with your rocks. Your parent says, “I spy a rock that is gray and speckled,” or “I spy a rock that is brown and has a stripe.” Point to the right rock as fast as you can. Then trade places: you describe a rock and your parent finds it. Play until each player has had five turns.

Scripture. “In his hand are the deep places of the earth: the strength of the hills is his also.” (Psalm 95:4, KJV)

The rocks deep under the ground and the strong rocks of the hills all belong to God. He made them, and He holds them in His hand.

Practice answers

1. Answers will vary: a stone step, a stone wall, a fireplace, a stone countertop, gravel in a flowerpot, or a pebble from the rock hunt.
2. Answers will vary. The child names a color (gray, brown, white, pink, black, speckled) and says whether the rock is shiny or dull.
3. The brown group has more. There are 6 in all.
4. A wet rock shows its colors more brightly, so it is easier to see what color it really is.
5. The drawing shows the rocks grouped by color. The child tells where the rock was found, names its color, and says how it feels (for example, smooth, bumpy, heavy or cold).

1.2 HARD AND SOFT

OBJECTIVES

- Test whether a rock is hard or soft by trying to scratch it with a coin.
- Tell that chalk is a soft rock and that most pebbles are harder than a coin.
- Check a scratch test carefully, the way a real scientist does.

Warm-up. Put a banana, an apple and a wooden spoon on the table. Press your thumb gently into each one. Which one does your thumb dent? Which one is too hard to dent? Put them in a row from the softest to the hardest.

Video. Coming soon. Hard and soft rocks for young children: the scratch test, chalk, the white cliffs of Dover and the Mohs hardness scale explained simply (search SciShow Kids, Homeschool Pop (Alternate), Science Max, USGS education, Smithsonian National Museum of Natural History).

KEY TERMS

hard

Not easy to scratch or dent. A hard rock stays the same when you rub a coin on it.

soft

Easy to scratch, dent or rub away. A soft rock gets a groove or makes powder when you scratch it.

scratch

A thin line or groove rubbed into something.

chalk

A soft, white rock made of tiny, tiny shells, too small to see. Chalk for drawing is soft too.

CORE IDEAS

The story. Have you ever drawn on the sidewalk with chalk? The chalk rubs off and leaves a line of color. That happens because chalk is **soft**. Real chalk is a rock, made of tiny, tiny shells, far too small to see without a microscope. In England, by the sea at a town called Dover, there are tall white cliffs made of chalk! Now pick up a pebble and try to draw with it on the sidewalk. Most pebbles leave hardly any line at all. They are much **harder** than chalk.

How they figured it out. Geologists have a simple way to tell if a rock is hard or soft. They try to **scratch** it. If a coin scratches a rock, the rock is softer than the coin. If the coin cannot scratch the rock, the rock is harder than the coin. Rub the edge of a coin on a piece of chalk, and you will see a groove and a little pile of white powder. Rub the same coin on a hard pebble, and the pebble stays the same.

The big idea. Sometimes a coin leaves a gray or shiny line on a hard pebble. Is that a scratch? A real scientist checks. Rub the line with your thumb. If it wipes away, it was only a bit of metal from the coin, and the pebble was not scratched at all. Rocks can be soft or hard no matter how big they are. A tiny pebble can be harder than a big stick of chalk. We cannot tell just by looking. We have to test.

God's handiwork. Hard rock makes a good, strong place to build. Jesus told about a wise man who "built his house upon a rock" (Matthew 7:24). When the rain and the floods came, that house did not fall. God made some rocks soft, so we can draw and write with them. He made other rocks hard, so they can hold up mountains and houses. Both are good gifts.

PICTURE STUDY



The Étretat Cliffs after the Storm, Gustave Courbet, 1870 · Oil on canvas · Musée d'Orsay, Paris, France

Gustave Courbet was a French painter who loved to paint things just as they really look: rocks, waves, trees and animals. One summer he stayed at Étretat, a fishing village on the coast of France. Its tall white cliffs are made of chalk, the same soft rock you tested today. The same kind of chalk makes the white cliffs of Dover, across the sea in England.

Courbet painted this picture on a clear day just after a storm. Waves and rain wear soft chalk away, so the sea has carved these cliffs into steep walls and curving shapes.

Look closely

- Find the white chalk cliffs. What shapes do they make?
- Find the beach at the bottom of the cliffs. What do you see lying on it?
- Find the sea. Is it rough or calm now that the storm is over?
- Look at the sky. How can you tell the storm has gone away?

Talk about it

1. These cliffs are made of chalk. Do you think a coin could scratch them? Why?
2. If you stood on the beach under these cliffs, how would you feel?
3. What do you think the waves will do to the soft chalk when the next storm comes?

Safety first. Press gently with the coin and scratch away from your body. Coins and small pebbles can cause choking, so keep them out of mouths and away from babies and toddlers. Wash your hands after the test.

MAKE AND DO: THE SCRATCH TEST

You will test chalk and your rocks from Lesson 1.1 to find out which are soft and which are hard. You will sort them onto two mats: a soft mat and a hard mat.

You will need

- A piece of sidewalk chalk or white chalk
- Your five rocks from the rock hunt
- A coin
- Two paper plates
- Crayons

Steps

1. Make two mats. On one paper plate, draw a feather or a pillow. That is the soft plate. On the other plate, draw a hammer or a brick. That is the hard plate.
2. Guess first. Hold up the chalk. Do you think the coin will scratch it? Hold up a pebble. Do you think the coin will scratch it?
3. Hold the chalk on the table. Rub the edge of the coin across it, pressing gently, three times. Look closely. Do you see a groove? Do you see white powder?
4. The coin scratched the chalk, so the chalk is soft. Put it on the soft plate.
5. Now hold one pebble on the table. Rub the edge of the coin across it three times. Look closely.
6. Is there a line? Rub it hard with your thumb. If the line wipes away, it was only metal from the coin. The pebble is hard. Put it on the hard plate.
7. Test each of your rocks the same way and put each one on the right plate.
8. Count the rocks on each plate. Which plate has more?
9. Last, try scratching the chalk with your fingernail. Chalk is so soft that even a fingernail can mark it!

Tips

- Use the same coin and press the same way for every rock. That makes it a fair test.
- Most yard pebbles will be hard. If the coin does scratch one of your rocks, you found a soft rock. Good work, geologist!

- Look with a magnifying glass to see the groove in the chalk.

Check your work

- I can scratch chalk with a coin.
- I can check whether a line on a pebble is a real scratch.
- I sorted my rocks into soft and hard.

FIELD NOTEBOOK

1. Draw your two plates, the soft plate and the hard plate, with your rocks on them.
2. Draw a piece of chalk with the groove the coin made and the little pile of powder beside it.
3. Draw a house built on a big, hard rock, like the wise man's house.

From history. In 1812 a German geologist named Friedrich Mohs made a list of ten minerals, from the softest to the hardest. Each one can scratch the ones before it on the list. The softest is talc, a mineral so soft it was ground up to make baby powder. The hardest is diamond. Geologists still use the Mohs scale today, and they still test rocks the same way you did: by trying to scratch them.

WORKED EXAMPLES

Example 1. Look at the scratch chart. A check mark means the coin scratched it. An X means the coin did not scratch it. How many things are soft? How many are hard?

Did the coin scratch it?	
 chalk	✓
 gray pebble	✗
 white pebble	✗
 brown pebble	✓

Did the coin scratch it? A check mark means yes.

1. Point to each row. The chalk has a check mark. The coin scratched it, so it is soft.
2. The gray pebble has an X. It is hard.
3. The white pebble has an X. It is hard.
4. The brown pebble has a check mark. It is soft.
5. Count the check marks: one, two. Count the Xs: one, two.

Answer: 2 are soft (the chalk and the brown pebble). 2 are hard (the gray pebble and the white pebble).

PRACTICE

1. **EASY** Which is softer, a piece of chalk or most pebbles?
2. **EASY** Point to something hard in this room. Now point to something soft.
3. **MEDIUM** A coin leaves a shiny line on a pebble. How can you check whether it is a real scratch?
4. **MEDIUM** You have 3 soft rocks and 2 hard rocks. How many rocks do you have in all? Use your fingers to count.
5. **HARD** Jesus said the wise man built his house upon a rock. Why is hard rock a good place to build a house?

COMMON MISTAKES

- Thinking big rocks are hard and small rocks are soft. Size does not tell us. A tiny pebble can be harder than a big piece of chalk.
- Thinking every line a coin leaves is a scratch. Often it is just metal from the coin. Rub it with your thumb to check.
- Thinking a heavy rock must be a hard rock. Heavy and hard are not the same. The only way to know is to test.

Make it a game · Hard or Soft?. Your parent names a thing: a pillow, a rock, a marshmallow, a brick, a cotton ball, a spoon, a teddy bear, a sidewalk. If it is hard, knock your fist gently on the table. If it is soft, wiggle your fingers in the air. Get one point for each right answer. When you reach ten points, you name things for your parent.

Scripture. “Therefore whosoever heareth these sayings of mine, and doeth them, I will liken him unto a wise man, which built his house upon a rock: And the rain descended, and the floods came, and the winds blew, and beat upon that house; and it fell not: for it was founded upon a rock.” (Matthew 7:24-25, KJV)

A house on hard rock stands firm in a storm. Jesus says that a person who listens to His words and does them is like that wise builder.

Practice answers

1. The chalk is softer. A coin can scratch chalk, but it cannot scratch most pebbles.
2. Answers will vary. Hard: a table, a wall, a spoon, a rock. Soft: a pillow, a blanket, a stuffed animal, a sock.
3. Rub the line with your thumb. If it wipes away, it was only metal from the coin, and the pebble is hard. If a groove is still there, the rock was really scratched.
4. 5 rocks in all.
5. Hard rock is strong. It does not wash away or crumble when the rain and floods come, so the house stays standing.

1.3 SMOOTH AND ROUGH

OBJECTIVES

- Tell by touch whether a rock is smooth or rough.
- Explain that moving water rolls and tumbles rocks until their corners wear away.
- Make rough chalk pieces smoother by tumbling them in a jar of water.

Warm-up. Rub your hand on a towel, then on a dinner plate, then on the bottom of a shoe or a piece of sandpaper. After each one, say “smooth” or “rough.” Now close your eyes. Your parent puts one of them under your hand. Can you guess which one it is?

Video. Coming soon. How river stones and beach pebbles become smooth and round: water tumbling rocks, rock tumblers and creek footage (search SciShow Kids, Homeschool Pop (Alternate), Science Max, USGS education and nature footage of streams and pebble beaches).

KEY TERMS

smooth

Even all over, with no bumps or sharp points. A bar of soap is smooth.

rough

Bumpy or scratchy, with edges and points you can feel.

tumble

To roll over and over. Rocks tumble in a river when the water pushes them along.

river stone

A rock that has been rolled and rubbed by moving water until its corners wore away.

CORE IDEAS

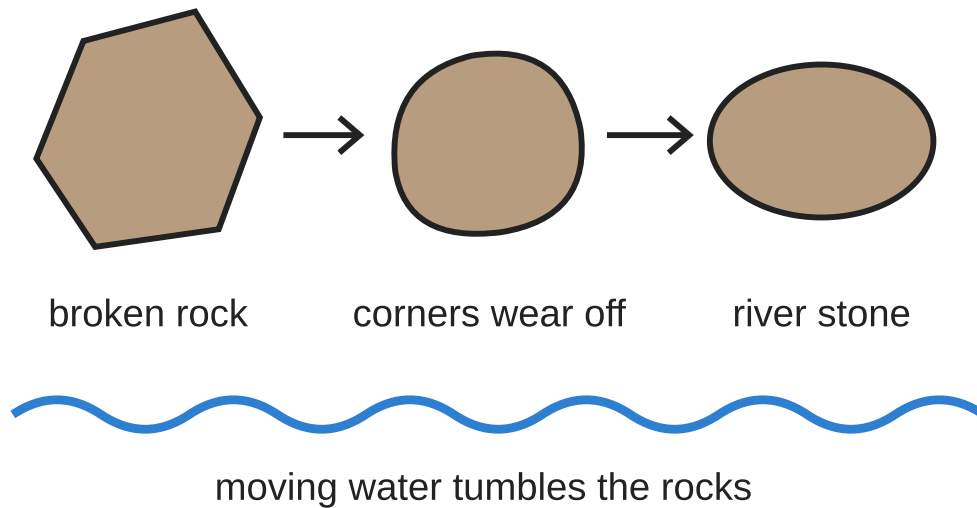
The story. Hold two rocks, one in each hand. One comes from a creek, a river or a beach. It is **smooth** and round, like a bar of soap or an egg. The other comes from a gravel driveway. It is **rough**, with sharp corners and edges that poke your fingers. Gravel like that is made when big machines crush large rocks into pieces. Both are rocks. Why are they so different?

How they figured it out. When a rock first breaks off a cliff or a mountain, it has sharp corners, just like a broken cookie. If the rock falls into a river, the moving water pushes it along. It rolls and **tumbles**. It bumps into other rocks and scrapes over the sand on the bottom. Each bump rubs off a tiny bit of rock. The corners stick out the most, so they wear away first. Bump after bump, the rock gets rounder and smoother. Waves on a beach do the same thing, rolling stones back and forth.

The big idea. The shape of a stone tells a story. A rough rock with sharp corners has just broken, or it has not been rolled very far. A smooth, round stone has been tumbled and

rubbed by water over and over. Smooth does not mean soft. Many river stones are very hard rocks. The water did not melt them. It rolled them, and the rocks and sand wore each other down, a tiny bit at a time.

God's handiwork. The Bible says, "The waters wear the stones" (Job 14:19). People noticed long, long ago that moving water makes stones smooth. God made water and rock to work together. Every smooth pebble on a beach or in a creek has been rolled and polished by the water He made.



Moving water tumbles a broken rock until its corners wear away and it becomes a smooth river stone.

PICTURE STUDY



John Ruskin, John Everett Millais, 1853–1854 · Oil on canvas · Ashmolean Museum, Oxford, England

John Ruskin was an English writer who loved rocks. As a boy he collected minerals, and when he grew up he wrote whole chapters about how to draw mountains and stones. His friend John Everett Millais was a painter.

One summer they traveled to Glenfinlas, a valley in Scotland with a rocky, rushing stream. Millais painted Ruskin standing on the rocks beside the rushing water. He painted the rocks right there by the stream, slowly and carefully, stone by stone.

Look closely

- Find the water rushing over the rocks. What color is it where it splashes?
- Point to a rock that looks smooth and rounded. Why do you think it is smooth?
- Find a place where the rocks look wet and dark, and a place where they look dry and light.
- Find John Ruskin. Where is he standing?

Talk about it

1. If you put your hand on the rocks in the stream, would they feel smooth or rough?
2. What sounds do you think Ruskin heard while he stood there?
3. Why do you think Millais painted the rocks so carefully?

Safety first. Only go near a creek, river or beach with a grown-up, and never wade in fast water. Use a plastic jar, not glass, for the tumbling test. A grown-up should break the chalk into pieces. Wash your hands after handling rocks.

MAKE AND DO: RIVER STONES IN A JAR

A river takes a long time to make a stone smooth. Chalk is so soft that you can see the same thing happen in a jar in just a few minutes. You will be the river!

You will need

- Two sticks of sidewalk chalk or white chalk
- A plastic jar with a tight lid (a peanut butter jar works well)
- Water
- A paper towel
- A smooth stone and a rough piece of gravel to feel, if you have them
- Crayons and paper

Steps

1. Feel a smooth stone and a rough piece of gravel. Say which is smooth and which is rough.
2. Your parent snaps each stick of chalk into three or four rough pieces. Feel the sharp corners and broken edges.
3. Keep one rough piece out on the paper towel. This is your “before” piece.
4. Put the other pieces in the plastic jar. Fill the jar halfway with water. Screw the lid on tight.
5. Shake the jar hard while you count to 10. Rest. Shake again while you count to 10. Do this five times. The rocks are tumbling, just like in a river!
6. Look at the water. Is it cloudy? That is chalk dust that wore off the pieces.
7. Pour the pieces out onto the paper towel. Put them next to your “before” piece.
8. Feel the corners. Which pieces are rough? Which are smoother and rounder?
9. Draw a “before” piece and an “after” piece side by side.

Tips

- If the corners are still sharp, shake some more. Real river stones are tumbled much, much longer than this.
- Keep your “before” piece dry so you can compare.
- A sugar cube also works. Shake it in a dry, closed jar and watch its corners turn round.

Check your work

- I can feel the difference between smooth and rough.
- I can tell how a river makes stones smooth.
- I made rough chalk pieces smoother by tumbling them.

FIELD NOTEBOOK

1. Draw a broken rock with sharp corners and a smooth river stone. Your parent can write “rough” and “smooth” under them.
2. Draw a river with stones tumbling along the bottom.
3. Find a smooth stone and lay it on your paper. Trace around it with a crayon, then draw its spots and stripes inside.

From history. On the south coast of England there is a long pebble beach called Chesil Beach. The waves have sorted its pebbles by size: they are small, like peas, at one end, and big, like potatoes, at the other. People say that fishermen landing on the beach on a dark night could tell where they were just by picking up a pebble and feeling how big it was.

WORKED EXAMPLES

Example 1. Look at the three rocks in the picture. Count the sharp corners on the broken rock. How many sharp corners does the river stone have? Which rock has been tumbled the most by the water?

(Use the map or drawing “From rough to smooth.” shown earlier in this lesson.)

1. Point to the first rock, the broken rock. Touch each sharp point as you count: one, two, three, four, five, six.
2. Point to the last rock, the river stone. Look for sharp points. There are none. It is round all the way around.
3. The middle rock has lost its sharp points but is not yet round all over.
4. The rock with no corners at all has been tumbled the most.

Answer: The broken rock has 6 sharp corners. The river stone has 0. The river stone has been tumbled the most.

PRACTICE

1. **EASY** Close your eyes. Your parent puts a stone in your hand. Is it smooth or rough?
2. **EASY** Where could you look to find smooth, round stones?
3. **MEDIUM** What makes river stones smooth?
4. **MEDIUM** Your parent puts out 5 smooth stones and 3 rough stones (or draws them). Which group has more? How many more?
5. **HARD** Is a smooth river stone always soft? Tell your parent why or why not.

COMMON MISTAKES

- Thinking someone polished river stones with a machine. Moving water and the bumping of other rocks and sand made them smooth.

- Thinking water melts rocks like ice. Rocks do not melt in a river. They are rubbed and worn down, a tiny bit at a time.
- Thinking a smooth stone must be soft. Many smooth river stones are very hard. Smooth tells about shape; hard and soft tell what a scratch test shows.

Make it a game · Feely Sock. Your parent puts four or five stones, some smooth and some rough, inside an old sock. Reach in without looking. Pull out a smooth one. Then pull out a rough one. Did you choose right? Take turns. For a harder game, your parent adds a piece of chalk or a toy, and you must leave it in the sock and pull out only stones.

Scripture. “The waters wear the stones” (Job 14:19, KJV)

These are the first words of the verse. Long ago, Job saw what you saw in your jar: moving water slowly wears stones away and makes them smooth.

Practice answers

1. Answers will vary. Smooth stones feel even and round with no sharp points. Rough stones have bumps, edges and points.
2. In a creek, a river or a brook, or on a beach where waves roll the stones.
3. Moving water rolls and tumbles them. They bump into other rocks and scrape on sand, and their corners wear away a tiny bit at a time.
4. The smooth group has more. It has 2 more.
5. No. Smooth and soft are different. Many river stones are very hard. They became smooth because water tumbled them and rubbed off their corners, not because they are soft.

1.4 DAVID'S FIVE SMOOTH STONES

OBJECTIVES

- Retell the story of David choosing five smooth stones from the brook (1 Samuel 17:40).
- Choose five smooth stones and tell why a smooth, round stone was the best kind for a sling.
- Say that David trusted God, and that God gave him the victory.

Warm-up. Put a ball and a toy block on the floor. Give each one a gentle push. Which one rolls straight and far? Which one tumbles and stops? A round thing moves smoothly. Keep that in mind as you hear David's story.

Video. Coming soon. David and Goliath for young children, 1 Samuel 17, and how a shepherd's sling works, with footage of smooth stones in a brook (search Moody Science classics, children's Bible story channels that follow the KJV closely, Smithsonian and museum videos on ancient slings, and nature footage of streams).

KEY TERMS

shepherd

A person who takes care of sheep and keeps them safe.

sling

A long strap or cord with a little pouch in the middle. A shepherd put a stone in the pouch, swung it around, and let go to throw the stone very far.

brook

A small stream of running water.

scrip

An old word for a shepherd's small bag.

CORE IDEAS

The story. Long ago, the army of Israel stood on one hill, and the army of the Philistines stood on another hill. Between them was a valley. Every day a giant named Goliath came out and shouted at Israel. He wore heavy armor and carried a huge spear. All the soldiers were afraid. Then a young **shepherd** named David came with food for his brothers. David was not afraid, because he trusted God. King Saul put his own armor on David, but David took it off. He was not used to it (1 Samuel 17).

How they figured it out. David took his staff and his **sling**. Then he "chose him five smooth stones out of the brook" (1 Samuel 17:40). David knew stones. He had kept his father's sheep safe from a lion and a bear (1 Samuel 17:34-36). He knew that a smooth, round stone sits snugly in the sling and flies straight. A rough, jagged stone wobbles and can slip out.

And he knew just where to find smooth stones: in a **brook**, where running water had rolled them round.

The big idea. David used what he knew about God's world. That is what scientists do too. But David knew the stone alone would not win. He told Goliath, "I come to thee in the name of the LORD of hosts" (1 Samuel 17:45). He said, "the battle is the LORD's" (1 Samuel 17:47). David put one stone in his sling and swung it. The stone flew and struck Goliath on the forehead, and the giant fell down. God gave Israel the victory that day.

Try it and see. Today you will be like David at the brook. You will look at many stones and choose five smooth ones. Rub each stone between your hands. Is it smooth all over? Is it round? Does it have any sharp corners? Count your stones into a little shepherd's bag: one, two, three, four, five. Then use them to tell David's story to someone in your family.

PICTURE STUDY



David and Goliath, Osmar Schindler, 1888 · Painting, widely known from prints and reproductions · Location not well recorded; the painting is widely reproduced

Osmar Schindler was a German painter who taught art in the city of Dresden. In this painting he shows the moment when young David goes out to meet the giant Goliath.

Look at how small David is and how big Goliath is. David has no armor and no sword. He has only his sling, his stones and his trust in God.

Look closely

- Find David. Is he big or small? What is he wearing?
- Find Goliath. What is he wearing? What is he holding?
- Find David's sling.

- Find the soldiers watching. How do you think they feel?

Talk about it

1. Does David look afraid? Why not?
2. If you were drawing this story, where would you put the brook with the smooth stones?
3. What would you say to Goliath if you were David?

Safety first. Never throw stones at people, animals, cars or windows, and do not make or swing a real sling. Collect stones only where a grown-up says it is all right, and only go near a creek with a grown-up. Keep small stones away from babies and toddlers, and wash your hands afterward.

MAKE AND DO: A SHEPHERD'S BAG OF FIVE SMOOTH STONES

You will make a shepherd's bag, called a scrip, and then choose five smooth stones to put in it, just as David did at the brook.

You will need

- A brown paper lunch bag (or an old sock)
- A piece of yarn or string about as long as your arm, for a strap
- Tape or a stapler (a grown-up uses the stapler)
- Crayons
- A pile of stones to choose from: your rocks from this unit, gravel from a path, or stones from a creek bank with a grown-up
- A laundry basket and five rolled-up pairs of socks for the game

Steps

1. Make your scrip. Color the paper bag brown or tan, like a shepherd's leather bag. Draw a sheep on it if you like.
2. Your parent tapes or staples the string to the top of the bag so you can wear it over your shoulder.
3. Pour out the pile of stones. Look at them all. Some are rough and some are smooth.
4. Pick up one stone at a time. Rub it between your hands. Feel for sharp corners. Ask: is it smooth? Is it round?
5. Choose the five smoothest, roundest stones. Count them into your scrip: one, two, three, four, five.
6. Pour your five stones out on the table. Count them again, this time backward: five, four, three, two, one.
7. Now tell David's story with your stones. Use one big rock for Goliath and one small stone for David.
8. Play a safe shepherd game: set up the laundry basket, step back three big steps, and toss the rolled-up socks into the basket. Count how many go in. (Stones stay in the bag. Socks are for tossing!)

Tips

- Stones about the size of a walnut or a little bigger are good for a shepherd's bag.
- If two stones seem the same, close your eyes and feel them. Your fingers can tell smooth from rough.
- Keep your scrip and stones to use in the unit review.

Check your work

- I made a shepherd's bag.
- I chose five smooth stones and counted them.
- I can tell David's story and say who gave him the victory.

FIELD NOTEBOOK

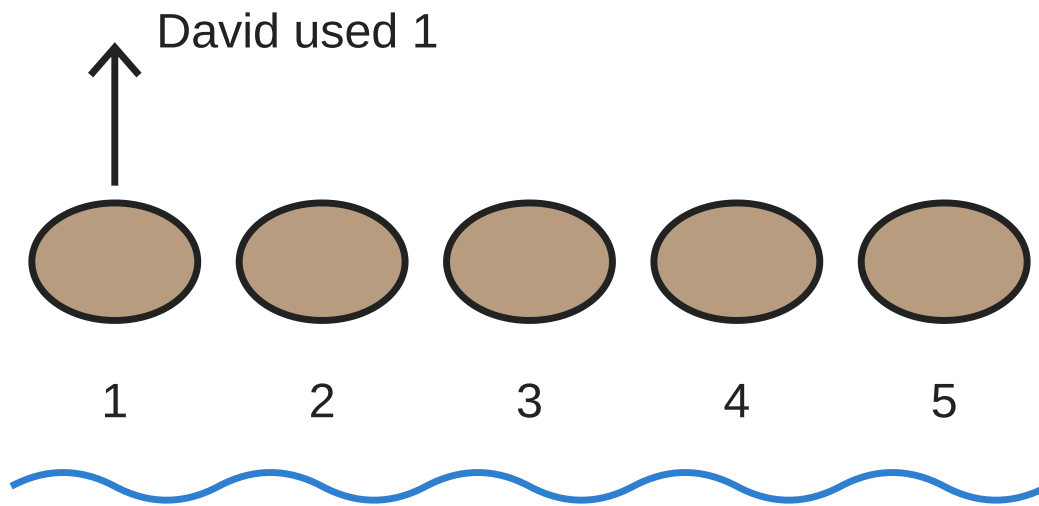
1. Draw David at the brook, bending down to pick up smooth stones from the water.
2. Draw your five smooth stones in a row. Your parent can write the numbers 1 to 5 under them.
3. Draw David and Goliath. Make Goliath very big and David small, and show David holding his sling.

From history. Slings were a real weapon in Bible times, and some people were amazing with them. The book of Judges tells of seven hundred left-handed men who "could sling stones at an hair breadth, and not miss" (Judges 20:16). Archaeologists digging at old cities in Israel, such as Lachish, have found many round sling stones, some about the size of a tennis ball, lying where they fell long ago.

WORKED EXAMPLES

Example 1. David chose 5 smooth stones. He put 1 stone in his sling and threw it at Goliath. How many stones were left in his bag?

David's Five Smooth Stones



David's five smooth stones.

1. Look at the picture. Count the stones: one, two, three, four, five. David had 5 stones.
2. The arrow shows the 1 stone David used.
3. Cover that stone with your finger. Count the stones that are left: one, two, three, four.
4. You can also hold up 5 fingers and fold down 1. Count the fingers still up.

Answer: 4 stones were left in David's bag. He needed only one, because God gave him the victory.

PRACTICE

1. **EASY** How many stones did David choose? Hold up that many fingers.
2. **EASY** Where did David find his smooth stones?
3. **MEDIUM** Why were the stones in the brook smooth?
4. **MEDIUM** Why is a smooth, round stone better for a sling than a rough, jagged one? Show with your stones.
5. **HARD** David was small and Goliath was a giant. Who helped David win? Tell what David said.

COMMON MISTAKES

- Thinking David won because he was big and strong. David was young and much smaller than Goliath. He trusted the LORD, and God gave him the victory.
- Thinking David's sling was a slingshot with a rubber band. A Bible sling was a long strap or cord with a pouch in the middle, swung around and let go.
- Thinking any rock would do. David chose smooth stones, because smooth, round stones fly straight and fit the sling well.

Make it a game • Five Stones. Long ago, children in many lands played a game called five stones, a little like jacks. Here is an easy way to play. Scatter your five smooth stones on a rug. Toss a soft ball up, pick up one stone, and catch the ball (or let it bounce once first). Keep going until you have picked up all five. Count out loud each time: one, two, three, four, five. Then let your parent try!

Scripture. "And he took his staff in his hand, and chose him five smooth stones out of the brook, and put them in a shepherd's bag which he had, even in a scrip; and his sling was in his hand: and he drew near to the Philistine." (1 Samuel 17:40, KJV)

David did his part: he chose good stones and was ready with his sling. But he went out trusting God. We can work carefully and still trust God for the outcome.

Practice answers

1. 5 stones. The child holds up five fingers.
2. In the brook, a small stream of running water.
3. The running water rolled and tumbled them, and their corners wore away, just like the river stones in Lesson 1.3.
4. A smooth, round stone sits snugly in the pouch and flies straight. A rough, jagged stone wobbles and can slip out.
5. God helped David win. David trusted the LORD. He said he came in the name of the LORD of hosts, and that the battle is the LORD's.

UNIT 1 REVIEW

This is an oral review. Read each question aloud and let your child answer by telling, pointing, sorting or showing. Have the egg carton of rocks, a piece of chalk, a coin and the five smooth stones ready. Give full points for a clear answer in your child's own words. The review is worth 20 points.

1. (3 pts) Pick up one of your rocks and show me how a geologist looks at it. What questions does a geologist ask about a rock?
2. (3 pts) Here are 2 gray rocks and 3 brown rocks, all mixed up. Sort them by color. Which group has more? How many rocks are there in all?
3. (3 pts) Which is softer, chalk or most pebbles? Show me how you can tell with a coin.
4. (3 pts) A coin leaves a shiny line on a pebble. How do you check if it is a real scratch?
5. (2 pts) Close your eyes and feel these two stones. Which one is smooth and which one is rough?
6. (3 pts) Why are stones from a river or a beach smooth and round?
7. (3 pts) Tell me the story of David's stones. How many stones did he choose? Where did he find them? Who gave him the victory?

UNIT PROJECT: MY ROCK COLLECTION

Make a rock collection in an egg carton or a shoe box with sections. Include your five rocks from the rock hunt sorted by color, at least one soft rock or piece of chalk and one hard pebble, one rough rock and one smooth river stone, and David's five smooth stones in your shepherd's bag. Make a drawing card for each section. Then give a short "museum tour" to your family: point to each rock and tell what you learned about it.

- **Collecting:** The collection has rocks for every lesson: color groups, hard and soft, smooth and rough, and five smooth stones.
- **Sorting:** Rocks are placed in clear groups, and the child can count the rocks in each group.
- **Telling:** On the museum tour the child explains the scratch test, how water makes stones smooth, and the story of David in their own words.
- **Care:** Rocks are clean, the drawings are colorful, and the collection is neat and kept safe.

Answer key

1. The child looks closely and turns the rock over, and asks questions such as: What color is it? Is it shiny or dull? Does it have spots or stripes? Is it smooth or rough?
2. The child makes a gray group and a brown group. The brown group has more. There are 5 rocks in all.
3. Chalk is softer. The child rubs the coin on the chalk and shows the groove and powder, then rubs it on a pebble, which stays the same.

4. Rub the line with your thumb. If it wipes away, it was only metal from the coin and the pebble is hard.
5. The child correctly names the smooth stone and the rough stone by touch.
6. Moving water rolls and tumbles them. They bump other rocks and scrape on sand, and their sharp corners wear away a tiny bit at a time.
7. David chose five smooth stones from the brook and put them in his shepherd's bag. He went out to meet the giant Goliath with his sling, trusting God. He used one stone, and God gave him the victory.

DIRT AND MUD

God made the ground under our feet, and it is full of wonders. In this unit your child will dig, shake, squish and plant like a real soil scientist. We will shake soil in a jar of water and watch it settle into layers of stones, sand, silt and clay. We will find earthworms and see how they make soil rich. We will mix mud and straw and dry our own little bricks in the sun.

Along the way we will hear three Bible stories about the ground: God forming the first man “of the dust of the ground” (Genesis 2:7), the Israelites making bricks for Pharaoh (Exodus 5), and Jesus’ parable of the sower, whose seed “fell into good ground” (Matthew 13:8). Our picture study includes Jean-François Millet’s *The Sower*. The unit ends with a fair test: a bean in good soil and a bean in sand, side by side in the window.

BEFORE YOU BEGIN

- Can count objects to 12
- Can sort things into two groups by how they look or feel
- Has finished Unit 1 (Rocks) or can say that rocks can be big or small, hard or soft

MASTERY CHECKLIST

- I can tell what soil is made of: bits of rock, bits of old plants, water and air.
- I can point to the layers in a soil shake jar and tell which bits sank first.
- I can tell three ways worms help the soil.
- I can make a sun-dried mud brick and tell why straw makes it stronger.
- I can tell why a bean grows better in good soil than in sand.
- I can retell the parable of the sower and the good ground.

OPTIONAL BOOKS AND RESOURCES

- **Soils 4 Kids, from the Soil Science Society of America** (<https://www.soils4kids.org/>): Free. Simple pages, pictures and activities about soil for children and teachers. A parent can choose pictures of soil critters and soil layers to show.
- ***The Natural History of Selborne*, by Gilbert White (free at Project Gutenberg)** (<https://www.gutenberg.org/>): Free. Search for the title. A parent may read aloud a few lines from Gilbert White’s letter about earthworms (Lesson 2.2). The whole book is for grown-ups.

2.1 WHAT IS DIRT? ★

OBJECTIVES

- Tell that dirt (soil) is a mix of tiny bits of rock, bits of old plants, water and air.
- Shake soil in a jar of water and point to the layers as they settle: stones and sand on the bottom, fine mud above.
- Say that God formed the first man from the dust of the ground (Genesis 2:7).

Warm-up. Go outside with a spoon and a white paper plate. Scoop one spoonful of dirt onto the plate. Spread it out with a finger. Look closely. Can you find a tiny stone? A bit of a leaf or a root? Is it dry or damp? Smell it. Rub a pinch between your fingers. Does it feel gritty or smooth?

Video. Coming soon. Soil for young children: what soil is made of and a soil jar shake test; search SciShow Kids, Homeschool Pop (Alternate), Science Max, USDA NRCS and Soil Science Society of America kids' videos, and garden nature footage.

KEY TERMS

soil

The dirt that covers the ground where plants grow. It is a mix of tiny bits of rock, bits of old plants, water and air.

sand

Tiny bits of rock you can see and feel. Sand feels gritty.

clay

Bits of rock so tiny you cannot see one alone. Wet clay feels smooth and sticky.

settle

To sink slowly to the bottom of water and stay there.

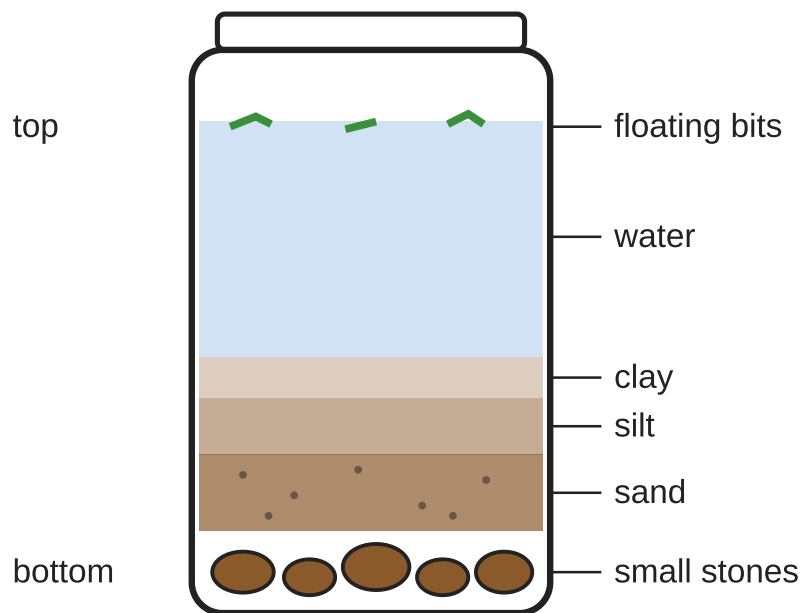
CORE IDEAS

The story. Pick up a handful of dirt. It looks plain and brown. But dirt is full of surprises! A scientist calls it **soil**. If you look closely, you can find tiny stones, bits of dead leaves, little roots and maybe even a beetle or a worm. Soil is under the grass, under the garden and under the trees. Almost every plant you have ever seen grows in it.

How they figured it out. How can we tell what soil is made of? Here is a trick that real soil scientists use. Put some soil in a jar of water, close the lid tight and shake it hard. Now set it down and wait. The heavy bits sink fast. Little stones and **sand** fall to the bottom first. Then finer mud, called silt, **settles** on top of the sand. The tiniest bits, called **clay**, sink very slowly. They keep the water cloudy for a long time. Bits of old leaves and roots are light, so they float on top.

The big idea. Soil is a mix. It has bits of rock in many sizes: stones, sand, silt and clay. It has bits of old plants that have rotted and turned dark. It has water and air in the little spaces between the bits. When rock is slowly broken into crumbs by water, ice, wind and roots, it becomes part of soil. Good garden soil has some of each, so it holds water but still lets air in for the roots.

God's handiwork. The Bible says God made the first man from dirt! "The LORD God formed man of the dust of the ground." Then God breathed life into him. The ground under your feet is a gift. It holds up our houses, grows our food and feeds the trees. When you look at your soil jar, you are looking at something God made with great care.



After shaking, soil settles in layers. The biggest, heaviest bits sink first.

PICTURE STUDY



The Large Piece of Turf, Albrecht Dürer, 1503 · Watercolor and gouache on paper · Albertina, Vienna, Austria

Albrecht Dürer was a German artist who loved to look closely at small things God made. He painted a clump of grass and weeds up close, as if he were a tiny bug looking up at a forest. He painted every blade of grass. At the bottom, he painted the dark, wet dirt the plants grow from.

Look closely

- Point to the dark dirt at the very bottom of the picture. What color is it?
- Find the tall dandelion flowers with their round heads.
- Find the roots and stems going down into the dirt.
- Count the dandelion heads you can find.

Talk about it

1. Why do you think Dürer painted the dirt along with the plants?
2. If you dug up this clump, what might you find in its dirt?
3. Is this picture big like a field, or close up like a bug would see it?

Safety first. Use a plastic jar with a tight lid, or have a grown-up hold a glass jar. Do not put dirt in your mouth. Wash your hands with soap after touching soil.

MAKE AND DO: THE SOIL SHAKE JAR

You will shake soil in a jar of water and watch it sort itself into layers, just like a soil scientist.

You will need

- A clear jar with a tight lid (a peanut butter jar or quart jar)
- Soil from the yard or garden, enough to fill the jar about one third
- Water
- A spoon or small shovel
- A marker or tape for marking layers
- Crayons and paper

Steps

1. Dig up some soil from the yard. Pick out big sticks and rocks.
2. Spoon soil into the jar until it is about one third full.
3. Pour in water until the jar is almost full. A grown-up closes the lid tight.
4. Shake, shake, shake! Count to thirty while you shake hard.
5. Set the jar on a table where no one will bump it. Watch for one minute. What sinks first?
6. Come back after one hour. Point to the layers. A grown-up can mark each layer with tape.
7. Leave it until tomorrow. Is the water clearer now? Look for bits floating on top.
8. Draw your jar with crayons. Color each layer the color you see.

Tips

- A squirt of dish soap in the water helps the bits come apart and settle more neatly.
- Try a second jar with sand from a sandbox. Do you get the same layers?

Check your work

- I can point to the stones and sand at the bottom.
- I can point to the fine mud on top of the sand.
- I can tell what floated on top.

FIELD NOTEBOOK

1. Draw your soil jar right after shaking (all cloudy) and the next day (in layers).
2. Tape a pinch of dry soil to the page with clear tape. Draw what you found in it: stones, leaves, roots.
3. Draw a plant growing in soil, with its roots reaching down into the dirt.

From history. George Washington Carver was a Christian scientist who taught farmers in Alabama how to care for their soil. Years of growing only cotton had worn the soil out. Carver showed farmers that planting peanuts, sweet potatoes and peas helped make the soil rich again. He even loaded a wagon with tools and seeds and drove it out to the farms, so farmers could learn right in their own fields.

WORKED EXAMPLES

Example 1. Look at the soil jar picture. How many layers of rock bits settled on the bottom? Which layer is at the very bottom?

(Use the map or drawing “Count the layers from the bottom up.” shown earlier in this lesson.)

1. Start at the bottom of the jar and point to each layer as you go up.
2. Small stones (1), sand (2), silt (3), clay (4).
3. Stop when you reach the water. The water and floating bits are not rock layers.

Answer: Four layers. Small stones are at the very bottom because they are biggest and heaviest.

PRACTICE

1. **EASY** Name two things you might find in a handful of soil.
2. **EASY** In the shake jar, which sinks first: a little stone or a speck of clay?
3. **EASY** Rub sand and wet clay between your fingers. Which feels gritty? Which feels smooth and sticky?
4. **MEDIUM** Why is the water still cloudy after the jar sits for an hour?
5. **MEDIUM** Sort these into two piles, “bits of rock” and “bits of plants”: sand, a dead leaf, a pebble, a root, clay.

COMMON MISTAKES

- Thinking dirt is all the same. Soil is a mix of rock bits, old plant bits, water and air, and soil in one yard can be different from soil in another.
- Thinking dirt is just “dirty” and useless. Soil grows nearly all our food.
- Thinking everything sinks at the same speed. Big, heavy bits sink fast; tiny clay bits sink very slowly.

Make it a game · Sink Fast, Sink Slow. A parent calls out a soil part: “stone!”, “sand!”, “clay!” or “leaf!” For a stone, drop to the floor fast. For sand, sink down a little slower. For clay, sink very, very slowly. For a leaf, float on tiptoe with your arms out. Play until everyone is giggling on the floor.

Scripture. “And the LORD God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul.” (Genesis 2:7, KJV)

God made the first man from the dust of the ground, then gave him life. Soil is a humble thing, but God used it in His most wonderful work.

Practice answers

1. Any two: tiny stones, sand, bits of leaves, roots, water, a worm or a bug.
2. The little stone. It is bigger and heavier, so it sinks fast.
3. Sand feels gritty. Wet clay feels smooth and sticky.
4. The tiniest clay bits are so small and light that they sink very slowly. They float in the water for a long time.
5. Bits of rock: sand, pebble, clay. Bits of plants: dead leaf, root.

2.2 WORMS IN THE SOIL

OBJECTIVES

- Tell three ways earthworms help soil: they eat dead leaves, leave rich castings and dig tunnels for air and water.
- Find, watch and gently handle an earthworm, then put it back where it lives.
- Count worms found in two places and say which place had more.

Warm-up. Go outside after a rain, or water a patch of garden with a watering can and wait a few minutes. Lift a flat stone, a board or a pile of damp leaves. What lives underneath? Look for wiggly earthworms. Gently put the stone back when you are done.

Video. Coming soon. Earthworms for young children: how worms dig tunnels, eat leaves and make castings, with close-up nature footage; search SciShow Kids, Homeschool Pop (Alternate), Science Max, Smithsonian, and garden and nature channels with underground worm footage.

KEY TERMS

earthworm

A long, soft animal with no legs and no bones that lives in the soil.

tunnel

A long hole a worm makes as it pushes and eats its way through the dirt.

castings

Worm droppings. They are little dark crumbs that make soil rich and good for plants.

CORE IDEAS

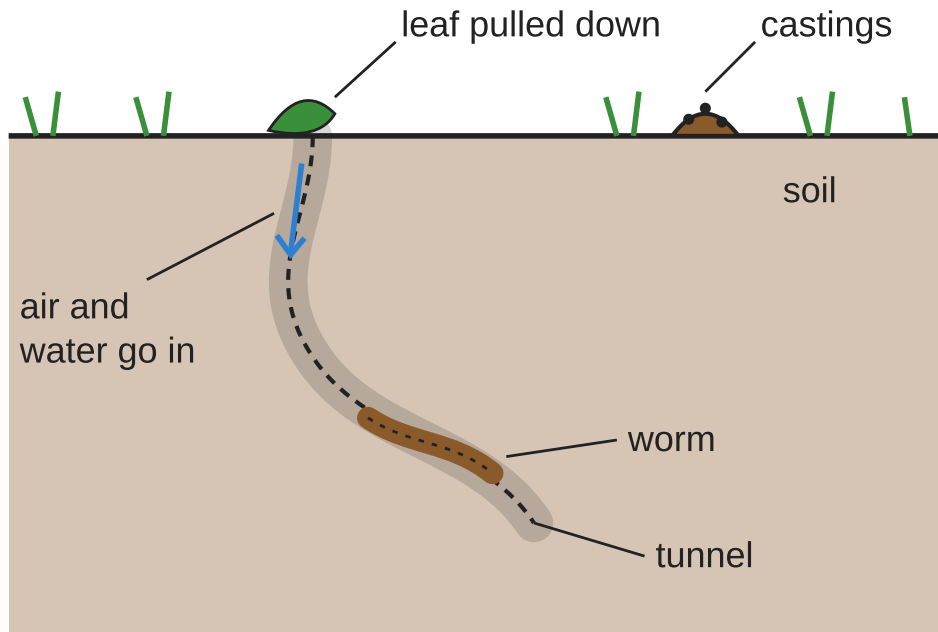
The story. Hold an **earthworm** very gently in your open hand. It feels cool and a little slimy. It has no legs, no bones and no eyes! Look closely and you will see that its body is made of many little rings. Near the front is a wide, smooth band, like a belt. The worm stretches out long and thin, then squeezes up short and fat. That is how it crawls.

How they figured it out. Long ago, a pastor named Gilbert White lived in a little English village. He loved to watch the birds, bugs and worms in his garden and write down what he saw. He noticed that worms come up at night and pull dead leaves down into their holes. He wrote that without worms, the earth would soon become hard and cold, and plants would not grow well. Worms seem small, he said, but they do a very big job.

The big idea. Worms are soil makers. They eat dead leaves and dirt. What comes out the other end is called **castings**: dark, crumbly bits that are full of plant food. Worms also dig **tunnels** as they go. The tunnels let air and rain sink down to the roots of plants. And worms mix the soil, carrying bits from the top down deep and bits from deep up to the top. Worms

breathe through their damp skin, so they need moist soil. After a big rain they sometimes come up to the top.

God's handiwork. God made "every thing that creepeth upon the earth," and He saw that it was good. A worm cannot sing like a bird or run like a horse. But God gave it a job that helps every garden and farm. Without worms, farmers would have a harder time growing our food. Even the smallest creature has a place in God's world.



Under the ground: worms pull leaves down, dig tunnels and leave castings.

PICTURE STUDY



Two Peasants Digging (after Millet), Vincent van Gogh, 1889 · Oil on canvas · Stedelijk Museum, Amsterdam, the Netherlands

Vincent van Gogh loved the paintings of Jean-François Millet, who painted farmers at work. Van Gogh painted his own copy of a Millet picture of two men digging a field. He used thick, swirly paint so you can almost feel the lumpy clods of dirt. When farmers dig like this, they often turn up worms!

Look closely

- Find the two men. What tools are they holding?
- Point to the lumps of dirt they have turned over.
- Look at the brushstrokes in the ground. Are they smooth or bumpy?
- What colors did Van Gogh use for the dirt?

Talk about it

1. If you could dig in this field, what living things might you find in the soil?
2. Why do farmers dig and turn the soil before they plant?

Safety first. Handle worms gently with clean, damp hands, and keep them out of the hot sun. Do not squeeze or cut a worm. Put every worm back in damp soil where you found it. Wash your hands with soap afterward.

MAKE AND DO: WORM WATCHING JAR

You will make a see-through worm home for a few days and watch worms mix the layers of soil.

You will need

- A large clear jar or a clear plastic bottle with the top cut off by a grown-up
- Dark garden soil
- Light-colored sand
- A few dead leaves and some vegetable peels
- A spray bottle of water
- Three or four earthworms from the garden
- A dark cloth or paper bag to cover the jar

Steps

1. Put a layer of dark soil in the jar, then a thin layer of sand. Do it again until the jar is nearly full. You will see stripes.
2. Spray the soil until it is damp, like a squeezed-out sponge. Not soggy!
3. Lay some dead leaves and peels on top.
4. Gently set the worms on top. Watch them burrow down. Count how many go in.
5. Cover the jar with the dark cloth. Worms like the dark. Keep it in a cool place.
6. Each day, lift the cloth and look. Are the stripes getting mixed up? Are leaves being pulled down? Spray a little water if the soil is dry.
7. After three or four days, put the worms back in the garden where you found them.

Tips

- Dig for worms in a damp garden bed or under a log. Early morning or after rain is best.
- Draw the jar on the first day and the last day so you can see how the worms mixed the layers.

Check your work

- I can show where the worms mixed the stripes of soil and sand.
- I can tell what the worms did with the leaves.
- I put the worms safely back in the garden.

FIELD NOTEBOOK

1. Draw an earthworm big on your page. Draw its rings and its wide band. Tell a parent which end you think is the front.
2. Draw your worm jar on the first day and on the last day, side by side.
3. Draw a picture of the ground cut open, like the diagram, with a worm in its tunnel and a plant's roots nearby.

From history. Gilbert White was a curate, a kind of pastor, in the village of Selborne in England. He wrote letters to friends about the animals and plants around his home, and they were made into a book called *The Natural History of Selborne*, which people still read today. In one letter he wrote that earthworms seem like “a small and despicable link

in the chain of Nature,” yet if they were lost, they “would make a lamentable chasm.” He meant that worms look unimportant, but the world would miss them badly.

WORKED EXAMPLES

Example 1. We dug one shovel of dirt in two places. In the soft garden bed we found 7 worms. In the hard dirt by the path we found 1 worm. Which place had more worms? How many more?

1. Put out 7 buttons for the garden bed and 1 button for the path.
2. Line them up side by side. The garden row is longer, so it has more.
3. Match the 1 path button with 1 garden button. Count the garden buttons left with no partner: 1, 2, 3, 4, 5, 6.

Answer: The garden bed had more worms: 6 more. Soft, damp soil with leaves is a better home for worms.

PRACTICE

1. **EASY** Does an earthworm have legs? Does it have bones?
2. **EASY** What do worms eat?
3. **EASY** Point to the tunnel in the diagram. What goes down the tunnel to help plants?
(Use the map or drawing “Find the tunnel.” shown earlier in this lesson.)
4. **MEDIUM** Why do worms need damp soil?
5. **MEDIUM** Count the rings on a worm picture a parent draws with 10 rings. Then tell one way worms help a garden.

COMMON MISTAKES

- Thinking that if you cut a worm in two, you get two worms. Usually that hurts or kills the worm. Never cut a worm.
- Thinking worms are dirty pests. Worms are some of the best helpers a garden has.
- Thinking worms come up after rain because they like to swim. Worms come up when the soil is very wet, and many get stuck on sidewalks. You can gently move them back to the grass.

Make it a game • Wiggle Worm Tunnels. Lay a blanket over some chairs to make a “tunnel.” One child is the worm and crawls through with no hands, scooting on the tummy. A parent calls out “Rain!” and the worm wiggles out to the top. The parent calls “Sun!” and the worm hurries back down into the dark tunnel. Take turns being the worm.

Scripture. “And God made the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the earth after his kind: and God saw that it was good.” (Genesis 1:25, KJV)

Worms creep upon the earth, and God made them too. He saw that they were good, and they do good work in the soil.

Practice answers

1. No legs and no bones.
2. Dead leaves and other old plant bits, along with the soil they swallow.
3. Air and water go down the tunnel to the plant roots.
4. They breathe through their skin, and their skin must stay damp.
5. 10 rings. Worms help by eating dead leaves, leaving castings that feed plants, or digging tunnels for air and water.

2.3 MUD PIES AND BRICKS

OBJECTIVES

- Tell that mud is soil mixed with water, and that sticky clay mud dries hard in the sun.
- Make sun-dried mud bricks, one with straw and one without, and compare them.
- Retell how the Israelites made bricks for Pharaoh in Egypt (Exodus 5).

Warm-up. Take two spoonfuls of dry dirt in a bowl. Squeeze it. Does it hold together? Now add a few drops of water and squeeze again. Add a few more. When does it make a ball? When is it too runny? You just made mud!

Video. Coming soon. How mud bricks and adobe bricks are made by hand with clay, sand, straw and a wooden mold, dried in the sun; search Smithsonian, museum and archaeology channels, Homeschool Pop (Alternate), and traditional craft footage of adobe brick making.

KEY TERMS

mud

Soil mixed with water so it is soft and squishy.

brick

A block made of clay mud, dried hard, used to build walls and houses.

straw

The dry, hollow stems of grain plants like wheat. Brick makers mix it into mud to make bricks stronger.

mold

A box or shape you press soft stuff into so it comes out the same shape every time.

CORE IDEAS

The story. Have you ever made a mud pie? Then you are a mud worker, just like people long ago! In the Bible, God’s people, the Israelites, lived in Egypt. Pharaoh, the king, made them work hard as slaves. Their job was to make bricks out of mud. They mixed mud with water and **straw**, pressed it into shapes and let the bricks dry in the hot sun. One day Pharaoh got angry. He said, “Ye shall no more give the people straw to make brick.” Now they had to find their own straw and still make just as many bricks! But God saw their trouble, and He sent Moses to lead them out.

How they figured it out. People in Egypt painted pictures of brick making on the walls of tombs. In one painting you can see workers carrying water, mixing **mud** with hoes, and pressing it into a wooden **mold**. Then they lift the mold off and leave rows of wet bricks to bake in the sun. Builders today in hot, dry lands still make sun-dried bricks the same way. These bricks are called adobe.

The big idea. Good brick mud needs clay. Remember the tiny, sticky bits from our soil jar? Clay is what makes mud hold together. When clay mud dries, the water goes away into the air, and the mud gets hard. But mud also shrinks as it dries, and it can crack. Straw is like a net inside the brick. It helps hold the mud together so the brick does not crack and fall apart so easily. A little sand helps too.

Try it and see. You will make your own little **bricks**. Make some with straw or dry grass, and some without. Let them dry in the sun for several days. Then gently press each one with your thumb and tap it on the grass. Which brick is stronger? Now you know why the Israelites needed their straw!

PICTURE STUDY



Brick Making, from the Tomb of Rekhmire, Ancient Egyptian painter; copy by Nina de Garis Davies, Painted in the days of the pharaohs; copy made in the 1900s · Wall painting; copy in tempera on paper · Original in the tomb of Rekhmire near Luxor, Egypt; copy at the Metropolitan Museum of Art, New York

Rekhmire was an important helper to one of the pharaohs of Egypt. On the walls of his tomb, painters showed workers making mud bricks for a big temple. The pictures are in rows, like a comic strip, so you can follow every step.

Long after, an artist named Nina de Garis Davies carefully copied the painting so people around the world could see it. It shows us how bricks were made in Egypt, the same kind of work the Israelites did for Pharaoh.

Look closely

- Find the pool of water. What are the workers using to carry water?
- Find a worker pressing mud into a mold, a small box shape.
- Count the bricks set out in a row to dry.

- Find a worker carrying bricks. How is he carrying them?

Talk about it

1. What steps does it take to make a brick? Tell them in order.
2. How do you think the workers felt working all day in the hot sun?
3. How is this picture like your own brick making?

Safety first. Wear old clothes and play outside. Never eat mud or mud pies. A grown-up handles any scissors used to cut the mold. Wash your hands with soap when you are done.

MAKE AND DO: SUN-DRIED MUD BRICKS

You will make little mud bricks just like brick makers in Egypt. Half will have straw and half will not, so you can see what straw does.

You will need

- Garden soil with some clay in it (soil that is sticky when wet)
- Water in a cup
- A handful of straw or dry grass, broken into short pieces
- A bucket or old bowl and a stick or spoon for mixing
- A mold: an ice cube tray, or a small milk or juice carton cut open by a grown-up
- A board or tray to dry the bricks on
- A sunny, dry place

Steps

1. Pick out stones and sticks from the soil.
2. Put soil in the bucket. Add water a little at a time and stir until the mud is thick like cookie dough. Squish it with your hands!
3. Scoop half the mud into a second bowl. Mix in a big handful of straw pieces. Now you have mud with straw and mud without straw.
4. Press the mud without straw into half of your molds. Push it into the corners and smooth the top.
5. Press the mud with straw into the other half. A grown-up can mark these with a stick so you know which is which.
6. Set the molds in the sun. After a day or two, when the bricks pull away from the sides, tip them out onto the board.
7. Let them dry in the sun for several more days, until they are light in color and hard.
8. Test them: look for cracks, press with your thumb and tap them on the grass. Which kind is stronger?

Tips

- If your soil is very sandy, the bricks may crumble. Try soil from a different spot, or add a scoop of craft clay.
- Bring the bricks inside if it rains, or they will turn back into mud!
- Use your dry bricks to build a tiny wall or house for a toy.

Check your work

- I made bricks with straw and without straw.
- I can tell which kind cracked more.
- I can tell the story of the Israelites and the straw.

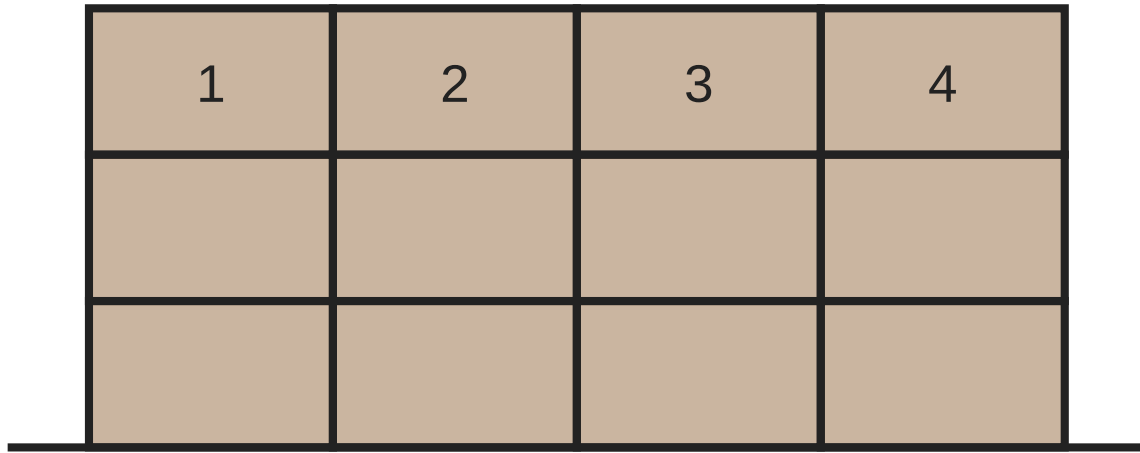
FIELD NOTEBOOK

1. Draw the steps of brick making in a row like the Egyptian painting: water, mixing, mold, drying.
2. Draw your two kinds of bricks. Draw any cracks you see.
3. Draw a little house or wall you would like to build with mud bricks.

From history. In the dry lands of New Mexico, the Pueblo people build houses of adobe, the same kind of sun-dried mud brick and mud plaster. At Taos Pueblo, families have lived in tall adobe houses for hundreds of years, and they still smooth fresh mud plaster onto the walls to keep them strong. Spanish missionaries in the American Southwest also built many churches of adobe.

WORKED EXAMPLES

Example 1. Look at the picture of a little brick wall. How many bricks are in it?



3 rows of 4 bricks

Touch and count each brick.

1. Count the bricks in the top row: 1, 2, 3, 4.
2. Count how many rows there are: 1, 2, 3.
3. Now count every brick, touching each one: 1, 2, 3, 4 (top row), 5, 6, 7, 8 (middle row), 9, 10, 11, 12 (bottom row).

Answer: 12 bricks: 3 rows of 4 bricks.

PRACTICE

1. **EASY** What do you mix with soil to make mud?
2. **EASY** In the Bible, who made the Israelites make bricks?
3. **EASY** What did Pharaoh stop giving the Israelites?
4. **MEDIUM** Point to your two bricks. Which one has fewer cracks? Why does straw help?
5. **MEDIUM** Put these brick-making steps in order: dry in the sun, mix mud and water, press into a mold.

COMMON MISTAKES

- Thinking any dirt makes a good brick. Sandy soil crumbles. Brick mud needs sticky clay.

- Thinking a brick is dry as soon as it feels firm. A brick needs several sunny days to dry all the way through.
- Thinking sun-dried bricks last in the rain. Rain can soften them, so adobe walls are covered with a coat of mud plaster that is patched often, and builders in rainy places bake bricks in a hot kiln instead.

Make it a game • Brick Makers’ Relay. Set a basket of wooden blocks or boxes (the “bricks”) at one end of the yard. Each player runs, picks up one brick, carries it back and adds it to a wall. Count the bricks out loud as the wall grows. For a second round, put the “straw” (a pile of socks) far away, and each player must fetch a sock before each brick, just like the Israelites. Which round was harder?

Scripture. “Ye shall no more give the people straw to make brick, as heretofore: let them go and gather straw for themselves.” (Exodus 5:7, KJV)

Pharaoh made the work harder for God’s people. But God heard them, and He brought them out of Egypt. God sees when we have hard work and trouble, and He cares for us.

Practice answers

1. Water.
2. Pharaoh, the king of Egypt.
3. Straw for making bricks.
4. Usually the brick with straw has fewer cracks. The straw works like a net that holds the mud together as it dries.
5. Mix mud and water, press into a mold, dry in the sun.

2.4 PLANTING IN SOIL

OBJECTIVES

- Plant one bean in good garden soil and one in sand, care for them the same way, and compare how they grow.
- Tell that good soil gives roots water, air and food, while sand dries out fast and has little plant food.
- Retell the parable of the sower and the seed that fell into good ground (Matthew 13:8).

Warm-up. Hold a cup of garden soil in one hand and a cup of sand in the other. Look and feel. Which is darker? Which is grittier? Now pour a little water into each cup at the same time. Watch. In which cup does the water disappear fast? Which one stays damp longer?

Video. Coming soon. Growing a bean seed for young children, with time-lapse of a bean sprouting roots and leaves, and comparing plants in soil and sand; search SciShow Kids, Science Max, Homeschool Pop (Alternate), Smithsonian and garden time-lapse nature footage.

KEY TERMS

seed

A tiny package from a plant that can grow into a new plant of the same kind. It carries a baby plant and a little lunch inside.

sprout

When a seed wakes up and its first root and shoot start to grow.

root

The part of a plant that grows down into the soil to drink water and hold the plant tight.

good soil

Dark, crumbly soil that holds water and has plant food in it, so plants grow well.

CORE IDEAS

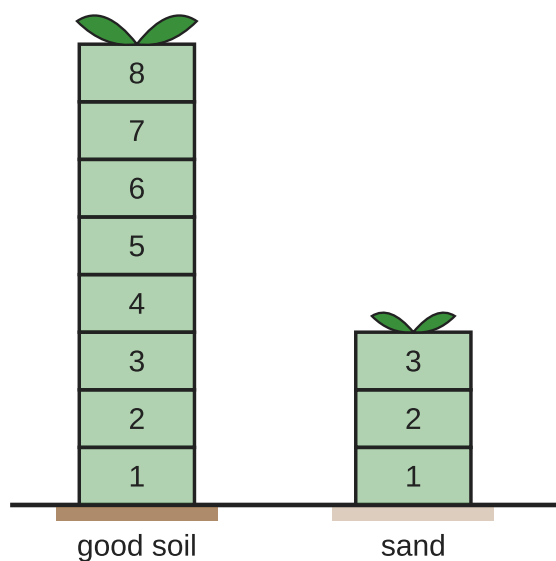
The story. Jesus once told a story about a farmer who went out to sow seeds. He scattered them by hand. Some seeds fell on the hard path, and the birds ate them. Some fell on stony ground with only a little dirt, and they dried up. Some fell among thorns and got choked. “But other fell into good ground, and brought forth fruit.” Those seeds grew big and gave lots and lots of new seeds. A farmer knows that seeds need **good soil**.

How they figured it out. How can we find out if soil really matters? Do a fair test, like a scientist! Plant one bean in good garden soil and one bean in sand. Give them the same kind of pot, the same sunny window and the same water. Change only one thing: the soil. Then watch and measure. If one plant grows better, you will know it was the soil.

The big idea. A bean **seed** carries its own little lunch inside, so it can **sprout** almost anywhere that is damp and warm. Both of your beans may sprout! But soon the lunch runs out. Then the plant needs its **roots** to find water and plant food in the soil. Good soil has bits of old leaves and worm castings that feed the plant. It holds water like a sponge but still has room for air. Sand lets water run right through, and it has very little plant food. So a bean in sand usually grows smaller and paler than a bean in good soil.

God's handiwork. Every bean you plant grows into a bean plant, never a sunflower or a tree. God made each plant to make seeds "after his kind." He made the soil to feed them, the rain to water them and the sun to warm them. When Jesus told about the good ground, He was also talking about our hearts. A heart like good soil hears God's word, holds on to it and grows good things.

How tall did our beans grow?



Our two bean plants, measured in blocks.

PICTURE STUDY



The Sower, Jean-François Millet, 1850 · Oil on canvas · Museum of Fine Arts, Boston

Jean-François Millet grew up on a farm in France. He knew how hard farmers work, and he loved to paint them. In this picture, a farmer takes big steps down a field, throwing seed from a bag with a wide swing of his arm. It is late in the day, and the light is going.

Many people who see this painting think of the parable Jesus told about the sower. Millet painted the farmer big and strong, filling most of the picture, as if his work were very important. And it is! Without sowers, there would be no bread.

Look closely

- Find the bag of seed. How is the farmer carrying it?
- Look at his right hand. What is it doing?
- Find the birds in the sky. What might they be hoping to eat?
- Look at the top of the hill. Can you find another farmer working with his animals?

Talk about it

1. Is the farmer walking slowly or taking big steps? How can you tell?
2. Where do you think the seeds will land? Will they all grow?
3. How is this picture like the story Jesus told?

Safety first. Do not eat the dry bean seeds; raw beans can make you sick. Wash your hands with soap after working with soil.

MAKE AND DO: THE BEAN RACE: GOOD SOIL AND SAND

You will plant two beans, one in good soil and one in sand, and watch them grow for two or three weeks. It is a fair test: only the soil is different.

You will need

- Two dry beans of the same kind (pinto, lima or bush beans; soak them in water overnight first)
- Two cups or pots the same size, with a small hole poked in the bottom by a grown-up
- Good garden soil or potting soil
- Clean sand (play sand works)
- A tray to catch drips
- A small cup for watering (use the same cup for both)
- Building blocks or a ruler for measuring
- Two labels: a drawing of dirt and a drawing of sand

Steps

1. Fill one pot with good soil and one with sand. Put the labels on.
2. Poke a hole with your finger, as deep as your first knuckle, in each pot.
3. Drop one soaked bean in each hole and cover it up.
4. Give each pot the same small cup of water.
5. Set both pots side by side in the same sunny window.
6. Each day, look. Feel the top of each pot with your finger. When the soil feels dry, give both pots the same small cup of water.
7. Once a week, measure each plant by stacking blocks beside it. Count the blocks. A grown-up writes the number on a chart.
8. After two or three weeks, compare. Which bean is taller? Which has more leaves? Which leaves are greener?

Tips

- Plant two or three beans in each pot in case one does not sprout. Pull out the extras after they come up, leaving one in each pot.
- Clear plastic cups let you see the roots growing down the sides.

Check your work

- I watered both pots the same way.
- I can measure each plant with blocks.
- I can tell which soil grew the better plant and why.

FIELD NOTEBOOK

1. Each week, draw both bean plants side by side. Draw their leaves and color them.

2. Draw a bean seed cut open: the baby plant and its lunch. (Split a soaked bean with your fingers to see.)
3. Draw the farmer from Millet's painting, and draw where his seeds landed: the path, the stones, the thorns and the good ground.

From history. When Millet's *The Sower* was shown in Paris, some people were surprised to see a plain farmer painted so large and strong. Years later, the painter Vincent van Gogh loved this picture so much that he copied it and painted his own sowers again and again. He thought the sower was one of the finest things an artist could paint.

WORKED EXAMPLES

Example 1. Look at the bean chart. The bean in good soil grew 8 blocks tall. The bean in sand grew 3 blocks tall. Which bean is taller? How many blocks taller?

(Use the map or drawing "Count each stack, then find the difference." shown earlier in this lesson.)

1. Count the blocks in the good soil stack: 1, 2, 3, 4, 5, 6, 7, 8.
2. Count the blocks in the sand stack: 1, 2, 3.
3. The good soil stack is higher, so that bean is taller.
4. Lay a finger across the top of the sand stack. Count the good soil blocks above your finger: 1, 2, 3, 4, 5.

Answer: The bean in good soil is taller, by 5 blocks.

PRACTICE

1. **EASY** Name three things a seed needs to grow into a strong plant.
2. **EASY** In Jesus' story, which seeds grew and gave fruit?
3. **EASY** Point to the part of a bean plant that grows down into the soil. What is it called?
4. **MEDIUM** Why did we put both pots in the same window and give them the same water?
5. **MEDIUM** You pour water into a pot of sand and a pot of good soil. Which one dries out faster? Why is that hard on a plant?

COMMON MISTAKES

- Thinking a seed needs soil to sprout. A seed can sprout on a wet paper towel, using the food stored inside it. It needs good soil to keep growing.
- Thinking more water is always better. Too much water can drown the roots, because roots need air too.
- Thinking plants eat dirt. Plants take in water and some plant food from the soil, but they make most of what they need using sunlight, air and water in their leaves.

Make it a game · Where Did the Seed Fall?. Lay out four spots on the floor: a towel for the hard path, a pile of pillows for the stony ground, a jump rope in a tangle for the thorns, and a brown blanket for the good ground. A parent tosses a bean bag “seed.” Wherever it lands, the children act it out: birds swoop in to peck it, it wilts in the sun, it gets choked by thorns, or, on the good ground, everyone slowly grows from a crouch to a tall plant with arms raised high.

Scripture. “But other fell into good ground, and brought forth fruit, some an hundredfold, some sixtyfold, some thirtyfold.” (Matthew 13:8, KJV)

Seeds in good ground grow and give many, many new seeds. Jesus said a person who hears God’s word and understands it is like good ground.

Practice answers

1. Any three: water, good soil, warmth, sunlight, air.
2. The seeds that fell into good ground.
3. The root.
4. To make it a fair test. Only the soil was different, so if one grew better, we know the soil made the difference.
5. The sand dries out faster, because water runs right through it. The roots cannot find enough water to drink.

UNIT 2 REVIEW

This is an oral review. Ask each question aloud and let your child answer by talking, pointing, drawing or showing. Help with words if needed; the goal is to see what your child remembers. The review is worth 20 points.

1. (3 pts) What is soil made of? Name two things.
2. (3 pts) Show me the soil shake jar (or its drawing). Which bits sank to the bottom first? Why?
3. (3 pts) Tell me three ways worms help the soil.
4. (2 pts) Why do worms need damp soil?
5. (3 pts) Tell me how to make a mud brick, step by step.
6. (2 pts) In the Bible, what did Pharaoh stop giving the Israelites? Why did they need it?
7. (2 pts) Which bean grew better, the one in good soil or the one in sand? Why?
8. (2 pts) Tell me Jesus' story about the sower. Where did the good seed fall?

UNIT PROJECT: MY DIRT AND MUD SHOW

Set up a little "soil museum" on a table and give a tour to the family. Show your soil shake jar and its drawing, your worm drawings, your sun-dried mud bricks (with straw and without), and your two bean plants with their block chart. At each spot, tell what you did and what you found out. Finish by telling the story of the sower and the good ground.

- **Observation:** Points to the soil layers, the brick cracks and the two bean plants and tells what was seen.
- **Explanation:** Tells in their own words why heavy bits sink first, how worms help, why straw helps bricks and why good soil grows better beans.
- **Records:** Drawings of the jar, worms, bricks and beans are finished and colored, and the bean block chart is filled in.
- **Care:** Handled worms gently and returned them, watered the beans faithfully, and set up the show neatly.

Answer key

1. Any two: tiny bits of rock (stones, sand, silt, clay), bits of old plants, water, air.
2. The small stones and sand, because they are biggest and heaviest. The tiny clay bits sank last.
3. They eat dead leaves, they leave castings that feed plants, and they dig tunnels that let air and water in. (They also mix the soil.)
4. They breathe through their skin, which must stay damp.
5. Mix soil (with clay) and water and straw into thick mud, press it into a mold, take it out and let it dry in the sun.
6. Straw. Straw holds the mud together so the bricks do not crack and break.
7. Usually the one in good soil. Good soil holds water and has plant food; sand dries out fast and has little food.

8. A farmer scattered seed. Some fell on the path, some on stony ground, some among thorns, and some on good ground. The seed on good ground grew and gave much fruit.

WATER

On the second day of creation, God divided “the waters which were under the firmament from the waters which were above the firmament” (Genesis 1:7). Water is everywhere: in the tap, in the freezer, in the clouds, in every puddle after the rain. In this unit your child will hold an ice cube until it melts, watch a pot steam, and see drops of water appear out of the air on a cold glass. Water can be a **solid**, a **liquid** and a **gas**, and it is the same water all along.

Next your child becomes a puddle detective, tracing a puddle with chalk to see where the rain goes: into the ground, downhill to the sea, and up into the air to make clouds again. Then comes a tub of water and a pile of things to test. Why does a rock sink while pumice, a rock from a volcano, floats? Why does a ball of clay sink when the same clay shaped like a boat floats?

The unit ends with the great rain of Genesis 7, when God shut Noah’s family and the animals into the ark and “the waters increased, and bare up the ark.” Your child will build a toy ark, load it two by two, and send a rainstorm over it. Everything in this unit is said, pointed to, built or drawn. No reading is needed.

BEFORE YOU BEGIN

- Can tell hot from cold and wet from dry
- Can count objects to 10 by pointing
- Can sit and listen to a short Bible story read aloud
- Has handled and sorted rocks (Unit 1)

MASTERY CHECKLIST

- I can show water as ice, as a liquid, and as a gas we cannot see.
- I can tell what makes ice melt and where the drops on a cold glass come from.
- I can tell three places rain goes after it falls.
- I can guess and test whether a thing will float or sink, and tell why pumice floats.
- I can retell the story of Noah’s ark and the Flood and count animals by twos.

OPTIONAL BOOKS AND RESOURCES

- **USGS Water Science School** (<https://www.usgs.gov/special-topics/water-science-school>): Free. Pictures and plain explanations of the water cycle, rain and rivers from the U.S. Geological Survey. Written for older students, so a parent can choose pictures to show and explain them in simple words (Lessons 3.1 and 3.2).
- **NOAA SciJinks** (<https://scijinks.gov/>): Free. Bright pictures and short articles about water, clouds and weather from the National Oceanic and Atmospheric Administration. Look for the water cycle pages for Lesson 3.2.

3.1 WATER EVERYWHERE ★

OBJECTIVES

- Name the three ways water can be: solid ice, liquid water and water vapor.
- Tell that cold makes water freeze and heat makes ice melt and water dry up into the air.
- Find ice, liquid water and water vapor at work in the kitchen.

Warm-up. Set out three cups. Put an ice cube in one, cold tap water in the second, and leave the third empty. Let your child touch the ice and dip a finger in the water. Ask: Which one is hard? Which one pours? Which one is cold? Then point to the empty cup and ask, “Is anything in here?” (Air, and some water vapor we cannot see.)

Video. Coming soon. Ice, water and steam for young children (ice melting, water boiling, drops forming on a cold glass); search NOAA SciJinks, SciShow Kids, Homeschool Pop (Alternate), Science Max, and time-lapse footage of ice cubes melting.

KEY TERMS

solid

Something that keeps its own shape, like a rock or an ice cube. Ice is water as a solid.

liquid

Something that pours and takes the shape of its cup, like water or milk.

water vapor

Water as a gas. It floats in the air, and we cannot see it.

melt

To change from a solid to a liquid when it gets warm, the way ice turns into water.

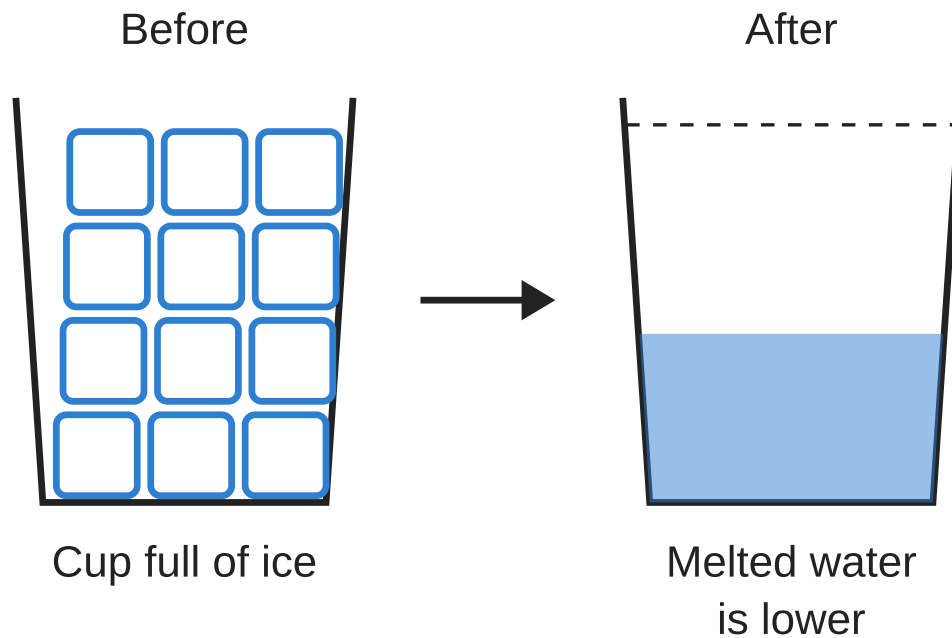
CORE IDEAS

The story. Open the freezer and take out one ice cube. Hold it in your hand. It is hard and cold, and it has corners. Now watch it. Little by little it gets wet and slippery. Drops run down your fingers. Soon there is no cube at all, only a tiny pool of water in your hand. Where did the ice go? It did not go anywhere. The ice *became* water. It was water all along.

The big idea. Water can be three ways. When it is very cold, water is a **solid**. We call it ice. A solid keeps its own shape. When ice warms up, it **melts** and becomes a **liquid**. A liquid pours and splashes and takes the shape of its cup. When water gets very hot, it turns into a gas called **water vapor**. Water vapor floats away into the air, and we cannot see it at all. The white cloud over a hot pot is made of tiny drops of water that cooled back down in the air. Cold makes water freeze. Heat makes ice melt and makes water dry up into the air. It is the same water, three ways.

Try it and see. Water is everywhere in your kitchen. It runs from the tap. It sits frozen in the freezer. It puffs up from the pot when your parent cooks pasta. It even hides in the air. Fill a glass with ice and wait a few minutes. Little drops will form on the *outside* of the glass. They did not leak through! They came from water vapor in the air. The vapor touched the cold glass, cooled down and turned back into liquid drops.

God's handiwork. God once asked Job, "Out of whose womb came the ice?" Only God could answer that. He made water, and He made it able to change. Ice floats on top of a pond like a lid, and the fish stay safe in the water underneath. Liquid water fills our cups and our rivers. Water vapor rises up to make the clouds. It is one good gift from God, used three good ways.



A cup full of ice melts into water that does not reach the top.

PICTURE STUDY



The Great Wave off Kanagawa, Katsushika Hokusai, about 1831 · Color woodblock print · Prints are kept in many museums, among them the Metropolitan Museum of Art in New York and the British Museum in London

Katsushika Hokusai was an artist in Japan who loved to draw his country's tall mountain, Mount Fuji. He drew this picture, and skilled craftsmen carved it into wooden blocks, brushed ink on them and pressed them onto paper, one color at a time. Because it was printed, many copies were made, and people all over the world know this picture.

Look for water in this picture. You will find it in more than one way.

Look closely

- Find the giant wave. Trace its curl in the air with your finger.
- Find the white foam at the top of the wave. What does it look like to you?
- Find the boats. How many can you count? Can you see the men holding on?
- Find the little mountain in the middle. What is the white on top of it?

Talk about it

1. Where in the picture is water a liquid? Where is water frozen? (The sea is liquid. The snow on the mountain is frozen water.)
2. How do you think the men in the boats feel?
3. If the sun shone on the snow on the mountain all summer, what would happen to it?

Safety first. Only a grown-up works at the stove or holds the hot pot and lid. Steam and boiling water can burn badly, so the child watches from a safe distance, an arm's length

or more away from the pot, and never reaches over the stove. Wipe up melted ice so no one slips.

MAKE AND DO: THREE WAYS IN THE KITCHEN

Today your kitchen is a science lab. You will find water as a solid, as a liquid and as a gas, and you will watch it change from one to another.

You will need

- Ice cubes and a small bowl
- A clear drinking glass
- A small pot of water and the stove (grown-up only)
- A metal pot lid that has been in the refrigerator for a few minutes, and an oven mitt (grown-up only)
- Paper folded into three boxes, and crayons

Steps

1. **Solid.** Put two ice cubes in the bowl. Touch them. Are they hard? Do they keep their shape? Leave them on the table while you do the next steps.
2. **Drops from the air.** Fill the clear glass with ice and a little water. Set it on the table and wait. In a few minutes, rub a finger on the outside of the glass. Where did those drops come from? (From water vapor in the air that cooled on the cold glass.)
3. **Gas.** A grown-up heats the pot of water until it bubbles. Watch from a safe spot. Do you see the white cloud rising? The water is turning into water vapor and going into the air.
4. **Back to liquid.** The grown-up puts on the oven mitt and holds the cold lid above the pot for a few seconds, then tips it so you can see underneath. Drops of water! The vapor cooled on the cold lid and became a liquid again.
5. **Melted.** Go back to the ice in the bowl. What happened? Ask: Is it still a solid?
6. Draw what you saw in your three boxes: ice in the first, a glass of water in the second, a pot with a cloud above it in the third.

Tips

- If your kitchen is very warm and dry, the drops on the glass may come slowly. Add more ice and wait a little longer.
- Use the words solid, liquid and water vapor out loud each time, so your child hears them often.

Check your work

- I can point to water as a solid, a liquid and a gas.
- I can tell what makes ice melt.
- I can tell where the drops on a cold glass come from.

FIELD NOTEBOOK

1. Draw an ice cube melting in three pictures: a whole cube, a half cube in a little puddle, and just a puddle.
2. Draw a cold glass with drops on the outside. Your parent can write your words beside it: "The drops came from the air."
3. Draw your freezer, your sink and your stove. Put a blue dot on each place where you find water, and tell how the water looks in each place.

From history. In the early 1700s, an instrument maker named Daniel Gabriel Fahrenheit, who lived and worked in Holland, made some of the first good thermometers filled with mercury. A thermometer tells how hot or cold something is. On the Fahrenheit scale, which many Americans still use, water freezes into ice at 32 degrees and boils at 212 degrees. Ask your parent to show you a thermometer and find the 32.

WORKED EXAMPLES

Example 1. Fill a clear cup all the way to the top with ice cubes. Let it sit until all the ice melts. Will the water come up to the top, go higher, or stay lower?

(Use the map or drawing "Before and after: the melted water is lower than the ice was." shown earlier in this lesson.)

1. Look at the cup full of ice. The ice comes all the way to the top. Put a piece of tape at the top as a mark.
2. Wait until every bit of ice has melted.
3. Now compare. Point to the tape. Point to the top of the water. Which is higher?

Answer: The water is lower than the tape. There were air spaces between the ice cubes, and ice takes up a little more room than the water it melts into.

PRACTICE

1. **EASY** Your parent holds up an ice cube. Is it a solid or a liquid?
2. **EASY** Say the three ways water can be.
3. **MEDIUM** Your parent draws or names five pictures: an icicle, a puddle, an ice cube, a cup of water, and a cloud over a hot pot. Sort them into three piles: frozen, liquid, and from the hot pot.
4. **MEDIUM** An ice cube tray has 2 rows. Each row has 6 cubes. Point to each cube and count them all.
5. **HARD** Tell your parent: Why do drops of water show up on the outside of a glass full of ice?

COMMON MISTAKES

- Thinking the white cloud over a hot pot is water vapor. Water vapor cannot be seen. The white cloud is tiny drops of liquid water that cooled in the air.
- Thinking the drops on a cold glass leaked through it. They came from water vapor in the air.
- Thinking ice is a different thing from water. Ice is water, frozen hard. When it warms, it is water again.

Make it a game · Freeze, Melt, Float!. Your parent calls out one word at a time. “Ice!” Freeze stiff like a statue. “Water!” Wiggle and flow all over the floor like a liquid. “Vapor!” Tiptoe and float around the room with arms waving like a gas rising into the air. Your parent can call them faster and faster. If you do the wrong one, you become the caller.

Scripture. “Out of whose womb came the ice? and the hoary frost of heaven, who hath gendered it? The waters are hid as with a stone, and the face of the deep is frozen.” (Job 38:29-30, KJV)

God asked Job these questions to show him how great God is. God made the ice and the frost, and He can make water hard as a stone. Every ice cube is a small reminder of His power.

Practice answers

1. A solid. It is hard and keeps its own shape.
2. Ice (a solid), liquid water, and water vapor (a gas).
3. Frozen: icicle, ice cube. Liquid: puddle, cup of water. From the hot pot: the cloud, which comes from water turning into water vapor.
4. 12 ice cubes.
5. Water vapor in the air touches the cold glass, cools down and turns back into liquid drops. The water did not leak through the glass.

3.2 WHERE RAIN GOES ★

OBJECTIVES

- Tell three places rain goes: it soaks into the ground, runs downhill, and dries up into the air.
- Watch a puddle shrink by tracing it with chalk and measuring it with hands.
- Tell how water goes around from cloud to ground to sea and back to the clouds.

Warm-up. Pour a little water on a plate and a little water on a dish of dry dirt or a potted plant. Watch both for one minute. Ask: Where did the water on the dirt go? (It soaked in.) Now tip the plate a little. Which way does the water run? (Down, to the low side.)

Video. Coming soon. The water cycle and where rain goes for young children (puddles drying, rain soaking into soil, streams running to rivers and the sea); search NOAA SciJinks, USGS Water Science School, SciShow Kids, Homeschool Pop (Alternate), and time-lapse footage of a puddle drying.

KEY TERMS

puddle

A small pool of rainwater sitting in a low spot on the ground.

soak in

When water sinks down into dirt, the way a sponge drinks up water.

evaporate

When liquid water slowly dries up and goes into the air as water vapor.

water cycle

The way water goes around and around: up into the sky, down as rain, and up again.

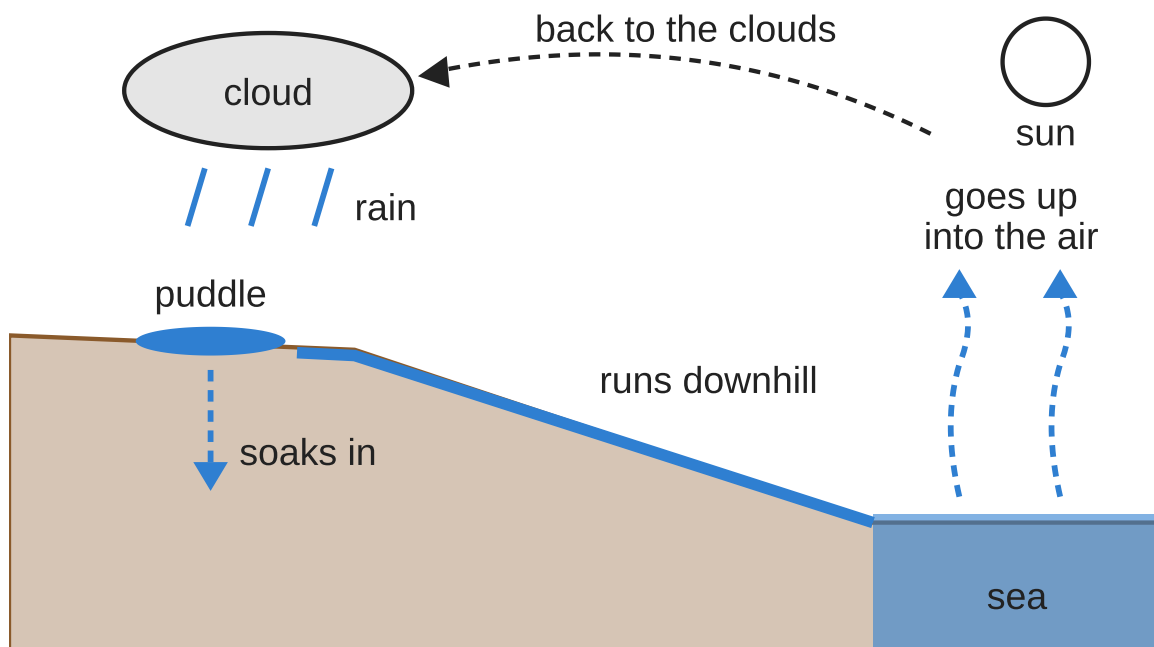
CORE IDEAS

The story. After a rain, go outside and find a puddle. Look into it closely. Do you see the sky? Do you see your own face? Now ask a scientist's question: *Where will this water go?* Tomorrow the puddle may be smaller. In a few days it may be gone. Rain does not just disappear. It goes somewhere, and you can follow it.

The big idea. Rain goes three ways. Some rain **soaks in**. It sinks down into the dirt, where plant roots drink it and worms wriggle through it. Some rain **runs downhill**. Water always flows down to the lowest place it can find. It runs down the driveway, into the gutter, into a creek, then into a river, and at last into the sea. And some rain **dries up into the air**. The sun warms the puddle, and the water turns into water vapor, the gas we cannot see. Scientists say the water **evaporates**. High in the sky the vapor cools into tiny drops that make clouds. Then it rains again. Around and around the water goes. We call this the **water cycle**.

Try it and see. Draw around a puddle with chalk. Come back after a while and draw around it again. The new line will be inside the old one. The puddle is shrinking! Is your puddle on dirt or on the sidewalk? A puddle on dirt often shrinks faster, because the water soaks in and dries up at the same time. A puddle on hard pavement cannot soak in. It can only dry up into the air or run away downhill.

God's handiwork. King Solomon watched water too. He wrote, "All the rivers run into the sea; yet the sea is not full." Why does the sea not overflow? Because God made the water rise up from the sea into the sky and fall again as rain on the hills. Then the rain runs back down to the sea. Every puddle in your yard is part of God's great water wheel.



Where rain goes: it soaks in, runs downhill to the sea, and goes up into the air to make clouds again.

PICTURE STUDY



Sudden Shower over Shin-Ōhashi Bridge and Atake, Utagawa Hiroshige, 1857 · Color woodblock print · Prints are kept in many museums and libraries, among them the Library of Congress in Washington, D.C., and the Metropolitan Museum of Art in New York

Utagawa Hiroshige was an artist in Japan who made one hundred pictures of his city, Edo, which is now called Tokyo. Like Hokusai's *Great Wave*, this picture is a woodblock print. Hiroshige drew it, and craftsmen carved it into wooden blocks and printed it in colors.

Hiroshige shows the moment a sudden shower pours down on a big bridge over a river. He drew the rain as hundreds of thin lines. Look where all that rain is landing.

Look closely

- Find the lines of rain. Which way are they slanting?
- Count the people hurrying across the bridge. What are they holding over their heads?
- Find the man on the long raft of logs in the river.
- Look at the top of the picture. What color is the rain cloud?

Talk about it

1. When the rain lands on the bridge, where will it run to next?
2. Where will the river carry all that rainwater?
3. When the sun comes out, what will happen to the wet bridge?

Safety first. Stay with your child outdoors. Choose a puddle away from the street and from storm drains, and never play near fast-moving water in ditches, creeks or gutters. Do not go out while there is thunder or lightning. Puddle water is dirty, so do not drink it, and wash hands after.

MAKE AND DO: FOLLOW A PUDDLE

You will be a puddle detective. You will trace a puddle with chalk and come back to see how it changes. Then you will find out where the water went.

You will need

- Sidewalk chalk in two or three colors
- A puddle after rain on a driveway or sidewalk (or make one: pour a bucket of water in a low spot on pavement)
- A second bucket of water and a patch of bare dirt (for the dirt puddle)
- A clock or timer
- Paper and crayons

Steps

1. Find your puddle. Look into it. Tell what you see.
2. Trace all the way around the edge of the puddle with chalk.
3. Measure across the puddle with your hands. Put one hand down, then the other, hand after hand, and count. Your parent can write the number down.
4. Make a second puddle by pouring the second bucket on bare dirt. Trace it too, or ring it with small sticks if chalk will not show.
5. Come back after one hour. Trace each puddle again with a new color. Measure across again with your hands.
6. Come back once more later in the day and do it again. Which puddle shrank faster?
7. Stand beside your puddle and look around. Which way is downhill? Walk the way the water would run. Where does it end up?
8. Draw your puddle with its rings of chalk.

Tips

- A sunny, breezy day dries a puddle fastest. On a cool, cloudy day, check again the next morning.
- If a puddle on dirt disappears in a few minutes, that is a good answer too: the water soaked in quickly.

Check your work

- I can show that my puddle got smaller.
- I can tell three places the water went.
- I can point to where water runs downhill.

FIELD NOTEBOOK

1. Draw your puddle with its chalk rings, one inside another.

2. Draw a raindrop's trip: a cloud, rain falling, a puddle, a stream, the sea, and an arrow back up to the cloud.
3. Draw the place in your yard where water goes after a rain. Your parent can write your words: "The water goes here."

From history. Long ago, many people thought rivers were fed by giant hidden seas under the mountains. Around 1670, a Frenchman named Pierre Perrault decided to measure instead of guess. He measured how much rain fell on the land around the start of the River Seine, and he figured out how much water the river carried away. The rain was more than enough to fill the river. Perrault showed that rivers are fed by rain and melted snow. He wrote about it in a book in 1674.

WORKED EXAMPLES

Example 1. A child traced a puddle three times and measured across it with hands. In the morning it was 9 hands across. At lunch it was 6 hands. After supper it was 3 hands. Did the puddle get bigger or smaller? How much smaller was it at lunch than in the morning?

1. Say the three numbers in order: 9, then 6, then 3.
2. Each number is smaller than the one before, so the puddle got smaller.
3. Start at 9 and count back to 6: 8, 7, 6. That is 3 counts back.

Answer: The puddle got smaller. At lunch it was 3 hands smaller than in the morning.

PRACTICE

1. **EASY** Say three places rain can go.
2. **EASY** Go outside and point to the lowest place you can see in your yard or street. Will rain run there or away from there?
3. **MEDIUM** One puddle is on dirt. One puddle is on the sidewalk. Point to the puddle where the water can soak in.
4. **MEDIUM** You drew 4 chalk rings around your puddle. You draw 1 more ring after supper. How many rings are there now?
5. **HARD** Tell the story of a raindrop. Start in the cloud and end back in the cloud.

COMMON MISTAKES

- Thinking a puddle that dries up is gone forever. The water went into the ground or into the air, and it will fall again as rain.
- Thinking clouds are made of smoke or cotton. Clouds are made of tiny drops of water or tiny bits of ice.
- Thinking water can run uphill by itself. Water always flows down to the lowest place it can find.

Make it a game · I Am a Raindrop. You are a raindrop! Start curled up small in a cloud (on the couch). Your parent says “Rain!” and you fall gently to the floor. Then your parent calls out what happens next. “Soak in!” Lie flat and still like water in the dirt. “Run downhill!” Run to the other side of the room, the sea. “Dry up!” Rise slowly onto your tiptoes and float back to the cloud. Play until you have gone around three times.

Scripture. “All the rivers run into the sea; yet the sea is not full; unto the place from whence the rivers come, thither they return again.” (Ecclesiastes 1:7, KJV)

Solomon noticed that rivers pour into the sea every day, yet the sea never overflows, and the rivers never run dry. The water goes back up and comes down again as rain. God made the water go around.

Practice answers

1. It soaks into the ground, it runs downhill, and it dries up into the air (evaporates).
2. Rain will run there, because water always flows downhill to the lowest place. (The child points to any low spot, ditch, gutter or drain.)
3. The puddle on dirt. Water cannot soak into a hard sidewalk.
4. 5 rings.
5. Any good telling such as: The raindrop fell from the cloud onto a hill. It ran downhill into a creek, then a river, then the sea. The sun warmed it, and it went up into the air as water vapor. High up it cooled and became part of a cloud again.

3.3 FLOATING AND SINKING

OBJECTIVES

- Guess, then test, whether things float or sink, and sort them into two groups.
- Tell why pumice floats: it is a rock full of tiny holes filled with air.
- Show that shape matters by making a lump of clay that sinks into a boat that floats.

Warm-up. Fill a bowl with water. Hold up a coin and a cork (or a wooden block). Ask: Which one is bigger? Which one will sink? Put your thumb up for float and down for sink. Then drop them in and see. Were you right?

Video. Coming soon. Sink or float for young children (pumice floating, clay boat versus clay ball, why big ships float); search SciShow Kids, Science Max, Homeschool Pop (Alternate), Smithsonian, USGS volcano pages for pumice, and nature footage of floating pumice rafts.

KEY TERMS

float

To stay up on top of the water.

sink

To go down to the bottom of the water.

pumice

A light rock from a volcano, full of tiny holes. It can float on water.

CORE IDEAS

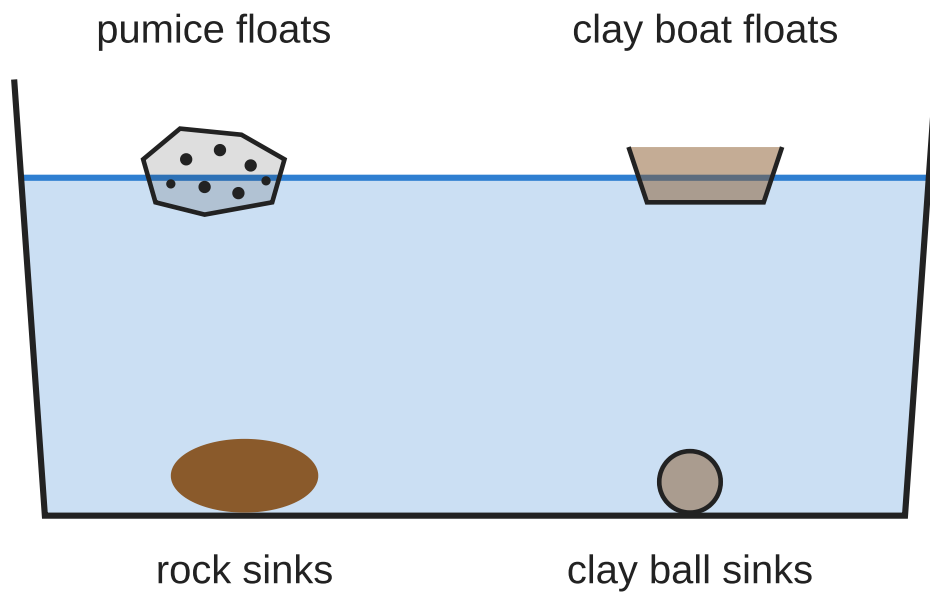
The story. Drop a rock into a tub of water. Plop! It goes straight to the bottom. It **sinks**. Now take a gray, scratchy stone called **pumice**. Drop it in. It bobs back up and rides on top of the water like a little boat. It **floats**. Both of them are rocks. Why does one sink and one float?

How they figured it out. Look very closely at the pumice with a magnifying glass. It is full of tiny holes, like a sponge. Pumice comes from a volcano. When hot, melted rock blasts out of a volcano, it is full of gas bubbles, like a fizzy drink. It cools and hardens so fast that the bubbles are trapped inside. Each little hole was once a bubble. Now the holes are full of air. All that air makes pumice very light for its size, so it floats. Sailors have even seen whole rafts of pumice floating on the sea after a volcano erupted.

The big idea. Floating is not just about big and small. A huge ship floats, but a tiny coin sinks! What matters is how heavy a thing is *for its size*. A rock, a coin and a spoon are heavy for their size, so they sink. A cork, a block of wood and a piece of pumice are light for their size, so they float. Shape matters too. Roll some clay into a ball and it sinks. Press the same

clay into a bowl shape with high sides, and it floats! The bowl holds a big pocket of air and pushes lots of water out of the way, and the water pushes up on it. That is how heavy ships float.

God's handiwork. God made water so it pushes up on everything we put in it. That push holds up ducks, logs, boats and even you when you float on your back in a pool. Remember the ice from our first lesson? Ice floats too, so ponds freeze on top and the fish live safely below. The psalm says of the sea, "There go the ships." God made the water strong enough to carry them.



Pumice and a clay boat float. A rock and a clay ball sink.

PICTURE STUDY



Breezing Up (A Fair Wind), Winslow Homer, 1873–1876 · Oil on canvas · National Gallery of Art, Washington, D.C.

Winslow Homer was an American painter who loved the sea. He spent many summers watching boats and fishermen along the coast of New England. In this painting a man and three boys are sailing a small boat on a windy day. The wind fills the sail, and the boat tips and splashes along.

A boat is heavy, and it is full of people. Yet it rides right on top of the water.

Look closely

- Count the people in the boat.
- Find the sail. Which way is the wind pushing it?
- Look at the water around the boat. Is it smooth or bumpy? Find the white splashes.
- Find the bigger ship far away.

Talk about it

1. The boat and the people are heavy. Why doesn't the boat sink?
2. What would happen if the boat filled up with water?
3. Would you like to be in this boat? Why or why not?

Safety first. A grown-up stays right beside the tub the whole time. Even shallow water can be dangerous for young children. Empty the tub as soon as you are done and wipe up spills so no one slips. Keep coins and other small things away from very little brothers and sisters, who might put them in their mouths.

MAKE AND DO: SINK OR FLOAT?

You will test things from around the house like a real scientist. First you guess. Then you test. Then you sort what you found.

You will need

- A clear plastic tub, dishpan or large bowl, filled with water
- A pumice stone (sold in drugstores for rough feet, or at garden centers)
- An ordinary rock about the same size as the pumice
- A cork or a block of wood, a coin, a metal spoon, a leaf, a plastic bottle cap
- A lump of modeling clay about the size of a walnut
- Two sheets of paper: draw a boat on one (float) and an arrow pointing down on the other (sink)
- A magnifying glass, if you have one
- A towel

Steps

1. Look at the pumice and the rock with the magnifying glass. Which one has holes? Hold one in each hand. Which feels lighter?
2. Pick up one thing. Guess: thumb up means it will float, thumb down means it will sink.
3. Gently put it in the water. Watch. Did it float or sink?
4. Take it out, dry it, and set it on the float paper or the sink paper.
5. Do the same with each thing. Count how many floated and how many sank.
6. Roll the clay into a tight ball and put it in the water. Does it sink?
7. Take it out. Press it flat with your thumbs and pinch up the edges to make a little bowl boat. Set it gently on the water. What happens now?
8. Tell your parent what you found, and draw your float pile and your sink pile.

Tips

- Some pumice stones sold in stores are made in a factory, and some real pumice sinks after it soaks for a long time because water fills the holes. If yours sinks, dry it out well and try again, or just look at its holes and talk about why pumice from a volcano floats.
- If the clay boat sinks, make the bottom thinner and the sides higher, and set it down very gently.

Check your work

- I can guess and then test whether a thing will float or sink.
- I can tell why pumice floats.
- I can make sinking clay into a floating boat.

FIELD NOTEBOOK

1. Draw your tub of water. Draw the things that floated at the top and the things that sank at the bottom.
2. Look at the pumice with a magnifying glass and draw it with all its tiny holes.
3. Draw your clay ball and your clay boat side by side. Your parent can write your words under each one.

From history. In 1612, the Italian scientist Galileo Galilei wrote a book about things that float and sink in water. Some men of his time said ice floats because it is flat and thin. Galileo disagreed. He said ice floats because it is lighter than the same amount of water, whatever its shape. He pointed out that if you push a piece of ice down to the bottom of a bowl of water and let go, it pops right back up. Try it yourself with an ice cube.

WORKED EXAMPLES

Example 1. A child tested seven things. Pumice, a cork, a leaf and a clay boat floated. A rock, a coin and a spoon sank. Which group has more: float or sink? How many more?

1. Count the things that floated: pumice, cork, leaf, clay boat. That is 4.
2. Count the things that sank: rock, coin, spoon. That is 3.
3. 4 is more than 3. Match them up one to one: one floater is left over with no partner.

Answer: The float group has more. It has 1 more than the sink group (4 floated, 3 sank).

PRACTICE

1. **EASY** Your parent drops an ordinary rock into water. Does it float or sink?
2. **EASY** Point to the little holes in a piece of pumice. What is inside the holes?
3. **MEDIUM** Sort these into a float pile and a sink pile: a cork, a wooden block, a coin, a rock.
4. **MEDIUM** In your test, 5 rocks sank and 2 pieces of pumice floated. How many stones did you test in all?
5. **HARD** Tell your parent: A big ship floats, but a little coin sinks. Why?

COMMON MISTAKES

- Thinking heavy things always sink and light things always float. A heavy ship floats and a light coin sinks. What matters is how heavy a thing is for its size.
- Thinking all rocks sink. Pumice is a rock that floats because it is full of air holes.
- Thinking shape does not matter. The same clay sinks as a ball and floats as a boat.

Make it a game · Sink or Float Guess. Your parent names a thing, such as a rubber duck, a key, a pumice stone, a marble, an apple or a paper clip. If you think it will float,

stand up tall on your tiptoes. If you think it will sink, crouch down low. Then test the ones you can in the tub. Score one point for every right guess. Can you get five points?

Scripture. “There go the ships: there is that leviathan, whom thou hast made to play therein.” (Psalm 104:26, KJV)

Psalm 104 praises God for all He made. The sea carries ships and is home to great sea creatures. God made the water able to hold up boats so people could travel and work on it.

Practice answers

1. It sinks.
2. Air. The air makes the pumice light for its size, so it floats.
3. Float: cork, wooden block. Sink: coin, rock.
4. 7 stones.
5. Floating depends on how heavy a thing is for its size, and on its shape. The ship is shaped like a bowl full of air spaces, so it is light for its size and pushes lots of water out of the way. The coin is small but heavy for its size, so it sinks.

3.4 NOAH'S RAIN

OBJECTIVES

- Retell the story of Noah, the ark and the great rain from Genesis 7.
- Count animals by twos, the way they came into the ark in pairs.
- Build a toy ark that floats and tell why it stays up on the water.

Warm-up. Gather a handful of toy animals or stuffed animals. Ask your child to find each animal's partner and line them up two by two. If an animal has no partner, set it aside. Ask: How many pairs did you make?

Video. Coming soon. Noah's ark and the Flood for young children (Genesis 6–8 read aloud, a life-size ark replica tour, how a big wooden boat floats); search Moody Science classics, and Homeschool Pop (Alternate).

KEY TERMS

ark

The huge wooden boat God told Noah to build to keep his family and the animals safe.

flood

When water covers land that is usually dry. Noah's Flood covered the whole earth.

pair

Two that go together, like two shoes or two sheep.

pitch

A sticky, black, waterproof coating. Noah spread it inside and outside the ark to keep the water out.

CORE IDEAS

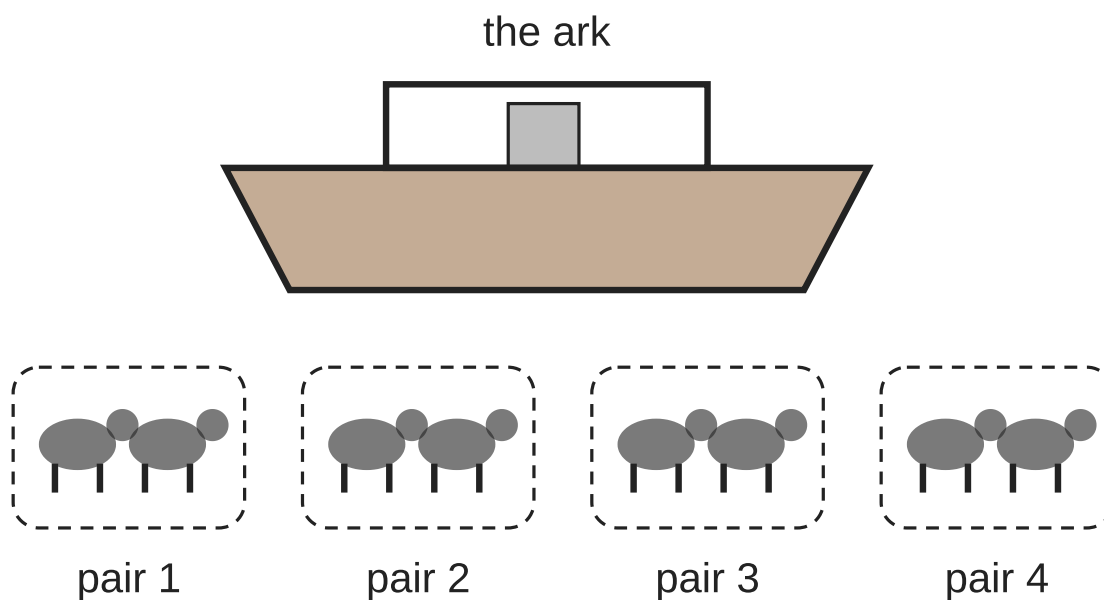
The story. In the book of Genesis, the world had grown very wicked. But one man, Noah, walked with God. God told Noah, "Make thee an ark of gopher wood." An ark is a huge boat. Noah built it just the way God said. He gave it rooms inside, and he covered it inside and out with sticky **pitch** to keep the water out. Then God said, "Come thou and all thy house into the ark." Noah, his wife, his three sons and their wives went in. The animals came too, two by two, in **pairs**. Then the Bible says, "the LORD shut him in."

The big idea. Then the water came. The Bible says "the fountains of the great deep" broke open and "the windows of heaven were opened." Water burst up from under the ground, and rain poured down from the sky. It rained for forty days and forty nights. The water rose over the fields, over the trees, and over the hills. This was the great **Flood**. And the ark? It floated! The Bible says the waters "bare up the ark." Remember the clay boat from our last lesson. The ark was very big and very heavy, but it was shaped like a boat and full of rooms

with air inside, so it was light for its size. The water pushed up on it and held it up, high above the drowned earth.

Try it and see. You can build a toy ark. A plastic food box or a metal loaf pan makes a good one. Put your animals inside two by two. Set it in a tub and pour rain on it. Does it float? Load more pairs. Watch the ark sit lower and lower in the water. A real ark needed to be strong and well built to carry all its animals safely.

God's handiwork. The Flood really happened. It is history, written down in God's Word, and Jesus Himself spoke about Noah and the ark. God was sad about sin, but He made a way to save Noah's family and the animals. Later we will learn about the promise God gave Noah after the water went down. For now, remember this: the same God who sends the rain kept Noah safe in the middle of it.



The animals came into the ark two by two.

PICTURE STUDY



Noah's Ark, Edward Hicks, 1846 · Oil on canvas · Philadelphia Museum of Art

Edward Hicks lived in Pennsylvania. He was a Quaker preacher who earned his living painting signs, wagons and pictures. He loved to paint animals and Bible stories. His best-known paintings show the peaceful animals of Isaiah's prophecy. In this one he painted the animals going into Noah's ark just before the Flood.

Hicks painted the animals carefully, one pair after another. Look closely and you may feel as if the rain is about to start.

Look closely

- Find a pair of animals that are the same kind. Can you find another pair?
- Point to the biggest animal you can see. Point to the smallest.
- Find the ark. How will the animals get inside?
- Look at the sky. What kind of weather is coming?

Talk about it

1. Why do you think the animals came two by two?
2. If you were one of Noah's family watching this line of animals, what would you say?
3. How do you think Noah felt when the door shut and the rain began?

Safety first. A grown-up stays beside the tub or sink the whole time. Even shallow water can be dangerous for young children. Empty the water when you finish and wipe up spills so no one slips.

MAKE AND DO: BUILD A TOY ARK

You will build your own small ark, load it with animals two by two, and send a rainstorm over it. Will your ark float?

You will need

- A plastic food container, a metal loaf pan, or a small plastic tub (this is the ark)
- Small toy animals, or animals you shape from modeling clay
- A bathtub, sink or large dishpan with water
- A watering can, or a paper cup with a few holes poked in the bottom by a grown-up (this is the rain)
- A strip of masking tape and a marker
- Crayons and paper (optional, for drawing a door and windows to tape on)

Steps

1. Decorate your ark if you like. Draw a door and windows on paper and tape them to the outside.
2. Find the pairs. Match each animal with its partner. Count the pairs.
3. Set the empty ark in the water. Does it float? Your parent puts a strip of tape on the side where the water comes up.
4. Load the animals two by two. Count by twos as each pair goes in: 2, 4, 6, 8.
5. Look at the water line now. Is the ark sitting lower in the water than before?
6. Make the rain! Pour water from the watering can over the tub while you count slowly to 10. Splash the water with your hand to make waves.
7. Does the ark still float? Did any water get inside? Tell how Noah kept the water out of the real ark.
8. Tell the story of Noah to your parent while you play with your ark.

Tips

- If the ark tips over, put the heaviest animals in the middle and down low.
- If rain fills your ark, talk about why Noah's ark had a roof and pitch to keep the water out. Bail it out with a spoon and try again.

Check your work

- I can tell the story of Noah and the Flood.
- I can count animals by twos.
- I can tell why my ark floated.

FIELD NOTEBOOK

1. Draw the ark with rain falling all around it. Put Noah's family at the window.
2. Draw two animals of the same kind side by side to make a pair. Draw three more pairs.

3. Draw your toy ark floating in the tub. Your parent can write your words about what happened when you made it rain.

From history. In Genesis 6:15, God told Noah how big to make the ark: three hundred cubits long, fifty cubits wide and thirty cubits high. A cubit is about the length from a man's elbow to the tip of his fingers, so the ark was about as long as one and a half football fields. It had three decks (Genesis 6:16), with plenty of room for the animals and their food. Shipbuilders today still use a long, narrow shape like this for big ships that ride steady on the waves.

WORKED EXAMPLES

Example 1. Look at the picture. The animals are going into the ark in pairs. There are 4 pairs. How many animals are there in all?

(Use the map or drawing "Count the animals by twos." shown earlier in this lesson.)

1. Point to the first pair and count the animals: 1, 2.
2. Keep going, one animal at a time, through all four pairs: 3, 4, 5, 6, 7, 8.
3. Now count again the quick way, by twos, one pair at a time: 2, 4, 6, 8.

Answer: 8 animals.

PRACTICE

1. **EASY** Who built the ark?
2. **EASY** Show with your fingers how the animals came into the ark.
3. **MEDIUM** Line up 3 pairs of toy animals. How many animals is that?
4. **MEDIUM** Where did the Flood water come from? Point down for one place and up for the other.
5. **HARD** The ark was huge and very heavy. Tell your parent why it did not sink.

COMMON MISTAKES

- Thinking the ark was a small, round boat like a toy. The Bible gives its size, and it was longer than a football field, with three decks inside.
- Thinking the Flood was only rain. The Bible says water also burst up from "the fountains of the great deep."
- Thinking the story is just pretend. The Bible tells it as true history, and Jesus spoke of "the days of Noe" as a real time.

Make it a game • Two by Two. Make pairs of animal cards: draw the same animal on two cards, for six or eight different animals, or use a matching-card game. Mix the cards and lay them face down. Take turns flipping two cards. If they match, you found a pair!

March the pair into a shoebox ark and say the animal's name. When every pair is in the ark, close the lid and say, "The LORD shut him in."

Scripture. "And the flood was forty days upon the earth; and the waters increased, and bare up the ark, and it was lift up above the earth." (Genesis 7:17, KJV)

"Bare up" means held up. The same water that covered the earth lifted the ark and carried it. God used the water to judge the world and also to carry Noah's family safely.

Practice answers

1. Noah, with his family, just as God told him.
2. Two by two, in pairs. (The child holds up two fingers.)
3. 6 animals (2, 4, 6).
4. From under the ground ("the fountains of the great deep"), pointing down, and from the sky as rain ("the windows of heaven"), pointing up.
5. It was shaped like a boat and full of rooms with air inside, so it was light for its size and the water pushed up on it. Noah built it the way God told him, and God kept it safe.

UNIT 3 REVIEW

This is an oral review. Read each question aloud and let your child answer by telling, pointing, showing or drawing. Have an ice cube, a cup of water, a pumice stone and a few toy animals ready. Give full points for a clear answer in the child's own words. The review is worth 20 points.

1. (3 pts) Hold up an ice cube and a cup of water. Ask: Which one is a solid? Which one is a liquid? What is the third way water can be?
2. (3 pts) What makes ice melt? Where do the drops on the outside of a cold glass come from?
3. (3 pts) Tell three places the rain in a puddle can go.
4. (3 pts) Tell the trip of a raindrop from a cloud back to a cloud.
5. (3 pts) Show the pumice stone. Ask: Will it float or sink? Why?
6. (2 pts) A ball of clay sinks. How can you make the same clay float?
7. (3 pts) Tell the story of Noah's ark. Then line up 4 pairs of toy animals and count them by twos.

UNIT PROJECT: MY WATER BOOK

Make a little book of four pages, one for each lesson. On page one, draw water three ways: an ice cube, a glass of water and a pot with a cloud above it. On page two, draw your puddle with its chalk rings and a raindrop's trip to the sea and back. On page three, draw your sink-or-float tub with the floaters at the top and the sinkers at the bottom. On page four, draw Noah's ark with the animals going in two by two.

Your parent writes your words under each picture as you tell about it. Make a cover with your name and a big blue raindrop, staple the pages together, and read your book aloud to someone in your family by telling the pictures.

- **Observation:** Each drawing shows something the child really saw or did: the melting ice, the shrinking puddle, the things that floated and sank, the toy ark.
- **Understanding:** The child's spoken words name solid, liquid and water vapor, tell where rain goes, and explain why pumice and boats float.
- **Narration:** The child retells the story of Noah and the Flood in order, in their own words, and tells each page clearly.
- **Care:** The pages are colored with care, in order, and the book is put together neatly.

Answer key

1. The ice cube is a solid. The water in the cup is a liquid. The third way is water vapor, a gas we cannot see.
2. Warmth makes ice melt. The drops come from water vapor in the air that cooled on the cold glass and turned back into liquid.

3. It can soak into the ground, run downhill (to a creek, a river and the sea), and dry up into the air (evaporate).
4. It falls as rain, lands on the ground, runs downhill to a river and the sea (or soaks in), warms up and goes into the air as water vapor, and cools high up to make a cloud again.
5. It floats, because it is full of tiny holes filled with air, which makes it light for its size.
6. Shape it into a boat or bowl with sides, so it holds air and pushes lots of water out of the way.
7. God told Noah to build an ark. Noah, his family and the animals, two by two, went in, and the LORD shut them in. Water came up from the deep and rain fell forty days and forty nights, and the ark floated. Counting: 2, 4, 6, 8, so 8 animals.

WEATHER

Every morning the sky has something new to show us. Some days are bright and sunny, some are gray and cloudy, and some bring rain or soft white snow. In this unit your child becomes a weather watcher. You will keep a picture weather chart, make a pinwheel to catch the wind, find the colors hiding in sunlight, and learn to count the seconds between a flash of lightning and the boom of thunder.

Along the way you will meet Thomas Jefferson writing down the weather, sailors reading the wind, Isaac Newton splitting sunlight with a prism, and Benjamin Franklin learning that lightning is electricity. You will hear God's promise to Noah in the rainbow (Genesis 9:13) and see how great and strong God is in the storm (Psalm 29:3). The picture study is John Constable's *Salisbury Cathedral from the Meadows*, where a bright rainbow shines over a passing storm.

Everything in this unit is said, pointed to, built or drawn; no reading is needed from the child. Keep the weather chart going all unit long. It ties the lessons together and leads into the Cloud Chart in the Field Lab.

BEFORE YOU BEGIN

- Can count objects to 10
- Can name the basic colors
- Can sort pictures or objects into two groups
- Knows the story of Noah and the ark (Unit 3)

MASTERY CHECKLIST

- I can name four kinds of weather and draw a picture for each.
- I can keep a picture weather chart and count the kinds of days.
- I can tell that wind is moving air and show it with my pinwheel.
- I can tell how a rainbow is made and name its colors in order.
- I can tell God's promise to Noah that the rainbow reminds us of.
- I can count from flash to boom and say, "When thunder roars, go indoors."

OPTIONAL BOOKS AND RESOURCES

- **NOAA SciJinks** (<https://scijinks.gov/>): Free. Weather pages, pictures and games from NOAA and NASA, written for children. A grown-up can read short pages aloud about clouds, rain, wind, rainbows and lightning.
- **National Weather Service: Lightning Safety** (<https://www.weather.gov/safety/lightning>): Free. The official "When thunder roars, go indoors" safety pages, with tips for families on where to go and what to do in a thunderstorm (Lesson 4.4).

4.1 SUNNY, CLOUDY, RAINY, SNOWY ★

OBJECTIVES

- Tell what weather is: what the air and sky are doing right now.
- Name four kinds of weather (sunny, cloudy, rainy, snowy) and draw a simple picture for each.
- Keep a picture weather chart for a week and count the kinds of days.

Warm-up. Stand at a window with your grown-up. Do not look at the sun. Look at the sky, the ground and the trees. Is the sky blue or gray? Is anything falling? Are the trees moving? Now play “Show Me”: make a big circle with your arms for sunny, puff out your cheeks for cloudy, wiggle your fingers down like drops for rainy, and shiver for snowy. Which one is it today?

Video. Coming soon. Kinds of weather for young children (sunny, cloudy, rainy, snowy) and making a weather chart; search NOAA SciJinks, SciShow Kids, Homeschool Pop (Alternate) and calm nature footage of rain and falling snow.

KEY TERMS

weather

What the air and sky are doing right now, outside, where you are: sunny, cloudy, rainy, snowy, windy, warm or cold.

cloud

A great crowd of tiny drops of water, or tiny bits of ice, floating together high in the air.

rain

Drops of water that fall from the clouds to the ground.

snow

Soft flakes of ice that fall from the clouds when the air is very cold.

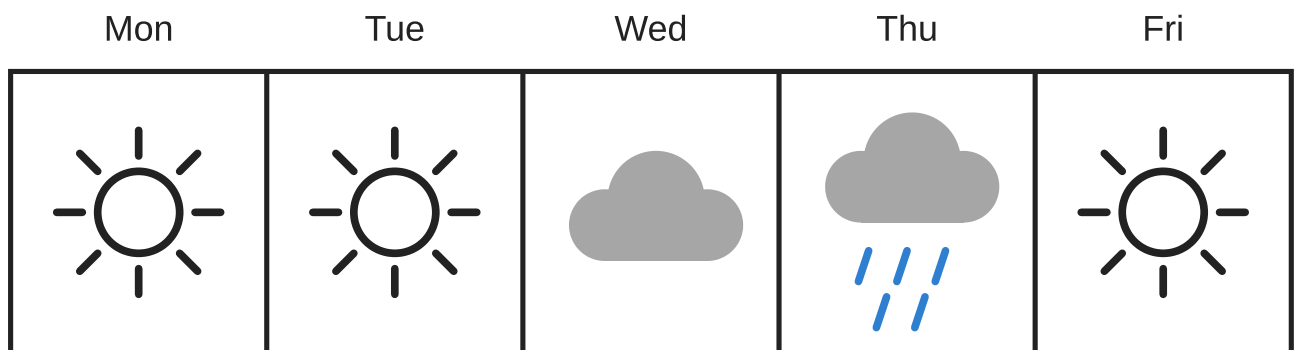
CORE IDEAS

The story. Go to a window and look out. Is the sky bright and blue? Is it gray and covered with clouds? Are drops falling, or soft white flakes? What you see is the **weather**. Weather is what the air and sky are doing right now, outside, where you are. Weather can change in one day. A sunny morning can turn into a rainy afternoon, and a rainy night can turn into a clear, bright day.

How they figured it out. People who want to know about the weather do not just guess. They look, and they write down what they see, day after day. Thomas Jefferson did this for many years of his life. He even wrote down how warm it was on July 4, 1776, the very day the Declaration of Independence was approved. Farmers, sailors and weather watchers still keep records like this. When you keep a weather chart, you are a weather watcher too.

The big idea. We can sort most days into four kinds. **Sunny:** the sun shines and few clouds hide it. **Cloudy:** clouds cover much of the sky. A **cloud** is a great crowd of tiny water drops, or tiny bits of ice, floating in the air. The sun is still there behind the clouds! **Rainy:** the tiny drops in a cloud bump together and grow until they are heavy, and then they fall as **rain**. **Snowy:** when the air is very cold, the water in the clouds freezes into tiny ice crystals that grow into snowflakes and drift down as **snow**. We can draw a little picture for each kind: a sun, a cloud, a cloud with drops, and a cloud with snowflakes. A chart of pictures lets you see a whole week at once.

God's handiwork. The Bible says God "covereth the heaven with clouds" and "prepareth rain for the earth" (Psalm 147:8). Every kind of weather has a job. Sunshine warms the ground and helps plants grow. Clouds shade us. Rain fills the streams and waters the gardens. Snow covers the ground like a soft blanket in winter and melts into water in spring. When you look out the window each morning, you are watching God care for His world.



A week on a picture weather chart. Count the suns!

PICTURE STUDY



The Magpie, Claude Monet, 1868-1869 · Oil on canvas · Musée d'Orsay, Paris

Claude Monet was a French painter who loved to paint light and weather. He liked to work outdoors, even in the cold. One winter, in the countryside of Normandy near the sea, he painted this snowy farmyard on a sunny day. Snow covers the ground, the fence and the roofs, and one little black bird, a magpie, sits on the gate.

Look closely at the snow. Monet did not paint it plain white. The shadows on the snow are soft blue, and the sunny parts glow warm. He painted the weather of one bright, cold day so well that you can almost feel the chill.

Look closely

- Find the little black bird sitting on the gate. It is a magpie.
- Look at the snow. Is it all white, or can you find blue and yellow in it?
- Find the shadows on the snow. Is the sun shining today?
- Find the house and the trees behind the fence. What is on their roofs and branches?

Talk about it

1. What kind of weather is in this painting? Which pictures could you draw on your weather chart for this day?
2. Is snow falling right now, or did it fall before? How can you tell?
3. What would you wear to go outside and see the magpie?

Safety first. Never look straight at the sun, even for a moment. It can hurt your eyes. If there is thunder or lightning, watch the weather from inside the house.

MAKE AND DO: MY PICTURE WEATHER CHART

You will make a chart with one box for each day of the week. Each day you will look outside and draw the weather in its box. At the end of the week you will count your pictures, just like a real weather watcher.

You will need

- A large sheet of paper or poster board
- Crayons or markers (yellow, gray, blue and black are helpful)
- A ruler (for the grown-up)
- Tape to hang the chart near a window
- Optional: weather stickers, or small paper suns, clouds, drops and snowflakes to glue on

Steps

1. The grown-up draws a row of seven big boxes and writes the day names above them while saying each name aloud.
2. Along the bottom, the child draws the four “key” pictures: a yellow sun (sunny), a gray cloud (cloudy), a cloud with blue drops (rainy), and a cloud with snowflakes (snowy). The grown-up writes the word under each picture.
3. Hang the chart by a window you can look out of every day.
4. Each morning at about the same time, go to the window together. Look at the sky. Do not look at the sun.
5. Decide which picture fits the day and draw it in that day’s box. If it is windy too, add a few curvy lines.
6. At the end of the week, point to each box and count: How many sunny days? How many cloudy? Rainy? Snowy?
7. Tell your grown-up which kind of weather you had the most of this week.

Tips

- Some days are partly sunny and partly cloudy. Draw a sun peeking out from behind a cloud.
- Look at the same time each day. Weather can change by afternoon, and that is interesting too. You can add a second picture for the afternoon.
- Keep the chart going for more weeks if your child enjoys it. It is a good start for the Cloud Chart in the Field Lab.

Check your work

- I can draw a picture for sunny, cloudy, rainy and snowy.
- I looked outside and drew the weather each day.
- I can count the pictures on my chart and tell which kind of day came most.

FIELD NOTEBOOK

1. Draw the sky out your window today. Use the colors you really see.
2. Draw yourself dressed for a rainy day and for a snowy day.
3. Draw a cloud. Next to it, draw lots of tiny dots to show the tiny water drops it is made of.

From history. In 1870, President Ulysses S. Grant signed a law that started a weather service for the whole United States. Weather watchers in many towns looked at the sky and their instruments at the same times each day and sent what they saw by telegraph, so people could know what weather was coming. That work grew into today's National Weather Service, which still keeps a careful record of the weather every day.

WORKED EXAMPLES

Example 1. Look at the weather chart. How many days were sunny? Were there more sunny days or rainy days?

(Use the map or drawing "Point and count the suns, the clouds and the raindrops." shown earlier in this lesson.)

1. Point to each box, one at a time: Monday, Tuesday, Wednesday, Thursday, Friday.
2. Count only the boxes with a sun: Monday is one, Tuesday is two, Friday is three.
3. Now count the boxes with raindrops: only Thursday. That is one.
4. Three is more than one.

Answer: 3 days were sunny (and 1 was cloudy and 1 was rainy). There were more sunny days than rainy days.

PRACTICE

1. **EASY** Look out the window (not at the sun). What is the weather right now? Draw its picture.
2. **EASY** The grown-up draws four pictures: a sun, a cloud, a cloud with drops, and a cloud with snowflakes. Point to the picture that means snowy.
3. **MEDIUM** Match each thing to the weather you would use it in: an umbrella, a sun hat, mittens, rain boots.
4. **MEDIUM** Look at the weather chart in the worked example again. Count the days that were NOT sunny.
5. **HARD** Can it snow on a hot summer day? Tell why or why not.

COMMON MISTAKES

- Thinking clouds are made of cotton or smoke. A cloud is made of tiny drops of water or tiny bits of ice floating in the air.

- Thinking the sun goes away on a cloudy day. The sun is still shining above the clouds; the clouds are just in front of it.
- Thinking every cloud brings rain. Many clouds float by all day and never rain at all.

Make it a game • Weather Charades. Take turns acting out a kind of weather without talking. Shade your eyes and smile for sunny. Spread your arms wide and float slowly for cloudy. Wiggle your fingers down for rainy. Shiver and catch pretend flakes on your tongue for snowy. The other player guesses the weather and draws its picture in the air. For a harder round, act out what you would wear for that weather.

Scripture. “Who covereth the heaven with clouds, who prepareth rain for the earth, who maketh grass to grow upon the mountains.” (Psalm 147:8, KJV)

God sends the clouds and the rain on purpose. The rain makes the grass grow, and the grass feeds the animals. Every kind of weather is part of God’s care for the earth.

Practice answers

1. Answers will vary. The child names the weather (sunny, cloudy, rainy or snowy) and draws the matching picture: a sun, a cloud, a cloud with drops, or a cloud with snowflakes.
2. The cloud with snowflakes.
3. Umbrella and rain boots: rainy. Sun hat: sunny. Mittens: snowy (cold).
4. 2 days: Wednesday (cloudy) and Thursday (rainy).
5. No. Snow needs very cold air so the water in the clouds freezes into ice crystals. On a hot day the air is too warm, so it rains instead. (Big summer storms can sometimes drop hail, which is lumps of ice, but hail is not snow.)

4.2 THE WIND

OBJECTIVES

- Tell that wind is moving air, and that we know it is there by what it does.
- Sort signs of a calm day and a windy day (smoke, flags, leaves, trees).
- Make a pinwheel and use it to find and compare the wind.

Warm-up. Hold your hand in front of your mouth and blow. What do you feel? Now open a paper or plastic bag, swing it through the air to fill it, and twist the top closed. Squeeze it gently. What is inside? You cannot see it, but it pushes back. That is air. Wave a sheet of paper like a fan at your face. You just made a little wind!

Video. Coming soon. What wind is and how it moves things, for young children, plus how to make a paper pinwheel; search NOAA SciJinks, SciShow Kids, Science Max, Homeschool Pop (Alternate) and nature footage of wind in grass, trees and windmills.

KEY TERMS

air

What is all around us. We cannot see it, but we breathe it and can feel it push.

wind

Air that is moving.

breeze

A gentle wind that rustles leaves and cools your face.

pinwheel

A toy wheel with paper blades that spins when the wind pushes it.

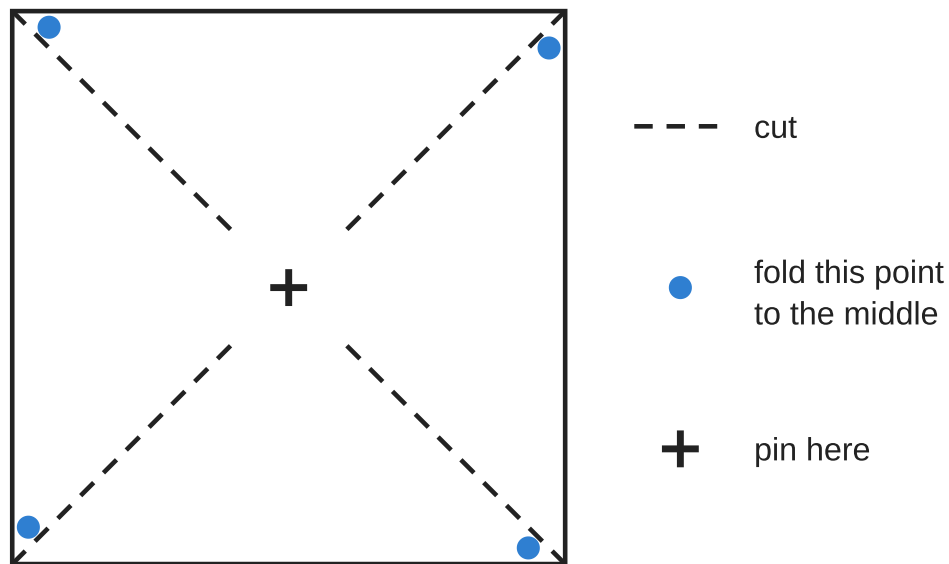
CORE IDEAS

The story. Hold your hand near your mouth and blow. You can feel something, but you cannot see it. That is **air**. Air is all around us, even when it seems like nothing is there. When air moves, we call it **wind**. You cannot see the wind, but you can see what it does. It waves flags. It bends the grass. It pushes clouds across the sky. It carries dandelion seeds far away, fills the sails of boats, lifts kites, spins windmills and dries the wash on a clothesline.

How they figured it out. Sailors have always watched the wind, because their ships could not sail without it. In 1805, a British navy officer named Francis Beaufort made a list that described how strong the wind was by what it did to a ship's sails. Later, people added signs you can see on land. When smoke goes straight up, the air is calm. When leaves rustle, there is a gentle **breeze**. When whole branches sway, the wind is strong. When it is hard to walk, the wind is very strong. You can be a wind watcher just by looking out the window.

The big idea. Why does the air move? The sun warms the ground, but not all places the same. A dark parking lot gets hotter than a shady lake. Air over the warm ground gets warm and rises, a little like a balloon floating up. Cooler air slides in to take its place. That moving air is wind. A gentle wind is a breeze. A strong wind can blow your hat right off your head!

God's handiwork. Jesus said, "The wind bloweth where it listeth, and thou hearest the sound thereof, but canst not tell whence it cometh, and whither it goeth" (John 3:8). We cannot see the wind, but we know it is real because we see what it does. God uses the wind to spread seeds, to cool us on hot days and to carry rain clouds over the fields. Today you will make a **pinwheel** so you can watch the wind at work.



Pinwheel pattern: cut on the dashed lines, fold each dotted point to the middle, and pin it there.

PICTURE STUDY



The Windmill at Wijk bij Duurstede, Jacob van Ruisdael, about 1668–1670 · Oil on canvas · Rijksmuseum, Amsterdam

Jacob van Ruisdael was a Dutch painter who loved big skies. In his country, the Netherlands, the land is very flat, and the wind blows across it from the sea. The Dutch built windmills to catch that wind. The turning sails of a windmill could grind grain into flour or pump water off the low fields. In this painting a great windmill stands by a river. Look at how much of the picture is sky!

Look closely

- Find the windmill's long sails. How many can you count?
- Find the boat on the river. What part of the boat catches the wind?
- Look at the clouds. Are they still, or do they look like they are moving?
- Find the land, the water and the sky. Which one takes up the most room?

Talk about it

1. How is a windmill like your pinwheel? How is it different?
2. What would happen to the windmill and the boat on a day with no wind?
3. If you stood by this river, what would the wind feel like?

Safety first. A grown-up does the cutting with sharp scissors and pushes the pin. Keep the pin's sharp point pushed fully into the pencil eraser. Walk, do not run, while holding a pinwheel, and never point it at anyone's face.

MAKE AND DO: MAKE A PINWHEEL

A pinwheel is a little windmill you can hold. When the wind pushes on its blades, it spins. The harder the wind pushes, the faster it spins. You will make one and then go looking for the wind.

You will need

- A square of stiff paper or card stock, about 6 inches (15 cm) on each side
- Crayons or markers
- A ruler and a pencil
- Scissors (for the grown-up)
- A pushpin or straight pin with a head (for the grown-up)
- A new pencil with an eraser on the end
- Optional: a small bead to go between the pinwheel and the eraser so it spins more easily

Steps

1. Color both sides of the paper square with bright colors and patterns.
2. The grown-up uses the ruler to draw a line from each corner toward the middle, like a big X, as in the pattern.
3. The grown-up cuts along each line from the corner toward the middle, stopping about an inch (2 to 3 cm) before the center. Count the cuts together: 1, 2, 3, 4.
4. Now each corner has two points. Choose one point at each corner, always the one on the same side (the dotted points on the pattern). Bend it gently to the middle without creasing it. Count the points: 1, 2, 3, 4.
5. The grown-up holds all four points in the middle and pushes the pin through them and through the center of the paper.
6. If you have a bead, slide it onto the pin behind the paper. Then the grown-up pushes the pin into the side of the pencil eraser, leaving a little space so the pinwheel can turn.
7. Blow on your pinwheel. Does it spin? Blow softly, then hard. Which way spins faster?
8. Take the pinwheel outside. Hold it up high, then down low. Turn and face different ways. Where does the wind spin it fastest?

Tips

- If the pinwheel will not turn, make the hole a little bigger or pull the pin out from the eraser a tiny bit.
- Do not crease the folded points. Gentle curves catch the wind better.
- Push the pinwheel into the ground or a flowerpot on a stick to make a wind watcher by your weather chart.

Check your work

- I can tell that wind is moving air.

- I helped make a pinwheel and counted its cuts and points.
- I can show that my pinwheel spins faster in a strong wind than in a soft one.

FIELD NOTEBOOK

1. Draw a tree on a calm day and the same tree on a windy day.
2. Draw three things the wind can move.
3. Draw your pinwheel spinning. Add curvy lines to show the wind.

From history. Much of the Netherlands is low, flat land near the sea, and some of it is even lower than the sea. For hundreds of years the Dutch used the wind to help them. Rows of windmills turned day and night, pumping water out of the wet fields and into rivers and canals so that people could farm and build towns there. Other windmills ground grain into flour or sawed logs into boards. Some of those old windmills still stand today, and visitors can watch their great sails turn.

WORKED EXAMPLES

Example 1. Your family tied a ribbon to the porch rail and looked at it each morning for five days. The ribbon hung straight down on Monday, blew out sideways on Tuesday, hung down on Wednesday, blew out on Thursday, and blew out on Friday. How many days were windy? Were there more windy days or calm days?

1. A ribbon that blows out sideways means wind. A ribbon that hangs straight down means calm.
2. Count the windy days: Tuesday is one, Thursday is two, Friday is three.
3. Count the calm days: Monday is one, Wednesday is two.
4. Three is more than two.

Answer: 3 days were windy and 2 days were calm. There were more windy days.

PRACTICE

1. **EASY** Name three things the wind can move.
2. **EASY** Can you see the wind? How do we know it is there?
3. **MEDIUM** Sort these into a calm pile and a windy pile: smoke going straight up, a flag flapping, a still pond, a kite flying, leaves blowing down the street.
4. **MEDIUM** Look at your pinwheel. How many cuts did we make? How many points did we fold to the middle?
5. **HARD** Your pinwheel spins fast when you blow hard and slowly when you blow softly. What does that tell you about wind?

COMMON MISTAKES

- Thinking the trees make the wind by waving their branches. It is the other way around: the wind moves the trees.
- Thinking air is nothing at all. Air is real. It takes up space in a bag, and it can push hard enough to move a sailboat.
- Thinking a “north wind” blows toward the north. A wind is named for where it comes from, so a north wind blows from the north.

Make it a game · Cotton Ball Wind Race. Put two cotton balls at one end of a table and a book standing up at the other end for the finish line. Each player gets a drinking straw. On “Go!”, blow through your straw to push your cotton ball to the finish. You are the wind! Try again with a crumpled paper ball, and then a small block. Which is easiest for your wind to move? Which is hardest?

Scripture. “The wind bloweth where it listeth, and thou hearest the sound thereof, but canst not tell whence it cometh, and whither it goeth: so is every one that is born of the Spirit.” (John 3:8, KJV)

“Listeth” means “wants” or “chooses.” Jesus used the wind to teach about God’s Spirit. We cannot see the wind, but we can hear it and see what it does. In the same way, we can see God at work in the lives of people who love Him.

Practice answers

1. Any three, such as leaves, flags, kites, clouds, hair, dandelion seeds, sailboats, windmills, pinwheels or clothes on a line.
2. No, we cannot see the wind itself, because air is invisible. We know it is there because we feel it on our skin and see what it moves, like leaves, flags and our pinwheel.
3. Calm: smoke going straight up, a still pond. Windy: a flag flapping, a kite flying, leaves blowing down the street.
4. 4 cuts and 4 points.
5. Faster, stronger moving air pushes harder. A strong wind spins the pinwheel fast, and a gentle breeze spins it slowly.

4.3 RAINBOWS

OBJECTIVES

- Tell that a rainbow appears when sunlight shines through raindrops, with the sun behind you and the rain in front.
- Name the colors of the rainbow in order, with red on the outside and violet on the inside.
- Tell God’s promise to Noah and the sign He gave (Genesis 9:13).

Warm-up. Blow some soap bubbles, or hold an old CD or DVD in the light and tip it slowly. What colors do you see swirling? Point to each one and name it. Where did all those colors come from? Today we will find out that they were hiding in the light all along.

Video. Coming soon. How rainbows form from sunlight and raindrops, and splitting light with a prism or a glass of water, for young children; search NOAA SciJinks, NASA, SciShow Kids, Science Max, Moody Science classics and real footage of rainbows.

KEY TERMS

rainbow

A curved band of colors in the sky, made when sunlight shines through raindrops.

sunlight

The light from the sun. It looks white, but it has all the colors of the rainbow mixed inside it.

prism

A clear piece of glass that bends light and spreads it out into colors.

promise

Saying you will surely do something, and then doing it. God always keeps His promises.

CORE IDEAS

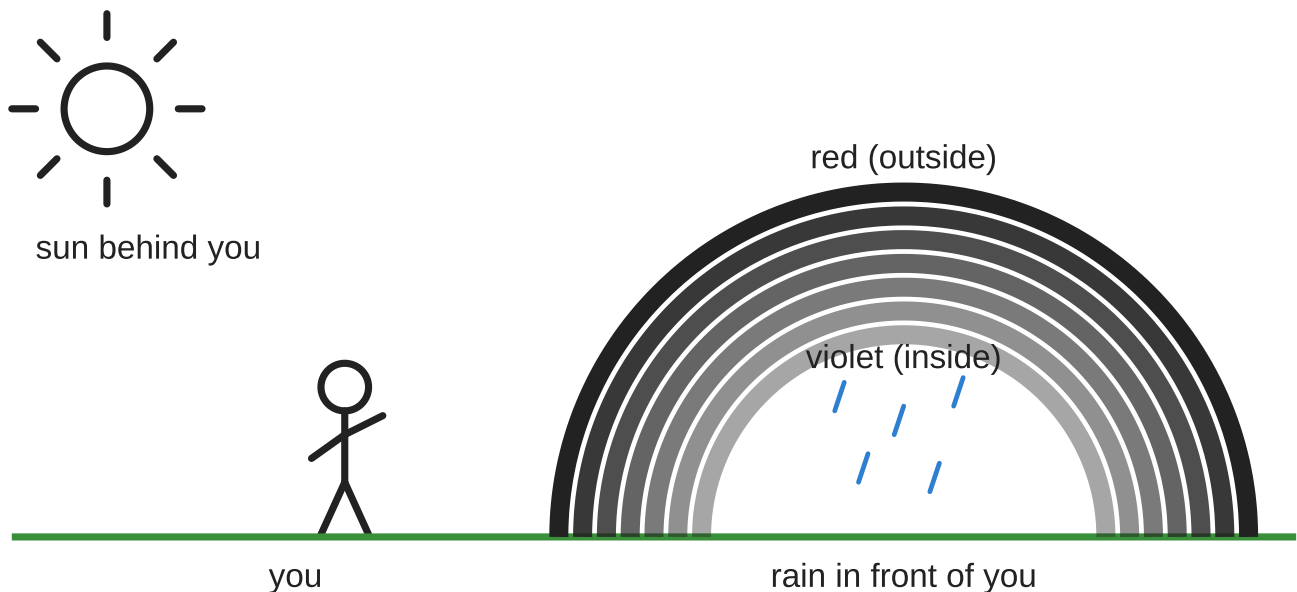
The story. After the great Flood, Noah and his family and all the animals came out of the ark onto dry ground. Then God made a **promise**. He would never again send a flood to cover the whole earth. And God gave a sign to help everyone remember: “I do set my bow in the cloud, and it shall be for a token of a covenant between me and the earth” (Genesis 9:13). A “bow” is a rainbow. A “token” is a sign. Every rainbow you ever see reminds us that God keeps His word.

How they figured it out. Long ago in England, a scientist named Isaac Newton made his room dark and let one thin beam of **sunlight** come in through a small hole in the window shutter. He set a **prism**, a clear piece of glass, in the beam. On the wall, the white light spread out into a band of colors! Newton learned that sunlight looks white, but it is really all

the colors mixed together. He named seven of them: red, orange, yellow, green, blue, indigo and violet.

The big idea. Each raindrop works like a tiny prism. Sunlight goes into the drop, bends, bounces off the back, and comes out again spread into colors. Millions and millions of drops together make a **rainbow**. To see one, you need two things: sunlight behind you and rain in front of you. That is why rainbows often show up in the morning or late afternoon, when the sun is low and a shower is passing. The colors always come in the same order. Red is on the outside of the bow and violet is on the inside.

Try it and see. You can make your own rainbow. Fill a clear glass with water and set it in a sunny window, then look for colors on a white paper below. Or stand with your back to the sun and spray a fine mist from a garden hose. Look into the mist, and a little rainbow will appear. God put His promise into the light and the raindrops for us to find.



To see a rainbow, keep the sun behind you and look toward the rain. Red is on the outside; violet is on the inside.

PICTURE STUDY



Salisbury Cathedral from the Meadows, John Constable, 1831 · Oil on canvas · Tate, London (shared with partner museums in Britain, so it travels between them)

John Constable was an English painter who loved the fields, rivers and skies of the English countryside. He liked to go outdoors and paint clouds just as he saw them. His good friend John Fisher lived in the town of Salisbury, and Constable visited him and painted Salisbury's great cathedral many times.

In this big painting, a storm is passing over the cathedral. The clouds are dark and the trees are tossing in the wind. But the sun has come out behind the painter, and a bright rainbow arches across the sky. Many people have felt that this painting shows hope after a storm, just like the rainbow God gave to Noah.

Look closely

- Find the rainbow. Follow it with your finger from one end to the other.
- Find the cathedral's tall, pointed spire. Is it near the rainbow?
- Find the horses and the wagon. What are they crossing?
- Look at the sky. Where is it darkest? Where is it lightest?

Talk about it

1. What kind of weather is the painter showing? What just happened, and what might happen next?
2. If the rainbow is in front of us, where must the sun be?
3. How does the rainbow make you feel when you look at the dark clouds around it?

Safety first. Never look straight at the sun, even when you are hunting for a rainbow. Keep your back to the sun. A grown-up should carry and set up the glass of water, and wipe up spills right away so no one slips.

MAKE AND DO: MAKE A RAINBOW

You will catch the colors hiding in sunlight, the same way raindrops do. Then you will make a paper rainbow with the colors in the right order.

You will need

- A clear, smooth drinking glass full of water
- A sunny windowsill or table in bright sunlight
- A sheet of white paper
- Optional: a garden hose with a spray nozzle, on a sunny day
- Optional: a glass prism or an old CD
- Crayons in red, orange, yellow, green, blue and purple (use dark blue for indigo and purple for violet)
- A paper plate or a large sheet of paper

Steps

1. **Glass rainbow.** The grown-up fills the glass to the top with water and sets it at the edge of a sunny windowsill or table, where the sunlight shines right through it.
2. Lay the white paper on the floor or a chair below, where the light coming through the glass lands. Move the paper (or the glass) slowly until you see a little band of colors.
3. Point to each color and name it. Which color is at one edge? Which is at the other?
4. **Hose rainbow (optional).** On a sunny morning or late afternoon, go outside and stand with your back to the sun. Spray a fine mist up into the air in front of you. Look into the mist for a rainbow. Turn around to face the sun (without looking at it) and see if the rainbow is still there.
5. **Paper rainbow.** On a paper plate cut in half, or a large sheet of paper, color seven curved stripes. Start with red on the outside, then orange, yellow, green, blue, indigo and violet on the inside. Count your stripes: 1 to 7.
6. Draw a sun in the corner and an ark below your rainbow. Tell your grown-up the promise the rainbow reminds us of.

Tips

- The glass rainbow works best in strong, direct sunlight. A south- or west-facing window in the afternoon is often good.
- If you have a glass prism or a CD, hold it in a sunbeam and catch the colors on the wall.
- In the hose rainbow, the rainbow disappears when you turn to face the sun. That shows the sun must be behind you.

Check your work

- I made colors appear from sunlight and water.
- I can name the rainbow colors in order, red on the outside to violet on the inside.
- I can tell what God promised Noah when He set His bow in the cloud.

FIELD NOTEBOOK

1. Draw the rainbow you made with the glass of water, using the colors you really saw.
2. Draw yourself looking at a rainbow. Put the sun behind you and the rain in front of you.
3. Draw Noah's ark on the mountain with God's rainbow in the sky above it.

From history. Long before Newton, a German friar named Theodoric of Freiberg wondered how raindrops make a rainbow. He could not climb into the clouds to look at a raindrop, so he made a giant one. He filled a round glass ball with water, shined sunlight into it, and watched what the light did inside. He saw the light go in, bounce off the back of the ball and come out in colors. One big model drop helped him understand millions of tiny ones.

WORKED EXAMPLES

Example 1. Look at the rainbow picture. How many colored bands does a rainbow have in Newton's list? Which color is on the outside?

(Use the map or drawing "Touch and count each band, from red on the outside to violet on the inside." shown earlier in this lesson.)

1. Start at the outside band and touch each one as you count: red, orange, yellow, green, blue, indigo, violet.
2. Count them: 1, 2, 3, 4, 5, 6, 7.
3. The band on the outside, at the top of the bow, is red.

Answer: 7 colors, with red on the outside (and violet on the inside).

PRACTICE

1. **EASY** Name the colors of the rainbow. Point to each one on your paper rainbow as you say it.
2. **EASY** What two things do you need to see a rainbow?
3. **MEDIUM** The sun is shining behind your back. Point to where you should look for a rainbow.
4. **MEDIUM** Red, orange, yellow, ... Which color comes right after yellow in the rainbow?
5. **HARD** Tell in your own words what God promised when He set His bow in the cloud.

COMMON MISTAKES

- Thinking a rainbow is a thing you could walk to and touch. A rainbow is light coming to your eyes from raindrops, so it seems to move away as you walk toward it.
- Looking for a rainbow toward the sun. The sun must be behind you and the rain in front of you.
- Thinking the colors can come in any order. In every rainbow the order is the same, red on the outside and violet on the inside.

Make it a game · Rainbow Hunt. Hunt through the house for one thing of each rainbow color, in order. First find something red and bring it back, then orange, then yellow, green, blue, and something deep blue or purple for indigo and violet. Lay them in a curved row on the floor to make a rainbow, with red on the outside. Count your treasures: did you find all seven?

Scripture. “I do set my bow in the cloud, and it shall be for a token of a covenant between me and the earth.” (Genesis 9:13, KJV)

A covenant is a very solemn promise. God made this promise to Noah, to his family and to every living thing. Every time you see a rainbow, you can thank God that He always keeps His promises.

Practice answers

1. Red, orange, yellow, green, blue, indigo and violet. (Indigo is a deep blue, and violet is purple.)
2. Sunlight and drops of water (rain, mist or spray).
3. In front of you, away from the sun, toward the rain or mist.
4. Green.
5. God promised Noah and all the earth that He would never again send a flood to cover the whole earth. The rainbow is the sign that reminds us of His promise (Genesis 9:13-15).

4.4 THUNDER AND LIGHTNING

OBJECTIVES

- Tell that lightning is a giant spark of electricity and that thunder is the sound it makes.
- Count the seconds between the flash and the boom, and tell which storm is closer.
- Say the safety rule “When thunder roars, go indoors” and name safe and unsafe places in a storm.

Warm-up. Make a tiny bit of lightning! In a dim room, rub a balloon on your hair or a wool sweater, then hold it near small bits of tissue paper and watch them jump. Or shuffle your socks across a carpet and gently touch a metal doorknob. Did you feel a little snap, or see a tiny spark? Lightning is the same kind of spark, only enormous.

Video. Coming soon. What lightning and thunder are, counting seconds from flash to bang, and thunderstorm safety for young children; search NOAA SciJinks, National Weather Service lightning safety, SciShow Kids, Homeschool Pop (Alternate), Science Max and real storm footage filmed from a safe place.

KEY TERMS

lightning

A giant spark of electricity that flashes in a storm, from cloud to cloud or from a cloud to the ground.

thunder

The loud boom or rumble that lightning makes.

thunderstorm

A storm with thunder and lightning, and often heavy rain and strong wind.

shelter

A safe place to go, like a house or a big building.

CORE IDEAS

The story. Benjamin Franklin lived in Philadelphia. He loved to experiment with the little sparks of electricity that people could make in those days. He wondered: is **lightning** the same thing, only much bigger? In 1752, so the story goes, he flew a kite in a storm to find out, and he drew sparks from a metal key tied to the wet string. Lightning was electricity! That test was very dangerous, and Franklin was blessed not to be hurt. Never fly a kite in a storm. Franklin also invented the lightning rod, a metal rod on the top of a building that gives lightning a safe path down into the ground. Lightning rods still protect houses, barns and churches today.

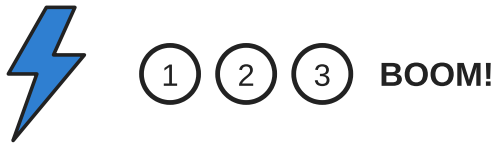
The big idea. Lightning is a giant spark. In a flash, it makes the air around it hotter than the outside of the sun. The hot air pushes out so fast that it makes a huge sound: **thunder**. The

flash and the boom happen at the same moment, but they do not reach you at the same time. Light is very, very fast, so you see the flash right away. Sound is slower, so the boom comes after. The farther away the lightning is, the longer you wait for the thunder.

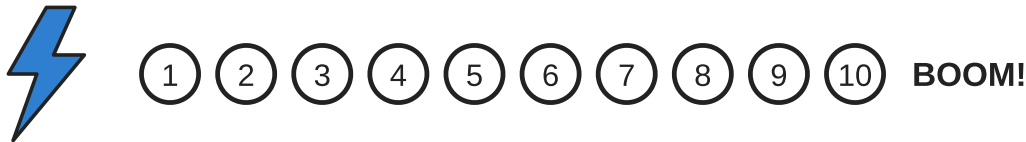
Try it and see. When you see a flash, count slowly: “one, one thousand; two, one thousand; three, one thousand,” until you hear the boom. A small number means the storm is close. A big number means it is farther away. If the numbers get smaller each time, the storm is coming toward you. (For grown-ups: about five seconds is about one mile.) But here is the most important part: if you can hear thunder at all, the storm is close enough for lightning to reach you. **When thunder roars, go indoors.**

God’s handiwork. “The God of glory thundereth” (Psalm 29:3). A **thunderstorm** shows us how great and strong God is. Storms also bring rain that the land needs. We can enjoy watching a storm from a safe **shelter**, like a house or a big building, or a car with a hard roof and the windows rolled up. Stay inside until the thunder has been quiet for a good long while (about half an hour). Wise people respect the storm and stay safe.

Storm A: 3 seconds (closer)



Storm B: 10 seconds (farther)



Count from the flash to the boom. Fewer seconds means the storm is closer.

PICTURE STUDY



The Storm on the Sea of Galilee, Rembrandt van Rijn, 1633 · Oil on canvas · Isabella Stewart Gardner Museum, Boston (stolen in 1990 and still missing; an empty frame hangs in its place)

Rembrandt was a Dutch painter who often painted stories from the Bible. This is the only painting of a storm at sea he ever made. It shows the night Jesus and His disciples were crossing the Sea of Galilee in a boat when a great storm came up (Mark 4:35-41). The disciples were afraid. Jesus stood up and said to the wind and the waves, “Peace, be still,” and the storm stopped.

This painting has a mystery. One night thieves broke into the museum and stole it. No one has found it since, and the museum still keeps its empty frame on the wall, hoping it will come home. We can only study it from photographs.

Look closely

- Find the giant wave. Which way is the boat tipping?
- Find the sail and the ropes. What is the wind doing to them?
- Look at the sky. Where is it dark, and where is there light?
- Find the men at the back of the boat. Can you find Jesus among them?

Talk about it

1. How do you think the men in the boat feel? How can you tell?
2. What did Jesus do in the storm? What does that tell us about Him?
3. What should we do when a storm comes, and Whom can we trust when we are afraid?

Safety first. When thunder roars, go indoors. Go into a house or a big building, or a car with a hard roof and the windows rolled up. Do not stand under a tree, in an open field,

on a hill, in a pool or lake, or in an open shelter like a picnic pavilion. Stay inside until the thunder has been quiet for about half an hour. Indoors during a storm, stay out of the bath and shower and away from windows. Never fly a kite in a storm. In the warm-up, touch the doorknob gently; the little spark is harmless.

MAKE AND DO: FLASH AND BOOM: A STORM SAFETY GAME

You will practice counting from the flash to the boom with a flashlight and a pot. You will make your own thunder with a paper bag. Then you will draw a storm safety plan for your family.

You will need

- A flashlight
- A pot and a wooden spoon
- A paper lunch bag
- Paper and crayons

Steps

1. **Flash and boom.** The child sits in a dim room. The grown-up stands across the room or in the doorway and flashes the flashlight. That is the lightning.
2. As soon as the child sees the flash, the child counts out loud: “one, one thousand; two, one thousand...” The grown-up waits a few seconds, then bangs the pot with the spoon. That is the thunder. Stop counting at the boom.
3. Play several rounds. Sometimes the grown-up waits a long time (a far storm) and sometimes only a moment (a near storm). After each round, the child says “near” or “far.”
4. Play one round where the numbers get smaller each time: 9, then 6, then 3. Is the storm coming closer or going away?
5. **Make thunder.** Blow up the paper bag and twist the top shut. Hold it tight and pop it with a quick clap of your other hand. The air bursts out fast and makes a bang. Lightning pushes air out much, much faster, and that makes thunder.
6. **Safety plan.** Fold a paper in half. On one side, draw safe places in a storm: your house, a big building like your church or the library, a car with a hard roof. On the other side, draw places that are not safe: under a tree, in a pool, in an open field.
7. Practice the rule. The grown-up calls “Thunder!” and the child runs to the house (or a pretend house, like the couch) and says, “When thunder roars, go indoors!”

Tips

- Count slowly and steadily, like a clock ticking. Saying “one thousand” after each number helps.
- If a real storm comes, watch from a window together and count the seconds. It makes a scary storm interesting and teaches calm.

- Some children are afraid of thunder. Remind them that they are safe inside, and that the boom is only the sound of the air.

Check your work

- I can tell that lightning is a giant spark and thunder is its sound.
- I can count from the flash to the boom and tell if a storm is near or far.
- I can say “When thunder roars, go indoors” and point to safe places on my plan.

FIELD NOTEBOOK

1. Draw a thunderstorm seen from a window: dark clouds, a lightning bolt and rain. Draw yourself safe inside.
2. Draw a house with a lightning rod on top and a line showing the lightning’s safe path down into the ground.
3. Draw your storm safety plan: three safe places and three places that are not safe.

From history. Benjamin Franklin did not keep his lightning rod a secret or try to get rich from it. He printed simple directions for making one in *Poor Richard’s Almanack*, a little yearly book that many families bought, so that anyone could put a rod on a house or barn. Soon lightning rods stood on rooftops in America and Europe, and many homes, barns and churches were saved from fire.

WORKED EXAMPLES

Example 1. In Storm A, you counted 3 seconds from the flash to the boom. In Storm B, you counted 10 seconds. Which storm is closer?

(Use the map or drawing “Count the circles in each row. The row with fewer circles is the closer storm.” shown earlier in this lesson.)

1. Look at the picture. Point to each numbered circle in the top row and count: 1, 2, 3.
2. Now count the circles in the bottom row: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
3. Which is the smaller number? 3 is smaller than 10.
4. Fewer seconds means the thunder had a shorter way to travel, so the lightning was closer.

Answer: Storm A is closer (3 seconds is fewer than 10). Both storms are close enough to hear, so with either one, go indoors!

PRACTICE

1. **EASY** Which comes first, the flash of lightning or the boom of thunder?
2. **EASY** Say the storm safety rule.

3. **MEDIUM** You see a flash and count to 8 before the boom. The next time you count to 4. Is the storm coming closer or going away?
4. **MEDIUM** Sort these into safe and not safe in a thunderstorm: your house, under a big tree, a car with a hard roof and the windows up, a swimming pool, an open field, the library.
5. **HARD** Why do we see the lightning before we hear the thunder?

COMMON MISTAKES

- Thinking thunder is made by clouds bumping together. Thunder is the sound of air pushed out very fast by the heat of lightning.
- Thinking a tree is a good place to hide from a storm. Lightning often strikes tall things like trees, so standing under one is dangerous.
- Thinking lightning never strikes the same place twice. It can strike the same place many times; very tall buildings are struck again and again.

Make it a game · Thunder Roars, Go Indoors!. Play outside or in a big room. Choose a “house” for safety, like a blanket on the ground or the couch. Everyone walks, hops or skips around. When the grown-up flashes a flashlight (or flicks the lights), everyone freezes and counts out loud. When the grown-up claps loudly for thunder, everyone runs to the house shouting, “When thunder roars, go indoors!” The first one inside gets to be the storm next time.

Scripture. “The voice of the LORD is upon the waters: the God of glory thundereth: the LORD is upon many waters.” (Psalm 29:3, KJV)

The loud boom of thunder reminds us how great and strong God is. The same God who made the storm also calmed the storm on the Sea of Galilee, so we do not need to be afraid. We stay safe inside and trust Him.

Practice answers

1. The flash. We see the lightning first and hear the thunder after.
2. “When thunder roars, go indoors.”
3. Coming closer, because the number of seconds got smaller (4 is less than 8).
4. Safe: your house, the car with a hard roof and windows up, the library. Not safe: under a big tree, a swimming pool, an open field.
5. They happen at the same time, but light travels much faster than sound. The light reaches our eyes right away, and the sound takes longer to reach our ears.

UNIT 4 REVIEW

This is an oral review. The grown-up asks each question aloud, and the child answers by telling, pointing, drawing or acting it out. Give full points for a clear answer in the child's own words. The review is worth 20 points.

1. (3 pts) Name four kinds of weather. Draw a quick picture for each one.
2. (2 pts) The grown-up draws a chart with three suns and two clouds. How many sunny days? Were there more sunny or cloudy days?
3. (3 pts) What is wind? Tell two ways we can know the wind is blowing.
4. (2 pts) Show me with your pinwheel (or tell me): how does it spin in a soft wind and in a strong wind?
5. (3 pts) What two things do we need to see a rainbow? Where must the sun be? Which color is on the outside?
6. (2 pts) What promise does the rainbow remind us of?
7. (3 pts) What is lightning, and what is thunder? You count 2 seconds after one flash and 9 seconds after another. Which storm is closer?
8. (2 pts) Say the thunderstorm safety rule and name one safe place and one place that is not safe.

UNIT PROJECT: MY WEATHER WEEK BOOK

Make a little book about the weather. Staple a few sheets of paper together. On the cover, glue or draw your picture weather chart for one whole week. Inside, make one page for each lesson: a page showing the wind moving things, with your pinwheel taped on or drawn; a page with your paper rainbow in the right color order and Noah's ark below it; and a page with your storm safety plan. Then tell your book to your family, page by page, like a real weather watcher giving the weather report.

- **Watching:** The weather chart has a picture for every day of the week, drawn from looking outside.
- **Science:** The pages show that wind is moving air, that rainbow colors go from red outside to violet inside, and that lightning comes before thunder.
- **Telling:** The child tells about each page clearly, including God's rainbow promise and the rule "When thunder roars, go indoors."
- **Care:** The book is colorful, neat for the child's age and put together with care.

Answer key

1. Sunny (a sun), cloudy (a cloud), rainy (a cloud with drops) and snowy (a cloud with snowflakes). One point for naming them, two for the matching pictures.
2. 3 sunny days. There were more sunny days than cloudy days (3 is more than 2).
3. Wind is moving air. We can feel it on our skin and see what it moves, such as leaves, flags, kites, clouds or a pinwheel.

4. It spins slowly in a soft wind and fast in a strong wind, because stronger moving air pushes harder.
5. Sunlight and drops of water. The sun must be behind you, with the rain in front. Red is on the outside.
6. God promised Noah that He would never again send a flood to cover the whole earth (Genesis 9:13).
7. Lightning is a giant spark of electricity, and thunder is the sound it makes. The 2-second storm is closer, because fewer seconds means closer.
8. "When thunder roars, go indoors." Safe: a house, a big building, or a car with a hard roof and the windows up. Not safe: under a tree, in a pool or lake, or in an open field.

DAY AND NIGHT

Every morning the sun comes up, and every evening it goes down. In between, shadows stretch and shrink, and after dark the moon and stars come out. In this unit your child will watch the sky like a real sky watcher: finding the east where the sun rises and the west where it sets, tracing shadows in chalk, drawing the moon's changing shapes and finding the Big Dipper at bedtime.

Along the way your child will learn the simple big idea behind it all: the earth turns like a slow top, giving us day when our side faces the sun and night when it turns away. The moon shines with the sun's light, and the sun itself is a star. We will read that on the fourth day "God made two great lights; the greater light to rule the day, and the lesser light to rule the night: he made the stars also" (Genesis 1:16), and we will look at paintings of a sunrise, sunlit haystacks and a starry night.

BEFORE YOU BEGIN

- Can tell morning, noon and night apart
- Knows never to look straight at the sun (from Unit 4)
- Can count objects to 10
- Can hold a crayon and draw simple shapes such as a circle

MASTERY CHECKLIST

- I can point to the east, where the sun comes up, and the west, where it goes down.
- I can tell that we have day and night because the earth turns.
- I can tell that shadows are long when the sun is low and short when the sun is high.
- I can tell that the moon shines with light from the sun, and I can name a crescent, a half moon and a full moon.
- I can find the Big Dipper and count its seven stars.
- I can say Genesis 1:16 with help.

OPTIONAL BOOKS AND RESOURCES

- **NASA Space Place** (<https://spaceplace.nasa.gov/>): Free. NASA's site for children, with simple pages, pictures and activities about the sun, moon, stars and day and night. A parent can read the pages aloud.
- **NASA Moon** (<https://moon.nasa.gov/>): Free. NASA's moon site, with clear photographs of the moon and a guide to its shapes. Good for comparing your moon-watch drawings with real pictures (Lesson 5.3).

5.1 THE SUN RISES ★

OBJECTIVES

- Watch the morning sky and point to the side where the sun comes up (the east) and the side where it goes down (the west).
- Tell in simple words why we have day and night: the earth turns like a spinning top.
- Show the sun's path across the sky: low in the morning, high at noon, low again in the evening.

Warm-up. Get a flashlight and an orange or a ball. Make a tiny dot on the ball with a marker. That dot is your house. In a dark room, your grown-up shines the flashlight on the ball. Slowly turn the ball. When is the dot in the light? When is it in the dark? Say “Good morning!” when the dot turns into the light and “Good night!” when it turns away.

Video. Coming soon. Why we have day and night and where the sun rises and sets, for young children (the earth spins, sunrise in the east, sunset in the west); search NASA Space Place, SciShow Kids, Homeschool Pop (Alternate), Science Max and calm time-lapse footage of a sunrise.

KEY TERMS

sunrise

The time in the morning when the sun first peaks up over the edge of the land and day begins.

sunset

The time in the evening when the sun goes down below the edge of the land and night is coming.

east

The side of the sky where the sun comes up every morning.

west

The side of the sky where the sun goes down every evening.

CORE IDEAS

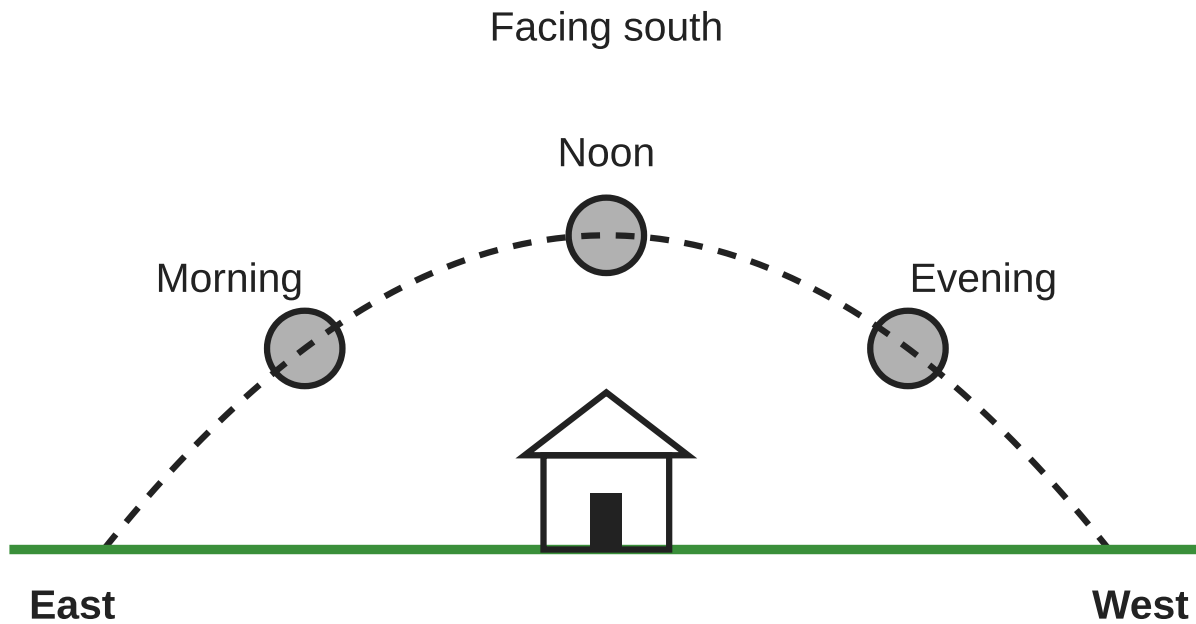
The story. Get up early one morning and go to a window with your grown-up. The sky is dark gray. Then one side of the sky starts to glow. It turns pink, then orange, then gold. The birds begin to sing. Then a bright edge of the sun peaks up over the trees or the houses. That is **sunrise**! The sun always comes up on the same side of the sky. We call that side the **east**. Remember: never look right at the sun. Look at the glow around it, then look away.

How they figured it out. People have watched the sunrise since the very first days of the world. For a long time, many people thought the sun went around the earth, because that is how it looks. Long ago, in the year 1543, a man from Poland named Nicolaus Copernicus

wrote a book that said something surprising. He said the earth is turning! Later watchers with telescopes showed that he was right. The sun only *looks* like it is moving across the sky. Really, we are the ones turning.

The big idea. The earth spins around like a slow top. It turns all the way around one time each day. When our side of the earth turns toward the sun, the sun seems to come up in the east, and it is day. At noon the sun is high in the sky. In the evening our side turns away, the sun seems to go down in the **west**, and that is **sunset**. Then it is night until our side turns back to the sun. The sun never goes to sleep. While we sleep, it is shining on children on the other side of the world.

God's handiwork. The sun has come up every single morning of your whole life. It has never missed one day. The Bible says, "The sun also ariseth, and the sun goeth down, and hasteth to his place where he arose" (Ecclesiastes 1:5). God set the earth turning so that we have day for work and play and night for rest. Every sunrise is a good morning from the One who made the sun.



The sun's path across the sky, as you see it standing outside and facing south. It comes up in the east, is highest at noon, and goes down in the west.

PICTURE STUDY



Impression, Sunrise, Claude Monet, 1872 · Oil on canvas · Musée Marmottan Monet, Paris

Claude Monet was a French painter who loved to paint light. One morning he looked out over the harbor of Le Havre, a town by the sea in France, and painted the sun coming up through the mist. He painted fast, with quick, loose brush strokes, to catch the light before it changed. A newspaper writer poked fun at this painting's name, and soon Monet and his painter friends came to be called the Impressionists.

Look closely

- Find the sun. What color is it? Is it high in the sky or low near the water?
- Look at the water under the sun. What did the sunlight paint there?
- Count the little dark boats you can find.
- Is the sky bright and clear, or soft and misty? How can you tell it is early morning?

Talk about it

1. If you stood in this harbor, which side of the sky would the sun be on: east or west?
2. What sounds do you think you would hear on this early morning?
3. What colors have you seen in the sky at sunrise?

Safety first. Never look straight at the sun, not even for a moment, and never through binoculars, a telescope or a camera. Looking at the sun can hurt your eyes for good. Look at the glow in the sky and at the ground, trees and houses, not at the sun itself.

MAKE AND DO: MY SUNRISE WINDOW

You will find the east side of your home by watching where the morning light comes from. Then you will make East and West signs and walk the sun's path across the sky.

You will need

- A window that gets morning light (your grown-up can help you find it)
- Paper and crayons
- Two index cards or pieces of paper and tape
- A paper plate, yellow paint or crayon, and a paper towel tube or stick for a paper sun

Steps

1. Early in the morning, stand at the window where the sky is brightest. Do not look at the sun. Look at the trees, roofs or hills under the glow.
2. Draw what you see out the window: the edge of the land, the houses and trees. Put a big orange glow where the sun is coming up.
3. Your grown-up writes EAST on one card. Tape it by that window or on that wall.
4. In the evening, find the window or wall where the sun goes down. Tape up a card that says WEST. Point: east, west. They are on opposite sides!
5. Color a paper plate yellow and tape it to a tube or stick. Now you have a paper sun.
6. Hold your sun low by the EAST sign and say, "Good morning!" Walk slowly across the room, lifting the sun up high in the middle for noon, then down low by the WEST sign. Say, "Good night!"
7. Try it again another morning. Did the sun come up on the same side?

Tips

- On a cloudy day, look for the brightest part of the clouds. The sun is behind it.
- Over many weeks, the sunrise spot slides a little along the edge of the sky as the seasons change. It is still on the east side.

Check your work

- I can point to the east, where the sun comes up.
- I can point to the west, where the sun goes down.
- I can walk the sun's path: low, high, low.

FIELD NOTEBOOK

1. Draw your sunrise window: the land, the trees and houses, and the orange glow where the sun comes up.
2. Draw a big curved line across your page like a rainbow. Draw a small sun at the left end, a sun at the top, and a sun at the right end. Your grown-up can write Morning, Noon and Evening under them.

3. Fold a page in half. On one side draw something you do in the daytime. On the other side draw your bed at night with a dark window.

From history. Nicolaus Copernicus lived in Poland and studied the sky for many years. His big book, which said the earth turns and travels around the sun, was printed in 1543, near the end of his life. Many people did not believe him at first. Later, Galileo Galilei looked through a telescope and Johannes Kepler worked out the paths of the planets, and step by step the idea was shown to be true. Kepler, a Christian, believed that studying God's world was a way of honoring the One who made it.

WORKED EXAMPLES

Example 1. Look at the sun path picture. The sun is drawn three times: in the morning, at noon and in the evening. Which sun is highest in the sky? Which two are low?

(Use the map or drawing "Find the highest sun." shown earlier in this lesson.)

1. Put your finger on the ground line at the bottom of the picture.
2. Slide your finger up to each sun. The one you have to reach up the farthest to touch is the highest.
3. The sun in the middle is the highest. It is marked Noon.
4. The sun on the left (Morning) and the sun on the right (Evening) are both close to the ground.

Answer: The noon sun is highest. The morning and evening suns are low, near the edge of the land.

PRACTICE

1. **EASY** Point to the side of your house where the sun comes up. What is that side called?
2. **EASY** Point to where the sun goes down in the evening. What is that side called?
3. **MEDIUM** Act it out: use your arm to show the sun's path from morning to evening.
4. **MEDIUM** Sort these into Day and Night: the sun is high, the stars are out, you eat lunch, you go to bed, the moon shines, you play outside in the sunshine.
5. **HARD** Use a ball and a flashlight to show your grown-up why we have night. Tell what is happening.

COMMON MISTAKES

- Thinking the sun goes around the earth each day. It only looks that way. The earth is turning, and that makes the sun seem to move across the sky.
- Thinking the sun goes out or goes to sleep at night. The sun keeps shining all the time. At night our side of the earth has turned away from it.

- Thinking the sun comes up in exactly the same spot every day. It always rises on the east side, but its spot slides a little along the edge of the sky as the seasons change.

Make it a game · Sunrise, Noon, Sunset. Everyone stands in a row facing the EAST sign. Your grown-up calls out a time of day. For “Sunrise!” crouch down low and slowly stretch your arms up on the east side. For “Noon!” stand on tiptoe with your arms high over your head. For “Sunset!” sink down low on the west side. For “Night!” lie down and pretend to sleep. Your grown-up mixes them up faster and faster. Can you remember which side is east?

Scripture. “From the rising of the sun unto the going down of the same the LORD’s name is to be praised.” (Psalm 113:3, KJV)

From sunrise in the east to sunset in the west, all day long, we can thank God. Try saying “Thank you, God” when you first see the morning light and again when you see the sunset.

Practice answers

1. The east. (The child points toward the morning light or the EAST sign.)
2. The west. (The child points toward the evening light or the WEST sign.)
3. The arm starts low on the east side, rises high overhead for noon, and comes down low on the west side.
4. Day: the sun is high, you eat lunch, you play outside in the sunshine. Night: the stars are out, you go to bed, the moon shines. (The moon can sometimes be seen in the daytime too, which is a fine thing to notice.)
5. The flashlight is the sun and the ball is the earth. As the ball turns, our side turns into the light (day) and then away from the light (night). The sun does not turn off; the earth turns.

5.2 SHADOWS ★

OBJECTIVES

- Tell what a shadow is: a dark place where something blocks the light.
- Trace a shadow in the morning and near noon and tell which one is longer.
- Tell that a shadow is long when the sun is low and short when the sun is high.

Warm-up. Turn on one lamp in a room and turn off the others. Hold your hand between the lamp and the wall. What do you see on the wall? Move your hand close to the lamp, then close to the wall. Does the shadow get bigger or smaller? Try making a bird, a dog or a bunny with your hands. Be careful not to touch the hot bulb.

Video. Coming soon. Shadows for young children (what makes a shadow, long and short shadows during the day, tracing a shadow with chalk); search NASA Space Place, SciShow Kids, Homeschool Pop (Alternate), Science Max and time-lapse footage of shadows moving across the ground.

KEY TERMS

light

What lets us see. Light comes from the sun, a lamp or a flashlight, and it travels in straight lines.

shadow

A dark place on the ground or wall where something blocks the light.

noon

The middle of the day, when the sun is highest in the sky and shadows are shortest.

CORE IDEAS

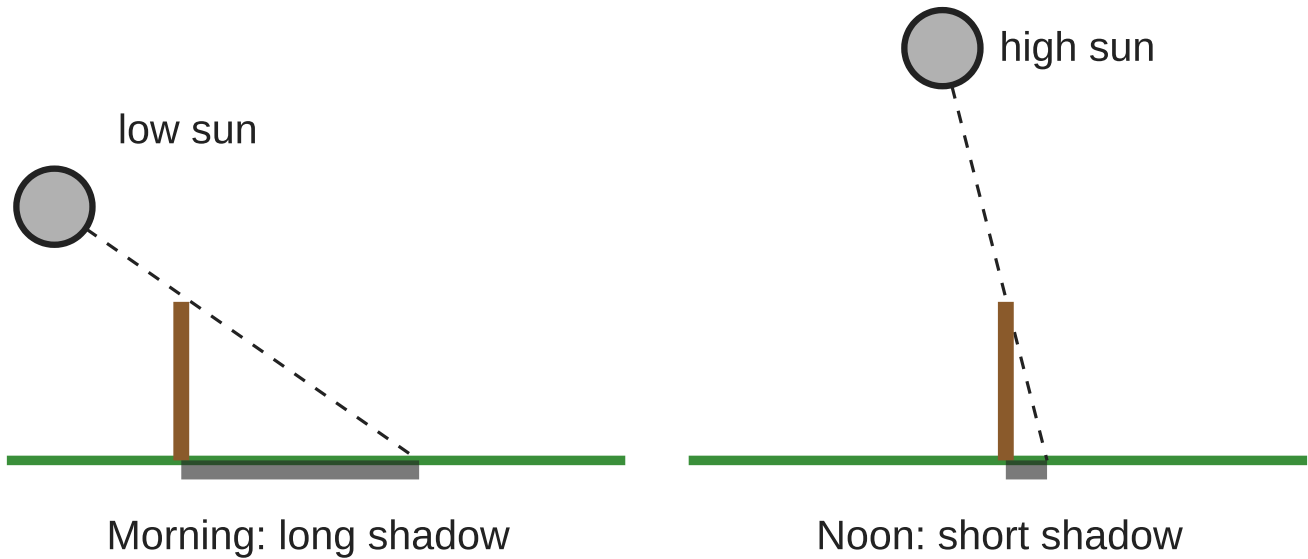
The story. Go outside on a sunny morning and look down. There is a dark shape on the ground right beside you. It has your head, your arms and your legs. Wave, and it waves. Jump, and it jumps. That dark shape is your **shadow**. Your body is blocking the sunlight, so the ground behind you gets no light. A shadow is not a thing at all. It is just a place where the light cannot reach.

How they figured it out. Long ago, people noticed that shadows change during the day. In the morning a tree's shadow is long and stretches far across the grass. Near the middle of the day it is short and stays close to the tree. In the evening it is long again, pointing the other way. People used this to tell time. They stood up a stick or a stone and watched where its shadow fell. That was the first kind of clock, called a **sundial**.

The big idea. **Light** travels in straight lines. When the sun is low in the sky, in the morning or evening, its light comes in sideways and makes a long shadow. When the sun is high, near

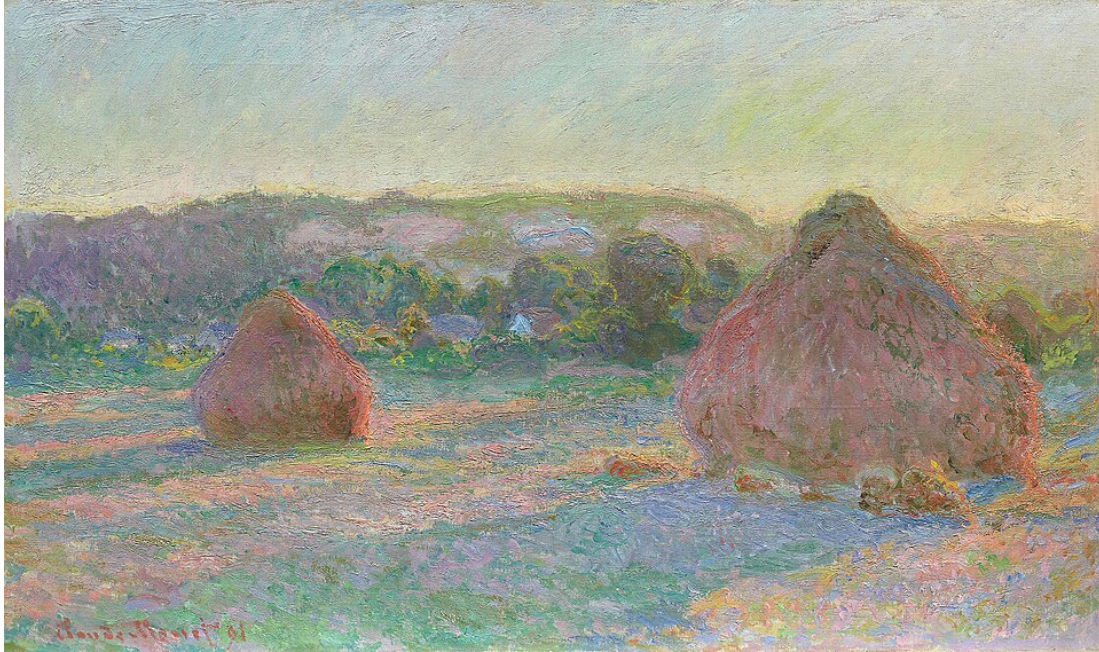
noon, its light comes down from above and makes a short shadow. Your shadow always points away from the sun. In the morning the sun is in the east, so your shadow points west. In the evening it points east. In most of our country the sun is never straight overhead, so even at noon you still have a small shadow by your feet.

Try it and see. Stand in the same spot in the morning and again near lunchtime, and let your grown-up trace your shadow with chalk each time. Then compare. Which shadow is longer? Which way does each one point? You are doing just what the sundial makers did. God made the sun to “rule the day” (Genesis 1:16), and its shadows tell us how the day is going.



A low sun makes a long shadow. A high sun makes a short shadow.

PICTURE STUDY



Stacks of Wheat (End of Summer), Claude Monet, 1890–1891 · Oil on canvas · Art Institute of Chicago

Near his home in Giverny, France, Claude Monet looked out at the big stacks of wheat that farmers built after the harvest. He painted the same stacks again and again: in the morning and evening, in summer and in winter, on sunny days and in the snow. He wanted to show how the light and the shadows changed. In this painting it is the end of summer, and the sun makes bright sides and dark shadows on the stacks.

Look closely

- Find the two stacks of wheat. Which one is bigger?
- Find the side of each stack where the sun is shining. Now find the darker side.
- Look on the ground. Can you find the shadows of the stacks?
- Look at the colors in the shadows. Are they black, or are they blue and purple?

Talk about it

1. Point to the side the sunlight is coming from. How did you know?
2. Do the shadows look long or short? Do you think the sun was high or low?
3. Why do you think Monet painted the same stacks at different times of day?

Safety first. Never look straight at the sun while you work with shadows. Look down at the ground and at your shadow. If you use a lamp indoors, do not touch the bulb; it gets hot.

MAKE AND DO: MORNING AND NOON SHADOW TRACING

Your grown-up will trace your shadow in chalk two times on the same day. Then you will measure each shadow with your feet and see how the sun changed it.

You will need

- Sidewalk chalk in two colors
- A sunny day and a flat driveway, sidewalk or patio
- A small stone or a chalk X to mark where you stand
- Your shoes (for measuring)

Steps

1. In the morning, go outside on a sunny day. Draw a big X with chalk. Stand on the X with your back to the sun.
2. Stand very still like a statue while your grown-up traces around your shadow with the first color of chalk. Mark where your feet are.
3. Look at your shadow. Is it long or short? Which way does it point?
4. Near the middle of the day, come back and stand on the same X, facing the same way. (In summer, when clocks are set ahead, the sun is highest closer to one o'clock.)
5. Your grown-up traces your new shadow with the second color.
6. Measure each shadow: walk heel to toe from your X to the tip of the shadow's head and count your steps.
7. Tell which shadow is longer and which way each one points. If you like, come back once more in the late afternoon and trace a third shadow.

Tips

- Stand on the very same X each time, or your shadows will be hard to compare.
- If clouds cover the sun, your shadow will fade away. Wait for the sun to come back out.

Check your work

- I can tell what makes a shadow.
- I can tell which shadow was longer: the morning one or the noon one.
- I can tell that my shadow points away from the sun.

FIELD NOTEBOOK

1. Draw a tree with a long shadow for morning. Next to it, draw the same tree with a short shadow for noon.
2. Draw yourself standing in the sun. Draw the sun in the sky and your shadow on the ground pointing the other way.
3. Make hand shadows on the wall with a lamp, then draw your favorite shadow animal.

From history. People have told time by shadows for thousands of years. The Bible tells of “the sun dial of Ahaz” in the days of King Hezekiah, and of a sign God gave when the shadow on it went backward (Isaiah 38:8). Many old churches and town squares in Europe still have sundials on their walls, and you may find one in a park or garden near you. A sundial has a pointer that casts a shadow, and the shadow moves around the dial as the sun moves across the sky.

WORKED EXAMPLES

Example 1. In the morning, Anna’s shadow was 8 shoe steps long. Near noon, her shadow was 3 shoe steps long. Which shadow was longer? How many more steps long was it?

1. Line up 8 blocks or buttons in a row for the morning shadow.
2. Line up 3 blocks right under them for the noon shadow, starting at the same end.
3. The morning row reaches farther. It is longer.
4. Count the blocks in the morning row that have no block under them: 4, 5, 6, 7, 8. That is 5 blocks.

Answer: The morning shadow was longer, by 5 shoe steps. The sun was low in the morning and high near noon.

PRACTICE

1. **EASY** Hold a toy between a flashlight and the wall. Point to its shadow. What made the shadow?
2. **EASY** Look at the shadow picture. Point to the long shadow. Point to the short shadow. *(Use the map or drawing “Point to the long shadow and the short shadow.” shown earlier in this lesson.)*
3. **MEDIUM** Your grown-up shines a flashlight on a standing pencil or toy. First the flashlight is low, then high overhead. When is the shadow longer?
4. **MEDIUM** Count the steps along your morning chalk shadow and your noon chalk shadow. Which number is bigger?
5. **HARD** Stand outside in the sun. Point to your shadow. Without looking at the sun, point to where the sun must be.

COMMON MISTAKES

- Thinking a shadow is a thing that follows you around. A shadow is only a place where your body blocks the light.
- Thinking shadows stay the same all day. They are long in the morning, short near noon and long again in the evening, and they point different ways.
- Thinking your shadow disappears at noon. In most of our country the sun is never straight overhead, so there is always a small shadow at your feet on a sunny day.

Make it a game • Shadow Tag. Play outside on a sunny day. The one who is “It” tries to step on another player’s shadow. If your shadow gets stepped on, you are It! Players can hide their shadows by standing in the shade of a tree or a house. Play in the morning and again near noon. When is it easier to step on a shadow: when shadows are long or when they are short?

Scripture. “The LORD is thy keeper: the LORD is thy shade upon thy right hand. The sun shall not smite thee by day, nor the moon by night.” (Psalm 121:5-6, KJV)

On a hot day, a shadow is a cool, safe place to rest. The Bible says God is like shade beside us. He watches over us all day and all night.

Practice answers

1. The toy blocked the light, so the wall behind it stayed dark.
2. The long shadow is in the morning picture, with the low sun. The short shadow is in the noon picture, with the high sun.
3. When the flashlight is low. A low light makes a long shadow, and a high light makes a short one, just like the sun.
4. Answers will vary. The morning shadow should take more steps than the noon shadow.
5. The child points the opposite way from the shadow. The shadow always points away from the sun.

5.3 THE MOON AND STARS

OBJECTIVES

- Tell that the moon does not make its own light; it shines with light from the sun.
- Name three moon shapes (crescent, half moon, full moon) and draw them.
- Tell that the sun is a star, and say Genesis 1:16 with help.

Warm-up. In a dark room, hold up a small white ball or a hard-boiled egg. Can you see it well? Now your grown-up shines a flashlight on it. The ball lights up! Did the ball make that light, or did the light come from the flashlight? The moon is just like that ball.

Video. Coming soon. The moon and stars for young children (why the moon shines, the moon's changing shapes, the sun is a star); search NASA Space Place, NASA Moon, SciShow Kids, Homeschool Pop (Alternate), Science Max and calm footage of the moon through a telescope.

KEY TERMS

moon

The big round ball of rock that travels around the earth. It shines at night with light from the sun.

star

A huge, very hot ball of glowing gas that makes its own light. The sun is a star. The other stars look tiny because they are very, very far away.

crescent

A thin, curved moon shape, like a fingernail or a banana.

full moon

When the whole round face of the moon is bright.

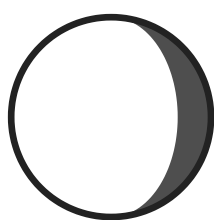
CORE IDEAS

The story. On the fourth day of creation, the Bible says, “God made two great lights; the greater light to rule the day, and the lesser light to rule the night: he made the stars also” (Genesis 1:16). The greater light is the sun. The lesser light is the **moon**. And then, almost like a happy extra, the Bible says God made the stars too, more than anyone can count.

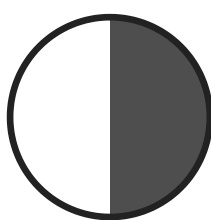
How they figured it out. People watched the moon night after night and saw that its shape changes. Some nights it is a thin **crescent**. A week later it looks like half a circle. Then it is a big round **full moon**. Then it shrinks again. Watchers figured out why. The moon is a ball of rock. It makes no light of its own. The sun shines on it, the way a flashlight shines on a ball. As the moon travels around the earth, we see more or less of its sunny side. The moon itself never really changes shape.

The big idea. The sun and the stars are the same kind of thing! A **star** is a huge ball of glowing gas that makes its own light. The sun is the star closest to us, so it looks big and bright. The other stars are so far away that they look like tiny dots. Stars are in the sky in the daytime too, but the sun is so bright that we cannot see them. When our side of the earth turns away from the sun, the sky gets dark and the stars come out for us to see.

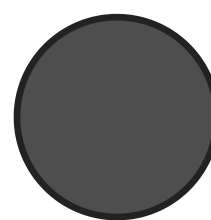
Try it and see. Look for the moon tonight, and again in a few nights. Draw its shape each time. Sometimes you can even see the moon in the daytime sky! Then make a moon with a ball and a lamp, and watch its shapes change in your own room. When you look up at the night sky, remember: the same God who made you made every one of those lights.



crescent



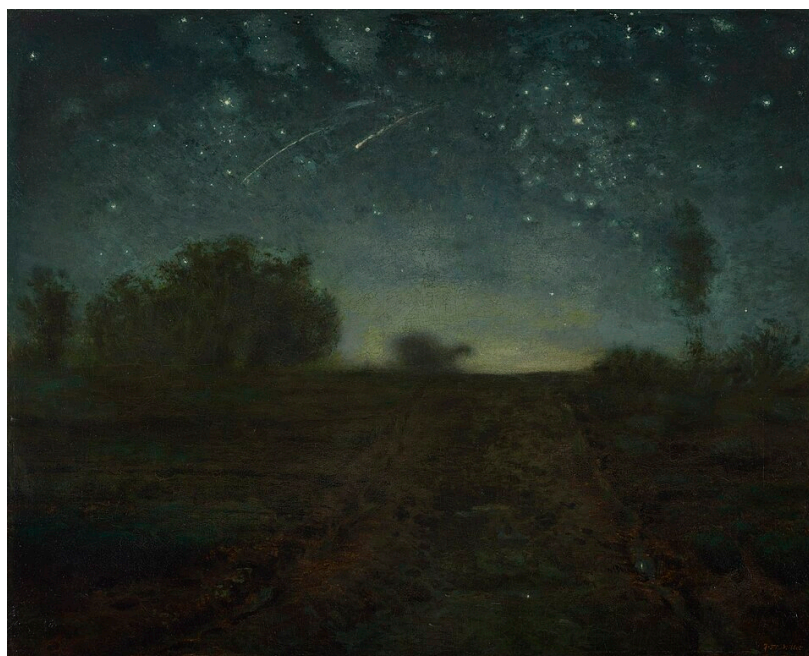
half moon



full moon

Three moon shapes. The moon is always a round ball. We just see more or less of its sunny side.

PICTURE STUDY



Starry Night, Jean-François Millet, 1850–1851, reworked about 1865 · Oil on canvas · Yale University Art Gallery, New Haven, Connecticut

You met Jean-François Millet when you looked at *The Sower*. He lived in the little village of Barbizon in France and painted farmers and fields. But one time he painted the fields at night, under the stars. He began this small painting, put it away, and came back to work on it again years later. It is one of the only night skies he ever painted. He wanted us to feel how big and quiet the sky is when the work of the day is done.

Look closely

- Look at the bottom of the painting. What color is the ground? Can you see any farm shapes in the dark?
- Look at the sky. Point to some of the stars. Are they big or tiny?
- Can you find any streaks of light? They look like shooting stars.
- Is the sky all one color, or is it lighter in some places and darker in others?

Talk about it

1. How does this painting make you feel: noisy or quiet, scary or peaceful?
2. What lights up the sky in this painting? How do you know it is night?
3. If you stood in this field, what sounds might you hear?

Safety first. Go outside at night only with your grown-up. If you use a lamp for the moon project, do not touch the bulb; it gets hot. It is safe to look at the moon, but never look at the sun.

MAKE AND DO: MAKE THE MOON'S SHAPES

You will use a lamp as the sun, a ball as the moon and your own head as the earth. As you turn, you will see the moon's shapes appear one after another.

You will need

- A lamp with the shade taken off (your grown-up sets it up)
- A white ball, such as a foam ball or a tennis ball, stuck on the end of a pencil or chopstick
- A dark room
- Paper and crayons

Steps

1. Your grown-up puts the lamp on a table at about the height of your head and turns off all the other lights.
2. Stand a few big steps from the lamp. Hold the ball on its stick out in front of you, a little higher than your head.
3. Face the lamp so the ball is between you and the lamp. The side of the ball you see is dark. This is the new moon.

4. Turn slowly to your left, keeping the ball out in front of your face. Watch a thin crescent of light appear on the ball.
5. Keep turning. Stop when you see half of the ball lit. That is a half moon.
6. Keep turning until your back is to the lamp. (Hold the ball up high so your head does not block the light.) The whole ball is lit. That is a full moon!
7. Keep turning all the way around and watch the light shrink back to a crescent. Then draw the three shapes you liked best.

Tips

- The ball never changes. Only the part of its lit side that you can see changes, just like the real moon.
- Take turns. Let your grown-up hold the ball while you watch, then switch.

Check your work

- I can show that the moon shines with light from the sun.
- I can name a crescent, a half moon and a full moon.
- I can tell that the sun is a star.

FIELD NOTEBOOK

1. Moon watch: on three nights this week, look at the moon with your grown-up and draw its shape. Your grown-up writes the day under each drawing.
2. Draw the three moon shapes: crescent, half moon and full moon.
3. Draw the fourth day of creation: a big sun on one side of your page, and the moon and many stars on the other side.

From history. In 1609, Galileo Galilei of Italy built a small telescope and pointed it at the moon. He was amazed. The moon was not smooth like a pearl, as many people thought. It had mountains and round holes called craters. Galileo drew pictures of what he saw. Many years later, on July 20, 1969, the American astronaut Neil Armstrong became the first person to step onto the moon. With Buzz Aldrin, he walked on its dusty gray ground, and they brought moon rocks home to earth.

WORKED EXAMPLES

Example 1. Look at the three moon shapes. Which moon shows the most light? Which shows the least? Put them in order from least to most.

(Use the map or drawing “Which moon shows the most light?” shown earlier in this lesson.)

1. Look at each circle and point to the bright part.
2. The crescent has only a thin sliver of light. That is the least.
3. The half moon has one half bright. That is more.
4. The full moon is bright all over. That is the most.

Answer: From least light to most light: crescent, half moon, full moon.

PRACTICE

1. **EASY** Point to the sun in a picture book or drawing. Is the sun a star?
2. **EASY** Draw a crescent moon in the air with your finger. Now draw a full moon.
3. **MEDIUM** Where does the moon get its light?
4. **MEDIUM** Your grown-up draws some stars on a paper. Count them. Then draw that many more of your own. How many stars are there now?
5. **HARD** Why can't we see the stars in the daytime? Tell your grown-up in your own words.

COMMON MISTAKES

- Thinking the moon makes its own light. The moon is a ball of rock that shines with light from the sun.
- Thinking the moon really changes shape. It is always a round ball. We just see more or less of its sunny side.
- Thinking the stars go away in the daytime, or that the moon only comes out at night. The stars are there all day but hidden by the sun's brightness, and the moon can often be seen in the daytime sky.

Make it a game • Moon Shape Match. Your grown-up cuts out paper moons: some crescents, some half moons and some full moons. Mix them up on the floor. When your grown-up calls “Crescent!” or “Half moon!” or “Full moon!” you race to find one and hold it up. Then put all the moons in order from thin to full and back to thin again.

Scripture. “And God made two great lights; the greater light to rule the day, and the lesser light to rule the night: he made the stars also.” (Genesis 1:16, KJV)

The sun rules the day and the moon rules the night, and God made the stars too. Say the verse with your grown-up, holding up two fingers for “two great lights” and wiggling your fingers like twinkling stars for “he made the stars also.”

Practice answers

1. Yes. The sun is a star, the one closest to us.
2. A thin curved shape like a fingernail for the crescent; a whole round circle for the full moon.
3. From the sun. The moon makes no light of its own; sunlight shines on it.
4. Answers will vary; check the count. For example, 5 stars and 5 more make 10 stars.
5. The stars are still there, but the sun is so bright that it hides them. When our side of the earth turns away from the sun at night, the sky is dark enough to see them.

5.4 BEDTIME SKY

OBJECTIVES

- Find the Big Dipper in a picture and in the real night sky with a grown-up.
- Count the seven stars of the Big Dipper: four in the bowl and three in the handle.
- Tell that the two pointer stars of the Big Dipper point toward the North Star.

Warm-up. Get a big spoon or a soup ladle from the kitchen. Point to its bowl, the part that holds the soup. Point to its handle. Long ago, people called a long-handled cup for scooping water a dipper. Tonight you will look for a dipper made of stars!

Video. Coming soon. Finding the Big Dipper and the North Star for young children (star patterns, pointer stars, stargazing with a family); search NASA Space Place, NASA Jet Propulsion Laboratory sky-watching tips, SciShow Kids, Homeschool Pop (Alternate) and planetarium-style night sky footage.

KEY TERMS

star pattern

A group of stars that seem to make a picture in the sky when we connect them like dot-to-dot.

Big Dipper

Seven bright stars that make the shape of a big scoop with a bowl and a long handle.

North Star

A star that stays in almost the same place all night, in the north. The Big Dipper helps us find it.

CORE IDEAS

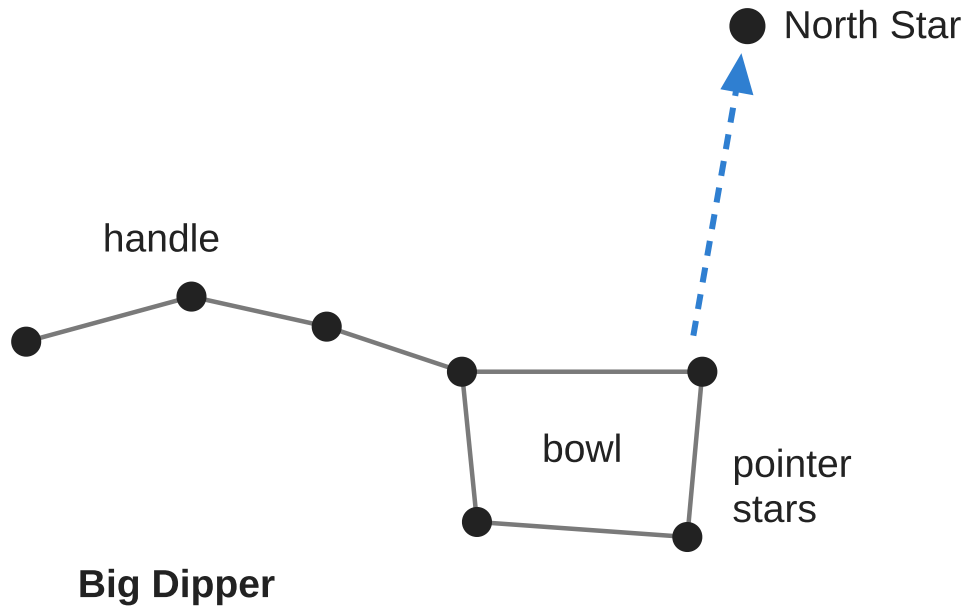
The story. On a clear night, put on your pajamas and a warm coat and go outside with your grown-up. Find a dark spot away from bright lights. Wait a little while and let your eyes get used to the dark. Then look up. More and more stars appear! Now look toward the north for seven bright stars in the shape of a big scoop. Four stars make the bowl. Three stars make the curved handle. That is the **Big Dipper**.

How they figured it out. People have looked at the night sky since the beginning. They noticed that the stars stay in the same shapes night after night and year after year, so they connected them like dot-to-dot pictures. These **star patterns** helped them remember where each star was. Many people long ago saw the Big Dipper as part of a great bear made of stars. Sailors and travelers learned to use it to find their way at night.

The big idea. The two stars at the outside end of the dipper's bowl are called the **pointer stars**. Draw a line from the bottom one through the top one, and keep going about five times

as far. You will come to a star all by itself. That is the **North Star**. As the earth turns, the other stars slowly swing around it during the night, but the North Star stays in almost the same place. If you face the North Star, you are facing north. The Big Dipper turns too, so sometimes it looks right side up and sometimes upside down.

God's handiwork. The Bible says God "tellethe the number of the stars; he calleth them all by their names" (Psalm 147:4). We can count the seven stars of the Big Dipper, but no one can count all the stars in the sky. God knows every one. And the same God who knows every star knows you by name too. That is a good thing to remember at bedtime.



The Big Dipper. Follow the two pointer stars to find the North Star.

PICTURE STUDY



Ursa Major, from *Urania's Mirror*, Sidney Hall (engraver), 1824 · Hand-colored engraving on card, with small holes punched for the stars · Published in London; sets are kept in libraries, including the Library of Congress

Urania's Mirror was a box of picture cards printed in London in 1824 to help people learn the stars. Each card shows a star pattern drawn as a picture: a bear, a lion, a hunter and many more. Tiny holes were punched in each card where the stars go. When you held a card up to a lamp or a window, light shone through the holes, and the stars twinkled just as they do in the sky. On this card, the Big Dipper is part of a great bear called Ursa Major, which means “Great Bear.”

Look closely

- Find the bear. Point to its head, its legs and its tail.
- Look for the stars on the bear's back and tail. Can you find the seven stars of the Big Dipper?
- Which part of the bear makes the handle of the dipper?
- Are all the star marks the same size? Why do you think some are bigger?

Talk about it

1. Why do you think the card makers punched holes where the stars are?
2. Do you think the stars really look like a bear? What else could they look like?
3. If you made your own star card, what picture would you draw?

Safety first. Go outside at night only with your grown-up, and stay in your own yard or another safe place. Watch your step in the dark. Only your grown-up should poke the star holes with a sharp pencil or pin.

MAKE AND DO: BIG DIPPER STAR VIEWER

Like the makers of *Urania's Mirror*, you will poke holes for stars and shine light through them. Then you will take your viewer outside and match it to the real Big Dipper.

You will need

- A paper cup or a piece of black construction paper
- A sharp pencil or a pushpin (for your grown-up only)
- A flashlight
- White crayon or chalk
- A copy of the Big Dipper picture from this lesson

Steps

1. Look at the Big Dipper picture. Count the stars with your finger: one, two, three in the handle; four, five, six, seven in the bowl.
2. With white crayon, draw seven dots in the dipper shape on the bottom of the cup or on the black paper.
3. Your grown-up pokes a small hole through each dot.
4. In a dark room, shine the flashlight through your viewer onto the ceiling. Seven stars appear! Point to the bowl and the handle.
5. Find the two pointer stars at the end of the bowl. Use your finger to follow their line up across the ceiling.
6. On a clear night, take your viewer outside with your grown-up. Look north and try to find the real Big Dipper. Hold up your viewer and compare.
7. Turn your viewer around in your hands. The real Big Dipper turns around the North Star during the night, too.

Tips

- In the spring, the Big Dipper is high in the north in the evening. In the fall it is low near the ground, so trees and houses may hide part of it.
- Stars are easier to see on a night when the moon is a thin crescent or not showing, and far from bright lights.

Check your work

- I can point to the bowl and the handle of the Big Dipper.
- I can count its seven stars.
- I can show how the pointer stars lead to the North Star.

FIELD NOTEBOOK

1. Draw the Big Dipper as seven dots, then connect them with lines like a dot-to-dot.
2. After your night walk, draw what you saw: the dark ground, the trees or houses, and the stars. Put the Big Dipper in your picture if you found it.

3. Draw the Great Bear around the Big Dipper stars, the way the old picture cards did.

From history. For hundreds of years, sailors on dark oceans used the North Star to find their way. Because it stays in almost the same place, it always shows which way is north. Once a sailor knew north, he knew south, east and west too. The Big Dipper helped them find the North Star quickly. Travelers on land, from cowboys on the prairie to families heading west in covered wagons, looked up at the same stars you can see from your own yard.

WORKED EXAMPLES

Example 1. How many stars are in the Big Dipper? Count the handle, count the bowl, and put them together.

(Use the map or drawing “Count the handle and the bowl.” shown earlier in this lesson.)

1. Look at the Big Dipper picture. Put your finger on the star at the end of the handle.
2. Count the handle stars: 1, 2, 3. There are 3.
3. Count the bowl stars: 1, 2, 3, 4. There are 4.
4. Put them together by counting on from 3: 4, 5, 6, 7.

Answer: 3 handle stars and 4 bowl stars make 7 stars in the Big Dipper.

PRACTICE

1. **EASY** Point to the bowl of the Big Dipper in the picture. Point to the handle.
(Use the map or drawing “Find the bowl and the handle.” shown earlier in this lesson.)
2. **EASY** Your grown-up puts 7 buttons on the table. Make the Big Dipper shape with them.
3. **MEDIUM** Put your finger on the two pointer stars. Follow their line. What star do they point to?
4. **MEDIUM** Sort these into Things in the Night Sky and Things Not in the Sky: the moon, a tree, stars, the Big Dipper, a house, the North Star.
5. **HARD** Turn your star viewer upside down. Is it still the Big Dipper? Tell why the real Big Dipper sometimes looks upside down.

COMMON MISTAKES

- Thinking the North Star is the brightest star in the sky. It is not. It is a medium-bright star that is special because it stays in almost the same place in the north.
- Thinking the Big Dipper always looks right side up. It slowly swings around the North Star, so it can be tipped sideways or upside down.
- Thinking the stars in a star pattern are close together and joined by lines. The lines are only in our pictures. The stars are far apart, and we connect them to help us remember.

Make it a game · Find the Dipper. Your grown-up hides seven paper stars around the room or the yard. Find them all, counting as you go. Then lay them on the floor in the Big Dipper shape. Put an eighth star (the North Star) where the pointer stars point. Take turns being the one who hides the stars. For a bedtime version, shine your star viewer on the ceiling and let each person find the bowl, the handle and the pointer stars.

Scripture. “He telleth the number of the stars; he calleth them all by their names.”
(Psalm 147:4, KJV)

There are far too many stars for us to count, but God has counted them all and given each one a name. He knows each of His children by name too.

Practice answers

1. The bowl is the four stars in a box shape; the handle is the three stars in a curved line.
2. Four buttons in a box shape for the bowl and three in a curved line for the handle.
3. The North Star.
4. In the night sky: the moon, stars, the Big Dipper, the North Star. Not in the sky: a tree, a house.
5. Yes, it is still the Big Dipper. As the earth turns during the night, the Big Dipper seems to swing around the North Star, so sometimes it looks right side up and sometimes upside down.

UNIT 5 REVIEW

This is an oral review. Read each question aloud and let your child answer by telling, pointing, acting it out or drawing. Help as needed and give credit for clear understanding. The review is worth 20 points.

1. (3 pts) Point to the side where the sun comes up in the morning. What is that side called? Where does the sun go down?
2. (3 pts) Use a ball and a flashlight (or your hands) to show why we have day and night.
3. (3 pts) What is a shadow? How do you make one?
4. (3 pts) When is your shadow longer, in the morning or at noon? Why?
5. (3 pts) Where does the moon get its light? Draw a crescent moon and a full moon.
6. (2 pts) Is the sun a star? Say Genesis 1:16 with your grown-up.
7. (3 pts) Show the Big Dipper with buttons or dots. How many stars does it have? What do the pointer stars point to?

UNIT PROJECT: MY DAY AND NIGHT BOOK

Make a little book about the sky by folding four or five pieces of paper in half and stapling them. On the pages, draw your sunrise window with the east marked; your morning and noon shadows (or a photo of your chalk tracings); the moon shapes from your moon watch; and the Big Dipper with the North Star. Make a cover with a sun on the front and stars on the back. Then tell your grown-up about each page while they write down your words, and end with Genesis 1:16.

- **Observation:** Drawings show things the child really saw: the sunrise side, real shadow tracings and real moon shapes.
- **Understanding:** The child can tell why we have day and night, why shadows change, where the moon gets its light and how to find the North Star.
- **Narration:** The child tells about each page in their own words, in clear order.
- **Care:** The book is colorful, finished and made with the child's best effort.

Answer key

1. The sun comes up in the east and goes down in the west. (The child points to each side.)
2. The earth turns like a top. When our side faces the sun it is day; when our side turns away it is night. The sun keeps shining all the time.
3. A shadow is a dark place where something blocks the light. You make one by standing between the light and the ground or wall.
4. In the morning, because the sun is low. At noon the sun is high, so the shadow is short.
5. From the sun; the moon makes no light of its own. The crescent is a thin curved sliver; the full moon is a whole bright circle.
6. Yes, the sun is the star closest to us. "And God made two great lights; the greater light to rule the day, and the lesser light to rule the night: he made the stars also."

7. Seven stars: four in the bowl and three in the handle. The pointer stars point to the North Star.

SEASONS

“Thou hast made summer and winter” (Psalm 74:17). God made the year go round like a wheel: spring, summer, fall and winter, and then spring again. In this unit your child will watch buds open in spring, feel the strong summer sun, sort and count bright fall leaves, and look for buds waiting on bare winter twigs. Along the way they will learn the simple reason for the seasons: the earth is tipped, so the sun climbs high with long days in summer and stays low with short days in winter.

The thread through the whole unit is **Our Tree**. In the first lesson your child picks one tree near home to watch and draw in every season, just as a real naturalist keeps a notebook. Three paintings from Pieter Bruegel the Elder’s famous set of the year, all painted in 1565, show the seasons too: *The Harvesters* in summer, *The Return of the Herd* in fall and *Hunters in the Snow* in winter, with Van Gogh’s *Almond Blossom* for spring.

A tip for parents: if you can, spread these lessons across the year and teach each one in its own season. If you teach them all at once, do each lesson now and then go back to visit Our Tree as each new season arrives, adding a drawing each time. The unit ends with God’s promise to Noah that “summer and winter” shall not cease (Genesis 8:22).

BEFORE YOU BEGIN

- Can name sunny, cloudy, rainy and snowy weather (Unit 4)
- Knows that the sun rises in the morning and sets at night (Unit 5)
- Can count objects to 15 by touching each one
- Can draw a simple tree with a trunk and branches

MASTERY CHECKLIST

- I can say the four seasons in order.
- I can tell one sign of each season.
- I can tell why summer is warm and winter is cold: the sun is high with long days in summer and low with short days in winter.
- I can tell how trees and animals get ready for winter.
- I can show my drawings of Our Tree in all four seasons.
- I can tell God’s promise to Noah about summer and winter.

OPTIONAL BOOKS AND RESOURCES

- **NASA Space Place: What Causes the Seasons?**
(<https://spaceplace.nasa.gov/seasons/en/>): Free. A short, clear explanation with pictures of how the tilt of the earth makes the seasons. Best read and explained by a parent.

- **NOAA SciJinks** (<https://scijinks.gov/>): Free. Weather and sky pages from the National Oceanic and Atmospheric Administration, with simple explanations of seasons, snow and weather for parents to share.

6.1 SPRING ★

OBJECTIVES

- Say the four seasons in order and name three signs of spring.
- Point to a bud on a twig and tell that it opens into new leaves or flowers when the days grow longer and warmer.
- Choose one tree to be Our Tree, to watch and draw in every season.

Warm-up. Stand at a window or step outside together. Ask: “What season is it right now? How can you tell?” Then hold up four fingers. Tell your child there are four seasons in every year, and say them together, touching one finger for each: spring, summer, fall, winter. Say them again faster, then once more in a whisper.

Video. Coming soon. Spring for young children: buds and flowers opening in time-lapse, birds building nests and baby animals (SciShow Kids, Homeschool Pop (Alternate), Smithsonian National Zoo, nature footage of robins and blossoms).

KEY TERMS

season

One of the four parts of the year: spring, summer, fall and winter.

spring

The season after winter, when the days grow longer and warmer and plants wake up and grow.

bud

A tiny, tight bundle on a twig. Inside, folded up small, are new leaves or flowers.

nest

A home a bird builds out of grass, twigs or mud for its eggs and babies.

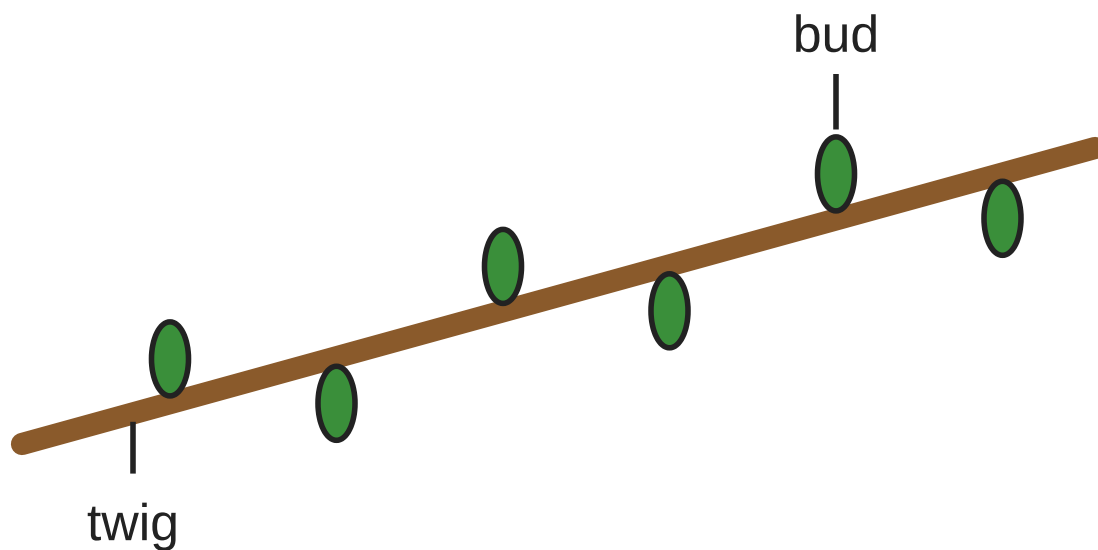
CORE IDEAS

The story. Go to a tree or bush near your home and look closely at the end of one twig. Do you see a little bump, pointed or round, wrapped up tight? That is a **bud**. Inside it, folded up very small, are new leaves or flowers. All winter the buds waited in their tough little coats. Then one spring day the coats split open, and something soft and green peeks out. A few weeks later, the grassy tree is covered with tiny new leaves.

How they figured it out. People have always watched for spring. Farmers watch the trees and the birds to know when to plant. They notice that the sun comes up earlier each morning and goes down later each evening. The days are getting longer. At noon the sun climbs higher in the sky, and its light feels warmer on your face. The snow melts, the ground gets soft, and spring rains come. Robins hop on the grass looking for worms. Other birds fly by with grass and twigs in their beaks. They are building **nests**.

The big idea. God made the year go round in four **seasons**: spring, summer, fall and winter. Then it starts again with spring. Spring is the waking-up season. The longer, warmer days tell plants it is time to grow. Seeds sprout, buds open and flowers bloom. Bees visit the flowers. Baby birds hatch in their nests, and lambs and calves are born on farms. Everything looks fresh and new.

Try it and see. In this unit you will pick one tree to be *Our Tree*. You will look at it and draw it in spring, summer, fall and winter, just like a real scientist keeping a notebook. A tree does not hurry, and it does not forget. **God's handiwork.** Every year God brings spring back, just as He promised Noah after the Flood (Genesis 8:22). Each bud that opens is a little reminder that God keeps His word.



Buds wait on a twig all winter. In spring they open into leaves and flowers.

PICTURE STUDY



Almond Blossom, Vincent van Gogh, 1890 · Oil on canvas · Van Gogh Museum, Amsterdam

Vincent van Gogh was a Dutch painter who lived for a while in the south of France. Almond trees there bloom very early, at the end of winter, before most other trees wake up. When his brother Theo had a baby boy and named him Vincent, the painter made this picture of blossoming branches against a blue sky as a gift for the new baby's family. New flowers for a new baby: it was a picture of new life.

Look closely

- Follow one branch with your finger from one side of the picture to the other.
- Find a flower that is wide open. Now find one that is still a closed bud.
- What color is the sky? Does it look like a warm day or a cold day?
- Are there any leaves yet, or mostly flowers?

Talk about it

1. What season does this painting make you think of? Why?
2. If you painted Our Tree in spring, what colors would you use?

Safety first. A grown-up should do all cutting with pruning shears, and ask the owner before cutting branches from any tree or bush. Never eat leaves, flowers or berries you find outside.

MAKE AND DO: BRING SPRING INDOORS

You can watch buds open right on your kitchen table. Cut a few twigs from a bush that blooms in early spring, put them in water, and watch the buds wake up in the warm house.

You will need

- Three twigs with fat buds, about as long as your child's arm (forsythia, pussy willow, apple, cherry or redbud work well)
- Pruning shears (for the grown-up)
- A jar or vase of water
- A sunny windowsill
- Paper and crayons

Steps

1. In late winter or early spring, take a walk and look for a bush or tree with fat buds on its twigs.
2. A grown-up cuts three twigs. Carry them home carefully so the buds do not break off.
3. Put the twigs in a jar of water and set it by a sunny window.
4. Count the buds on one twig together. Draw the twig with all its buds.
5. Each day, look closely. Are the buds getting fatter? Can you see any green or any flower color peeking out?
6. Change the water every few days.
7. When the buds open, draw the twig again. Did leaves come out, or flowers, or both?

Tips

- Some twigs open in one week and some take three. Be patient, like a farmer waiting for spring.
- If it is the wrong time of year for twigs, sprinkle grass seed on a wet kitchen sponge on a plate and keep it damp. Watch the little green shoots come up.

Check your work

- I can point to a bud.
- I can tell what came out of the buds.
- I can say the four seasons in order.

FIELD NOTEBOOK

1. Choose Our Tree, a tree you can visit often. Draw it as it looks in spring. A parent writes the date and the word "Spring" at the top.
2. Draw one twig with its buds. One week later, draw the same twig again and compare.
3. Draw three signs of spring you saw or heard this week, such as a bird, a flower and a puddle.

From history. Thomas Jefferson, the third president of the United States, loved the gardens at his home, Monticello, in Virginia. For many years he kept a Garden Book. In it he wrote down when the flowers bloomed, when the trees got their leaves and when his peas were ready to eat. Family stories say that every spring Jefferson and his neighbors

had a friendly contest to see who could bring the first peas of the year to the table. Writing down what you see, day after day and year after year, is just what a scientist does.

WORKED EXAMPLES

Example 1. Look at the picture of the twig. How many buds are on it?

(Use the map or drawing “Count the buds.” shown earlier in this lesson.)

1. Put your finger on the bottom end of the twig.
2. Slide your finger up the twig. Each time you touch a green bud, say the next number out loud: 1, 2, 3, 4, 5, 6.
3. Check by counting again from the top end down. You should get the same number.

Answer: There are 6 buds on the twig.

PRACTICE

1. **EASY** Say the four seasons in order, starting with spring.
2. **EASY** Point to a bud on a real twig or in the picture. What will come out of it?
3. **MEDIUM** Parent says each thing. Child says “spring” or “not spring”: baby birds in a nest, building a snowman, tulips blooming, sledding down a hill.
4. **MEDIUM** On your twig in the jar, 3 buds opened on Monday. Then 2 more opened. How many buds opened in all? Use your fingers.
5. **HARD** Tell in your own words why plants start to grow in spring.

COMMON MISTAKES

- Thinking a bare tree is dead in winter and comes alive in spring. It was alive all winter, resting, with its buds ready.
- Thinking spring comes on the same day everywhere. It comes earlier in warm places in the south and later in cold places in the north.
- Thinking the seasons can come in any order. They always go spring, summer, fall, winter, and then spring again.

Make it a game • Spring Says. The child crouches down small like a seed. The parent calls out things one at a time. If it belongs to spring (a robin, a tulip, a baby lamb, a bud opening, a spring rain), the child grows up tall like a flower with arms open wide. If it does not (a snowman, a pumpkin, a sled), the child stays small and still. Then trade places and let the child call out the things.

Scripture. “For, lo, the winter is past, the rain is over and gone; The flowers appear on the earth; the time of the singing of birds is come, and the voice of the turtle is heard in

our land;" (Song of Solomon 2:11-12, KJV)

The "turtle" here is the turtledove, a bird whose soft cooing is heard in spring. The Bible notices the same signs of spring you can see and hear: flowers and singing birds.

Practice answers

1. Spring, summer, fall, winter.
2. New leaves or flowers (some buds have both).
3. Spring: baby birds in a nest, tulips blooming. Not spring: building a snowman and sledding (those are winter).
4. 5 buds.
5. The days get longer, the sun climbs higher and shines warmer, and the snow melts and rain comes, so the ground warms up and plants can grow. God made plants to wake up when spring comes.

6.2 SUMMER

OBJECTIVES

- Tell that summer is the warmest season, with the longest days and the sun climbing highest at noon.
- Count and compare a summer day and a winter day on a picture chart.
- Tell why shade feels cooler, and remember never to look at the sun.

Warm-up. On a sunny day, go outside together. Hold one hand out in the sunshine for a slow count of ten. Then hold it in the shade of a tree or a house for another count of ten. Ask: “Which felt warmer? Why do you think so?”

Video. Coming soon. Summer for young children: long sunny days, the high noon sun, why shade is cool, gardens and fruit ripening (NASA Space Place, NOAA SciJinks, SciShow Kids, Homeschool Pop (Alternate), nature footage of summer gardens and insects).

KEY TERMS

summer

The warmest season of the year, with the longest days.

daylight

The time from sunrise to sunset, when the sun is up in the sky.

shade

A cooler spot where a tree, a roof or something else blocks the sunlight.

ripe

Ready to pick and eat, like a red strawberry or a soft, sweet peach.

CORE IDEAS

The story. Go outside on a summer afternoon and stand in the sunshine. Feel the warmth on your arms and on the top of your head. Now step under a tree. Ahh. The **shade** feels cooler. Summer is the warmest season of the year. Children run through sprinklers, gardens are full of beans and tomatoes, and the evening stays light so long that you may go to bed before the sky is dark.

How they figured it out. People who watch the sky every day see that the summer sun is different. At noon in summer it climbs very high in the sky. Its light comes down almost straight, so it heats the ground strongly. The sun also comes up early and goes down late, so there are many hours of **daylight**. In much of our country, a summer day has about fifteen hours of daylight, and a winter day has only about nine. More hours of strong sunshine make summer warm.

The big idea. Summer is the growing season. Plants use the long, sunny days to grow and grow. Corn stands tall in the fields, sunflowers reach for the light, and fruit grows plump and **ripe**. Animals are busy too. Young birds learn to fly, bees fill their hives with honey, and ants carry food into their tunnels. The Bible says the wise ant gathers her food in the summer (Proverbs 6:8).

Try it and see. In a dim room, shine a flashlight straight down onto a sheet of paper. A grown-up traces around the bright spot. Now tip the flashlight so the light comes in slanted. The spot gets bigger and dimmer, because the same light is spread out over more paper. Summer sunshine is like the straight-down flashlight: strong and bright. That is one big reason summer is hot. Remember: never look right at the sun, not even for a moment. It can hurt your eyes.

Summer day



Winter day



Each box = 1 hour of daylight

A summer day has many more hours of daylight than a winter day.

PICTURE STUDY



The Harvesters, Pieter Bruegel the Elder, 1565 · Oil on wood panel · The Metropolitan Museum of Art, New York

Pieter Bruegel the Elder was a painter who worked in Antwerp and Brussels, in the land that is now Belgium. In 1565 he painted a set of large pictures showing the different times of the year for a rich merchant of Antwerp. This one shows the wheat harvest at the end of summer. The wheat is golden and tall, the sky is bright, and the workers are hot and tired. You will see two more pictures from this same set later in this unit.

Look closely

- Find the men cutting the wheat with long, curved blades called scythes.
- Find the workers tying the cut wheat into bundles.
- Find the people eating lunch in the shade of the tree. Can you find the man who has fallen asleep?
- Look far away. Can you find the church and the water?

Talk about it

1. How can you tell this is a hot summer day?
2. Why do you think the workers chose to eat under the tree?
3. What would you bring for a picnic lunch in a summer field?

Safety first. Never look straight at the sun, not even with sunglasses on. On hot days, drink water, rest in the shade and wear a hat. Do not touch blacktop, metal slides or car seats that have been sitting in the sun; they can be hot enough to burn.

MAKE AND DO: THE ICE CUBE RACE

Which melts first: an ice cube in the sunshine or an ice cube in the shade? Make a guess, then race them and see.

You will need

- Two ice cubes the same size
- Two plates that are the same color and size
- A sunny day with a sunny spot and a shady spot outdoors
- Paper and crayons

Steps

1. Ask your child to guess: which ice cube will melt first, the one in the sun or the one in the shade? Draw a sun or a tree on the paper to show the guess.
2. Put one ice cube on each plate.
3. Set one plate in a sunny spot and one plate in the shade. Keep everything else the same: same plates, same size ice cubes, set out at the same time.
4. Every few minutes, go and look at both ice cubes. Which one is getting smaller? Which has a bigger puddle?
5. When one ice cube is all gone, look at the other one. Is it still there?
6. Draw both plates: one with the puddle and one with what is left of the other ice cube. Was the guess right?

Tips

- The grown-up watches the clock. The child only needs to say which one is smaller.
- Try it again with a dark plate and a white plate, both in the sun. Which ice cube melts first now?

Check your work

- I can tell which ice cube melted first.
- I can tell why the sunny spot is warmer than the shade.
- I can point to a shady spot.

FIELD NOTEBOOK

1. Draw Our Tree in summer, with all its leaves. Lay it next to your spring drawing. What changed?
2. Draw yourself standing in the sun and then standing in the shade of a tree.
3. Draw a fruit or vegetable that gets ripe in summer, like a tomato, a watermelon or a peach.

From history. Jean-Henri Fabre was a French teacher who spent many summers watching insects in his garden in the south of France. He loved the cicadas, insects that

buzz loudly in the hottest part of summer. Fabre watched a cicada drill a tiny hole in a branch to drink the sweet sap, and he saw thirsty ants crowd around to drink from the cicada's little well too. He wrote down everything he saw in books about insects that children and grown-ups still enjoy.

WORKED EXAMPLES

Example 1. Look at the picture chart. Each box stands for one hour of daylight. Which day has more daylight, the summer day or the winter day?

(Use the map or drawing "Each box is one hour of daylight." shown earlier in this lesson.)

1. Count the boxes in the summer row together, touching each one: 1, 2, 3 ... all the way to 15.
2. Count the boxes in the winter row: 1, 2, 3 ... up to 9.
3. Look at the two rows. The summer row is longer. 15 is more than 9.
4. Put your finger where the winter row stops. Count the summer boxes that are left over past that spot: 1, 2, 3, 4, 5, 6.

Answer: The summer day has more daylight. It has 15 hours, which is 6 more than the winter day's 9 hours.

PRACTICE

1. **EASY** Which season is the warmest?
2. **EASY** Without looking at the sun, point with your arm to show where the sun is at noon in summer. Is it high in the sky or low?
3. **MEDIUM** On the day-length chart, count the boxes in the winter row.
4. **MEDIUM** Parent names each thing. Child says "summer" or "not summer": a sprinkler, mittens, ripe tomatoes, a sled, swimming in a lake.
5. **HARD** Tell why it feels cooler in the shade of a tree.

COMMON MISTAKES

- Thinking summer is hot because the earth is closest to the sun. In fact, the earth is a little closer to the sun in early January, during our winter. Summer is hot because the sun climbs high and the days are long.
- Thinking sunglasses make it safe to look at the sun. They do not. Never look at the sun.
- Thinking it is summer everywhere at the same time. When it is summer here, it is winter in places on the bottom half of the globe, like Australia.

Make it a game • Where Is the Sun?. The parent names a season. The child shows where the noon sun would be by stretching an arm: way up high for summer, low near the ground for winter, and in the middle for spring and fall. Then the parent names a summer

thing (a picnic, a firefly, a watermelon) and the child pretends to do it. Take turns being the caller.

Scripture. “Go to the ant, thou sluggard; consider her ways, and be wise: Which having no guide, overseer, or ruler, Provideth her meat in the summer, and gathereth her food in the harvest.” (Proverbs 6:6-8, KJV)

“Meat” here means food. The little ant works hard while summer gives plenty, so she is ready when winter comes. Summer’s long days are a gift from God for working and growing.

Practice answers

1. Summer.
2. High in the sky (the arm points up high).
3. 9 boxes (9 hours of daylight).
4. Summer: a sprinkler, ripe tomatoes, swimming in a lake. Not summer: mittens and a sled.
5. The tree’s leaves block the sunlight, so less sunshine reaches you and the ground to warm you up.

6.3 FALL

OBJECTIVES

- Name three signs of fall: shorter, cooler days, leaves changing color and falling, and the harvest.
- Sort fall leaves by color and count each group.
- Tell two ways animals get ready for winter.

Warm-up. Bring in a handful of fallen leaves (or look at some through a window). Spread them on the table. Ask: “What colors do you see? Which leaf is the biggest? Which is the smallest? What color were these leaves in summer?”

Video. Coming soon. Fall for young children: why leaves change color, squirrels storing acorns, geese flying south and the harvest (SciShow Kids, Homeschool Pop (Alternate), Smithsonian, USDA Forest Service, time-lapse nature footage of autumn leaves).

KEY TERMS

fall

The season after summer, when the days grow shorter and cooler and many trees drop their leaves. Fall is also called autumn.

harvest

Gathering in the ripe food from the fields, gardens and orchards.

seed

A little package made by a plant that can grow into a new plant, like an acorn or a pumpkin seed.

store

To save food or other things to use later.

CORE IDEAS

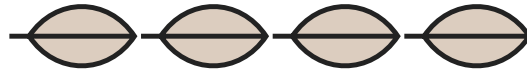
The story. Pick up a leaf from the ground on a fall day. Is it red, yellow, orange or brown? Only a few months ago this same leaf was green and hanging high on a tree. Now it crunches under your feet. **Fall** is also called *autumn*. The air feels cooler, the days are shorter, and many trees put on their brightest colors before they let their leaves go.

How they figured it out. Why do leaves change color? Scientists found that a green leaf has yellow and orange inside it all summer long. The green is so strong that it hides them. In fall, when the days get short and cool, the tree stops making green. The green fades away, and the yellow and orange show through at last. Some trees, like many maples, also make new red color in their leaves. Then the tree closes off each leaf where it joins the twig, and the wind blows it down.

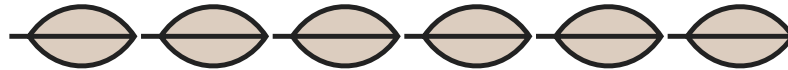
The big idea. Fall is the getting-ready season. Farmers bring in the **harvest**: corn, pumpkins, apples and wheat. Families fill their pantries. Animals get ready too. Squirrels bury acorns to dig up later, and some of the acorns they forget will sprout into new oak trees. Many geese fly south to warmer places in long V shapes across the sky. Plants drop their **seeds**, and the seeds wait in the ground for spring.

God's handiwork. God sends sunshine and rain all year so that there is food to gather in the fall. That is why fall is a time for giving thanks. And a tree that drops its leaves is not dying. It is getting ready to rest through the winter. Look closely at a twig after the leaves fall: the buds for next spring are already there, tucked in tight.

Red



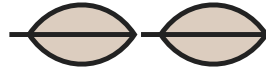
Yellow



Orange



Brown



A leaf collection sorted by color.

PICTURE STUDY



The Return of the Herd, Pieter Bruegel the Elder, 1565 · Oil on wood panel · Kunsthistorisches Museum, Vienna

Here is another picture from Bruegel's set of the year, painted in 1565, the same set as *The Harvesters*. Now summer is over. All summer the cattle ate grass on the hills. Now the herders are driving them down to the village, where they will be kept safe and fed through the winter. The trees have turned brown, and dark clouds are rolling in over the mountains.

Look closely

- Find the cows walking down the hill. Which way are they going?
- Find the man riding a horse and the herders walking with sticks.
- Look at the trees. Do they have green leaves, brown leaves or no leaves?
- Look at the sky. Is it bright and sunny or dark and cloudy?

Talk about it

1. What colors tell you it is fall in this picture?
2. Why do you think the herders are bringing the cows home now?
3. How is this picture different from *The Harvesters*?

Safety first. Wash hands after collecting leaves. Learn to spot poison ivy, which has leaves in groups of three ("Leaves of three, let it be"), and stay away from it. Never pick or eat mushrooms or berries you find outside.

MAKE AND DO: LEAF COLLECTION AND LEAF RUBBINGS

Go on a leaf hunt like a real naturalist. You will collect fall leaves, sort them by color, count them, press the best ones and make leaf rubbings.

You will need

- A paper bag for collecting
- About ten fallen leaves of different colors and shapes
- A heavy book and paper towels
- Plain white paper
- Crayons with the paper peeled off

Steps

1. Take a walk and pick up about ten fallen leaves. Look for different colors and different shapes. Pick up a leaf from Our Tree too.
2. At home, spread the leaves on the table. Sort them into piles by color: red, yellow, orange and brown.
3. Count the leaves in each pile. Which pile has the most? Which has the fewest?
4. Choose your three favorite leaves. Lay them between paper towels inside a heavy book. Leave them there for about a week to press them flat.
5. To make a leaf rubbing, put a leaf on the table with its bumpy side up. Lay a sheet of white paper on top.
6. Rub the long side of a peeled crayon gently over the paper. Watch the leaf's shape and its lines, called veins, appear like magic.
7. Make rubbings of two more leaves in different colors.

Tips

- Fresh, soft leaves make better rubbings than dry, crumbly ones.
- Save your pressed leaves. You will use one in the winter lesson.

Check your work

- I sorted my leaves by color and counted each pile.
- I made a leaf rubbing and can point to the veins.
- I can tell why leaves change color in fall.

FIELD NOTEBOOK

1. Draw Our Tree in fall, with its colored leaves and the leaves lying on the ground underneath.
2. Draw a squirrel burying an acorn.
3. Glue a pressed leaf onto the page and draw a picture of the tree it came from beside it.

From history. In the fall of 1621, the Pilgrims at Plymouth in New England gathered in their first harvest of corn after a very hard first year. One of them, Edward Winslow, wrote in a letter that their governor sent men out hunting birds so that they might “rejoice together” after gathering the fruit of their work. About ninety Wampanoag men came with their leader, Massasoit. They stayed three days and brought five deer to share. We remember that feast as the first Thanksgiving.

WORKED EXAMPLES

Example 1. Look at the leaf chart. Which color has the most leaves? How many leaves are there in all?

(Use the map or drawing “Count each row, then count them all.” shown earlier in this lesson.)

1. Count each row, touching each leaf: Red has 4. Yellow has 6. Orange has 3. Brown has 2.
2. Find the biggest number: 6. The yellow row is also the longest row.
3. Now count every leaf on the chart, row by row, without starting over: 1, 2, 3, 4 (red), 5, 6, 7, 8, 9, 10 (yellow), 11, 12, 13 (orange), 14, 15 (brown).

Answer: Yellow has the most leaves (6). There are 15 leaves in all.

PRACTICE

1. **EASY** What is another name for fall?
2. **EASY** On the leaf chart, point to the row with the fewest leaves. How many are in it?
3. **MEDIUM** Parent names each thing. Child says “fall” or “not fall”: a pumpkin, a sled, an acorn, a basket of apples, a swimsuit.
4. **MEDIUM** A squirrel buries 5 acorns. Then it buries 3 more. How many acorns did it bury in all? Use your fingers or real acorns.
5. **HARD** Tell where the yellow and orange in a fall leaf come from.

COMMON MISTAKES

- Thinking frost paints the leaves. The shorter days are the tree’s main signal, and the yellow and orange were in the leaf all along.
- Thinking a tree with no leaves has died. It is resting, with next spring’s buds already on its twigs.
- Thinking every tree loses its leaves in fall. Pines, spruces and other evergreens keep their green needles all winter.

Make it a game • Squirrel Hide-and-Seek. The parent hides ten acorns, pinecones or crumpled paper “acorns” around a room or the yard while the child waits with eyes closed. The child is a squirrel who must find the food before winter comes. The parent

slowly counts to thirty, then calls “Winter!” The squirrel counts how many acorns were found. Then the child hides them for the parent to find.

Scripture. “To every thing there is a season, and a time to every purpose under the heaven:” (Ecclesiastes 3:1, KJV)

God made a time for everything: a time to plant in spring, a time to grow in summer and a time to harvest in fall. Each season has its own work and its own gifts.

Practice answers

1. Autumn.
2. The brown row, with 2 leaves.
3. Fall: a pumpkin, an acorn, a basket of apples. Not fall: a sled (winter) and a swimsuit (summer).
4. 8 acorns.
5. They were in the leaf all summer, hidden by the strong green. In fall the tree stops making green, the green fades, and the yellow and orange show through.

6.4 WINTER

OBJECTIVES

- Name signs of winter: the coldest days, the shortest days, the low sun, bare trees and, in many places, snow.
- Tell how trees and animals get through the winter.
- Put the four drawings of Our Tree in order and tell God’s promise that the seasons will keep coming (Genesis 8:22).

Warm-up. Lay out your drawings of Our Tree from spring, summer and fall in a row. Point to each one and say its season together. Then ask: “What do you think Our Tree looks like in winter? Let’s go and see.”

Video. Coming soon. Winter for young children: why winter days are short and cold, the tilt of the earth, snowflakes up close, animals that hibernate or fly south (NASA Space Place, NOAA SciJinks, SciShow Kids, Homeschool Pop (Alternate), nature footage of snowflakes and winter birds).

KEY TERMS

winter

The coldest season of the year, with the shortest days and the longest nights.

snowflake

A tiny piece of ice that forms in a cloud and falls to the ground. Most snowflakes have six sides or six arms.

evergreen

A tree, like a pine or a spruce, that keeps its green needles or leaves all winter long.

hibernate

To sleep very deeply through the winter, the way woodchucks do.

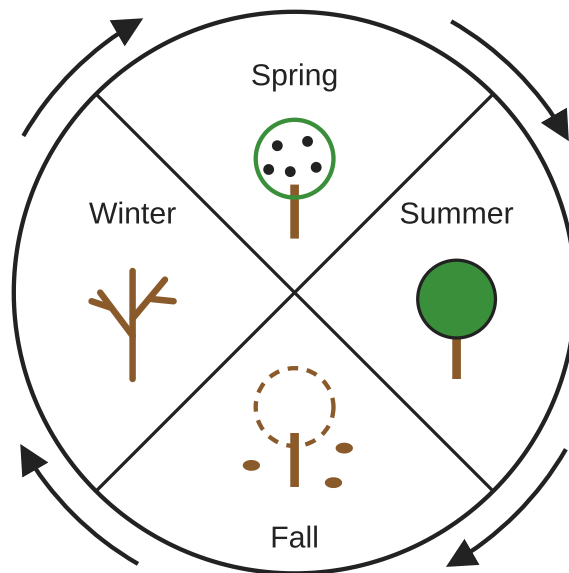
CORE IDEAS

The story. Go out and look at Our Tree in winter. If it is a maple or an apple tree, its branches are bare against the gray sky. You can see the shape of every limb, and maybe an old bird’s nest you never saw in summer. The cold air nips your nose. In many places snow covers the ground and sits on the branches. **Winter** is the coldest season of the year.

How they figured it out. In winter the sun stays low in the sky, even at noon. It comes up late and goes down early, so the days are short and the nights are long. Remember the flashlight: winter sunshine comes in slanted, so it is spread out and weak. Here is the reason. The earth is tipped a little, like a spinning top leaning to one side, as it travels around the sun all year. In summer our half of the earth leans toward the sun. In winter it leans away. That lean is what makes the seasons.

The big idea. God gave living things ways to get through the winter. Woodchucks curl up underground and **hibernate**. Many birds fly south, while others, like chickadees and cardinals, stay and puff up their feathers to keep warm. **Evergreen** trees like pines keep their needles. And look closely at a bare twig: the buds are already there, wrapped up tight, waiting for spring. Even the snow is a wonder. Every **snowflake** is made of ice, and most have six sides or six arms.

God's handiwork. Now lay out all four drawings of Our Tree: buds in spring, full green leaves in summer, bright colors in fall and bare branches in winter. What comes next? Spring again! After the Flood, God made Noah a promise: as long as the earth remains, summer and winter will not stop (Genesis 8:22). Every year Our Tree shows us that God keeps His word.



The seasons go around and around: spring, summer, fall, winter, and spring again.

PICTURE STUDY



Hunters in the Snow, Pieter Bruegel the Elder, 1565 · Oil on wood panel · Kunsthistorisches Museum, Vienna

This is the most famous picture in Bruegel's set of the year, and many people think it is the most famous winter painting in the world. Three tired hunters trudge home through deep snow with their dogs. Below them is a village with frozen ponds where people skate and play. Bruegel lived in flat country, but he painted tall, sharp mountains in the distance, perhaps remembering the mountains he crossed on a long trip to Italy.

Look closely

- Find the hunters and their dogs. One hunter carries a fox on his back. Can you find it?
- Find the people skating and playing on the frozen ponds.
- Find the people tending a fire outside the inn on the left.
- Look at the trees and the birds sitting in them. Are there any leaves?

Talk about it

1. How do you think the hunters feel after a long, cold day?
2. What colors did Bruegel use to make the picture feel cold?
3. Which would you rather do: skate on the pond or warm up by the fire?

Safety first. Dress in warm layers with a hat and mittens. Come inside if fingers or toes hurt or start to feel numb. Never walk on a frozen pond, lake or creek; the ice may be thinner than it looks. Never put your tongue on cold metal. Use only safe things like evergreen sprigs and dried leaves in the ice project, and never eat berries you find outside.

MAKE AND DO: AN ICE SUNCATCHER FOR OUR TREE

Turn water into a hanging ice picture full of things from the seasons, and hang it on Our Tree.

You will need

- A shallow pie tin or plastic container lid
- Water
- A piece of string or yarn about as long as your arm
- Small natural things: evergreen sprigs, a pressed leaf from your fall collection, seeds, pinecone scales
- A freezing cold night or a freezer

Steps

1. Arrange your natural things in the pie tin to make a pretty picture.
2. Slowly pour in water until the things are just covered.
3. Lay both ends of the string in the water near one edge, so the loop hangs out over the side.
4. Set the tin outside on a night when it will freeze, or put it in the freezer.
5. In the morning, touch the water. Is it still wet, or is it hard? What happened to the water?
6. Warm the bottom of the tin in your hands for a moment and pop the ice out.
7. Hang your suncatcher on a branch of Our Tree. Check it each day. Does it stay frozen, or does it start to melt and drip?

Tips

- If the weather is warm, hang the suncatcher outside anyway and watch how fast it melts. Then talk about why.
- Make two: one to hang in the sun and one in the shade, and see which lasts longer.

Check your work

- I can tell what made the water turn to ice.
- I can tell what will happen to my suncatcher when warm days come.
- I can name two ways animals get through the winter.

FIELD NOTEBOOK

1. Draw Our Tree in winter, with its bare branches and any snow. Look closely and draw a few buds on the twigs.
2. A grown-up folds a paper and helps cut a paper snowflake. Count its arms. Draw a snowflake with six arms next to it.

3. Fold a page into four squares. Draw Our Tree in spring, summer, fall and winter, one in each square, going around in order.

From history. Wilson Bentley was a farm boy in Jericho, Vermont, who loved snow. He fastened a camera to a microscope, and on January 15, 1885, he took the first photograph of a single snowflake. He spent the rest of his life catching snowflakes on a dark board and photographing them before they melted. He photographed more than five thousand snowflakes and never found two exactly alike. His neighbors called him “Snowflake” Bentley.

WORKED EXAMPLES

Example 1. Look at the circle of seasons. It is winter now. Which season comes next? How many seasons are there in one whole year?

(Use the map or drawing “Follow the arrows around the year.” shown earlier in this lesson.)

1. Put your finger on Winter.
2. Follow the arrow around the circle to the next season: Spring.
3. Keep going around and count each season as you touch it: Spring (1), Summer (2), Fall (3), Winter (4).
4. Now you are back at Winter where you started. Next comes Spring again.

Answer: Spring comes after winter. There are 4 seasons in a year.

PRACTICE

1. **EASY** Which season is the coldest?
2. **EASY** Point on the circle of seasons: which season comes after summer?
3. **MEDIUM** Match each animal to what it does in winter: a woodchuck, a goose, a chickadee. (Choices: flies south, sleeps all winter, stays and puffs up its feathers.)
4. **MEDIUM** Count the arms on your paper snowflake, or on the six-armed snowflake you drew.
5. **HARD** Tell the story of Our Tree all year long, using your four drawings. Then tell what God promised Noah.

COMMON MISTAKES

- Thinking winter is cold because the earth is far from the sun. The earth is actually a little closer to the sun in early January. Winter comes because our half of the earth leans away from the sun, so the sun stays low and the days are short.
- Thinking a bare tree is dead. It is resting, and its buds for spring are already on its twigs.

- Thinking it snows everywhere in winter. In warm places like southern Florida it almost never snows, and on the bottom half of the globe it is summer in December.

Make it a game · Four Seasons Freeze. Play music and let the child dance. When the parent stops the music and calls out a season, the child acts it out and freezes: spring, a seed sprouting up from the floor; summer, swimming; fall, a leaf floating down to the ground; winter, a shivering snowman. Go around the seasons in order, then mix them up.

Scripture. “While the earth remaineth, seedtime and harvest, and cold and heat, and summer and winter, and day and night shall not cease.” (Genesis 8:22, KJV)

God said this to Noah after the Flood. Seedtime is spring, when seeds are planted, and harvest is fall. Every time the seasons turn, God is keeping this promise.

Practice answers

1. Winter.
2. Fall.
3. Woodchuck: sleeps all winter (hibernates). Goose: flies south. Chickadee: stays and puffs up its feathers.
4. 6 arms.
5. In spring its buds opened into new leaves or flowers. In summer it was full of green leaves. In fall the leaves turned colors and dropped. In winter it was bare, with buds waiting on the twigs. Then spring comes again. God promised that as long as the earth remains, the seasons will not stop (Genesis 8:22).

UNIT 6 REVIEW

This is an oral review. Ask each question aloud and let your child answer by telling, pointing or showing. Your child may use their Our Tree drawings. The review is worth 20 points.

1. (3 pts) Say the four seasons in order, starting with spring.
2. (3 pts) What is a bud? What comes out of it in spring?
3. (3 pts) Why is summer warm? Show with your arm where the noon sun is in summer.
4. (3 pts) Why do leaves turn yellow and orange in fall?
5. (3 pts) Tell two ways people or animals get ready for winter in the fall.
6. (3 pts) Tell two ways living things get through the winter.
7. (2 pts) What did God promise Noah about the seasons?

UNIT PROJECT: OUR TREE THROUGH THE YEAR

Make a small book about Our Tree. Fold two sheets of paper in half to make a booklet. On the cover, draw Our Tree and have a parent write its name. On the next four pages, put your drawings of Our Tree in spring, summer, fall and winter, in order. Add something real to each page if you can: a rubbing of a bud scale or twig for spring, a green leaf rubbing for summer, a pressed leaf for fall and a paper snowflake for winter. On the last page, a parent writes Genesis 8:22 while the child tells the story of the tree aloud.

- **Looking closely:** Each drawing shows what Our Tree really looked like that season: buds or blossoms, full leaves, colored or falling leaves, bare branches.
- **Order:** The four seasons are in the right order: spring, summer, fall, winter.
- **Telling:** The child tells aloud how the tree changed in each season and why, using words like bud, daylight, harvest and evergreen.
- **Care:** The book is neat and colorful, and the real leaves and rubbings are glued on carefully.

Answer key

1. Spring, summer, fall, winter.
2. A tiny, tight bundle on a twig. New leaves or flowers come out of it.
3. The sun climbs high in the sky and the days are long, so there are many hours of strong sunshine. The arm points up high.
4. The yellow and orange were in the leaf all summer, hidden by the green. In fall the tree stops making green, so the yellow and orange show.
5. Any two: farmers bring in the harvest; families fill their pantries; squirrels bury acorns; geese fly south.
6. Any two: woodchucks hibernate; many birds fly south; chickadees and cardinals puff up their feathers; evergreens keep their needles; bare trees rest with buds waiting for spring.
7. As long as the earth remains, seedtime and harvest, cold and heat, summer and winter, and day and night will not stop (Genesis 8:22).

DINOSAUR BONES

Children love dinosaurs, and so did the first people who dug up their bones. In this unit your child meets the great land animals God made: **Tyrannosaurus rex** on two strong legs, three-horned **Triceratops** and long-necked **Brachiosaurus**. We learn that nobody alive has seen a dinosaur, so we know them from their bones, and that those bones are **fossils** kept in rock.

Your child will dig pasta “bones” out of a sandbox like a real fossil hunter, draw a life-size T. rex footprint on the driveway and measure it with shoes and hands, and listen to God tell Job about mighty **Behemoth**, who “moveth his tail like a cedar” (Job 40:17). Along the way we meet Benjamin Waterhouse Hawkins, who built the first life-size dinosaur statues, Sue Hendrickson, who found a T. rex in a cliff, and Mary Anning, the fossil hunter of the English seashore.

When museum signs talk about when dinosaurs lived, we read the sign carefully, look at what we can really see, and tell how many Christians read it from the Bible: God made the land animals, dinosaurs too, on Day 6, and many dinosaur bones were buried in Noah’s Flood. Everything in this unit is said, pointed to, built or drawn; no reading is needed from the child.

BEFORE YOU BEGIN

- Can count objects to 10
- Can tell bigger from smaller and longer from shorter
- Knows that God made the land animals (Genesis 1)
- Can listen to a short story and tell it back

MASTERY CHECKLIST

- I can name and point to T. rex, Triceratops and Brachiosaurus.
- I can show how a dinosaur stood, with its legs straight down under its body.
- I can tell what a fossil is and dig slowly like a fossil hunter.
- I can measure a T. rex footprint with my shoes or hands and say which is bigger.
- I can tell three clues about Behemoth from Job 40 and who made him.

OPTIONAL BOOKS AND RESOURCES

- **Smithsonian National Museum of Natural History** (<https://naturalhistory.si.edu/>): Free. Photographs and virtual tours of real dinosaur skeletons, including a T. rex and a Triceratops. Signs there give mainstream ages, so a parent can practice “What the sign says / What we observe / How Christians read it” together.
- **Field Museum, Chicago (home of Sue the T. rex)** (<https://www.fieldmuseum.org/>): Free to browse. Pictures and short articles about Sue, the T. rex in Lesson 7.2. A parent can choose pictures to show.

7.1 WHAT IS A DINOSAUR? ★

OBJECTIVES

- Say that dinosaurs were land animals God made, and that we know them from their bones.
- Name and point to three dinosaurs: Tyrannosaurus rex, Triceratops and Brachiosaurus, and tell one thing about each.
- Show how a dinosaur stood, with its legs straight down under its body, not sticking out to the sides like a lizard's.

Warm-up. Gather every toy animal in the house onto the floor. Ask your child, “Which ones do you think are dinosaurs?” Make a dinosaur pile and a not-sure pile. Keep both piles. At the end of the lesson, sort them again and see if any toys change piles.

Video. Coming soon. Dinosaurs for young children: T. rex, Triceratops and Brachiosaurus skeletons and how dinosaurs stood (search Homeschool Pop (Alternate), SciShow Kids, Smithsonian National Museum of Natural History, museum skeleton walk-through footage).

KEY TERMS

dinosaur

A land animal God made, now gone, that walked with its legs straight under its body. We know dinosaurs from their bones.

reptile

An animal with scaly skin, like a lizard, a turtle or a crocodile. Most reptiles lay eggs.

skeleton

All the bones of an animal fitted together. You have a skeleton inside you too.

kind

A family of animals God made to have babies like themselves (Genesis 1:25).

CORE IDEAS

The story. Long ago in England, a scientist named Richard Owen looked at some very big bones dug out of rock. They looked a little like the bones of a lizard, but they were far too big. In 1842 he gave these animals a new name: **dinosaurs**. The word means “terrible lizard,” which is a grand way of saying “fearfully great lizard.” Twelve years later, in a London park, an artist named Benjamin Waterhouse Hawkins built life-size dinosaur statues so everyone could see how big they were. Children came to gape at them, just as you might.

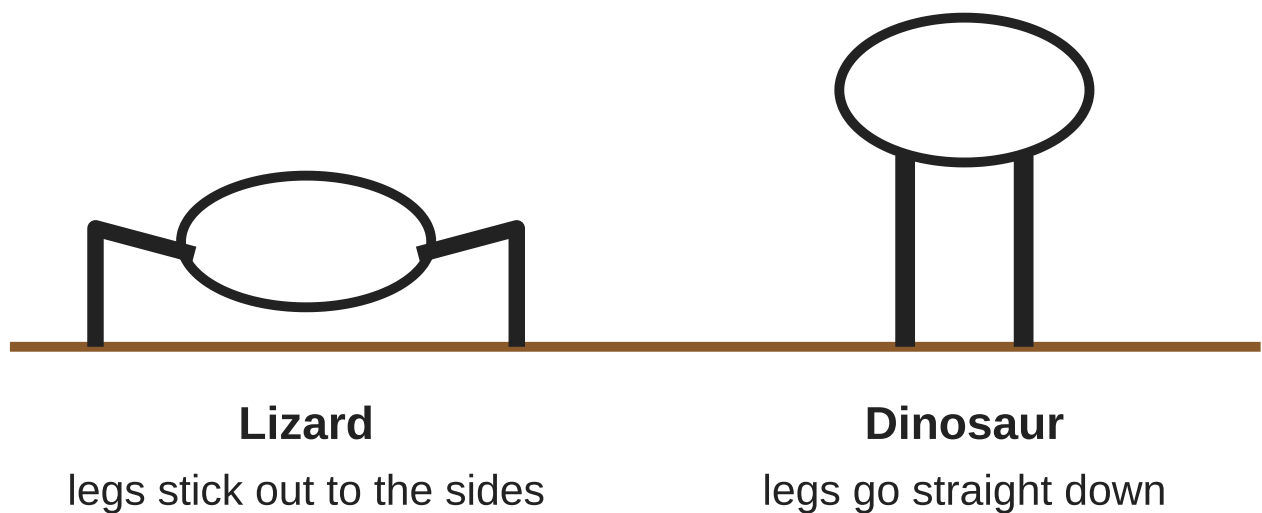
How they figured it out. Nobody alive today has seen a dinosaur. We know them from their bones. When scientists find bones, they fit them together like a puzzle to make a **skeleton**. The hip bones and leg bones show something special. A lizard's legs stick out to the sides, so

its belly drags low. A dinosaur's legs went *straight down* under its body, like the legs of a horse or a dog. That is one way scientists tell a dinosaur from other **reptiles**.

The big idea. God made many dinosaur **kinds**. Here are three to know. **Tyrannosaurus rex**, or T. rex, walked on two big legs. It had a huge head, teeth as long as bananas, and tiny arms with two fingers each. **Triceratops** walked on four legs and ate plants. It had three horns on its face and a wide bony shield, called a frill, behind its head. "Tri" means three, as in tricycle. **Brachiosaurus** was a giant plant-eater with a very long neck. Its front legs were longer than its back legs, so its back sloped down like a slide.

God's handiwork. The Bible says God made the beasts of the earth, each after his kind, "and God saw that it was good" (Genesis 1:25). Dinosaurs are part of that good work. When you look at a T. rex skeleton in a museum, you are looking at something God designed: strong bones, thick legs and a long tail to balance. A good scientist looks closely, asks questions and gives thanks to the Maker.

seen from the front



A lizard's legs stick out to the sides. A dinosaur's legs went straight down under its body.

Thinking About Time

What the sign says. Museum signs say dinosaurs lived a very, very long time ago, long before there were any people.

What we observe. We find dinosaur bones in rock. The bones do not come with a date written on them.

How Christians read it. Many Christians read the Bible to say God made the land animals, dinosaurs too, on Day 6, the same day He made Adam and Eve.

Try it. Point to Day 6 on your fingers as you count the days of creation.

Genesis 1:24

PICTURE STUDY



The Crystal Palace Dinosaurs, Benjamin Waterhouse Hawkins (sculptor), with advice from Richard Owen, 1854 (statues); photograph taken in 2006 · Life-size statues built over brick and iron and covered in cement, then painted; shown in photographs · Crystal Palace Park, Sydenham, London, England

Photo: Jes from Melbourne, Australia · CC BY-SA 2.0 (<https://creativecommons.org/licenses/by-sa/2.0>) · via Wikimedia Commons

Benjamin Waterhouse Hawkins was an English artist who loved animals. Scientists asked him to build the first life-size dinosaur statues in the world. He made them in a park in London, and they opened in 1854. They still stand there today, on islands by a lake.

Hawkins built his dinosaurs with only a few bones to go by, so he made some good guesses and some wrong ones. He put a spike on the nose of his Iguanodon. Years later, when whole skeletons were found, scientists learned the spike was really on its *thumb*! That is how science works: we find more bones, and we fix our pictures.

Look closely

- Find the biggest dinosaur statue. Is it standing on two legs or four?
- Look at the legs. Do they stick out to the sides like a lizard's, or go straight down?
- Find the spike on the Iguanodon's nose. Where should it really go?
- Imagine standing next to this statue. Would you be taller than its legs?

Talk about it

1. Why do you think people came from far away to see these statues?

2. If you could build a life-size dinosaur, which one would you make? Where would it fit?
3. Hawkins made a mistake about the spike. How did scientists find out?

MAKE AND DO: THREE PLAY-DOUGH DINOSAURS

You will make a T. rex, a Triceratops and a Brachiosaurus out of play dough, and give each one the right legs, horns and neck.

You will need

- Play dough or modeling clay, any colors
- A few pieces of dry pasta (penne or elbows) for horns and teeth
- A paper plate for each dinosaur
- A picture of each dinosaur from a library book or the lesson video

Steps

1. Look at the T. rex picture together. Count its legs (2) and fingers on each hand (2).
2. Roll a fat body, a big head and two thick legs. Add two tiny arms and a long tail to balance it. Stand it up on the plate.
3. Look at the Triceratops picture. Roll a body and four short, strong legs. Press on a flat frill behind the head and poke in three pasta horns. Count them aloud: one, two, three.
4. Look at the Brachiosaurus picture. Roll a big body, a very long neck and a small head. Make the front legs longer than the back legs.
5. Set the three dinosaurs side by side. Ask: Which is tallest? Which ate meat? Which had horns?
6. Check every dinosaur's legs. They should go straight down under the body, not out to the sides.

Tips

- A long tail helps a two-legged play-dough T. rex stand up, just as it helped the real one balance.
- If the Brachiosaurus neck flops, slide a straw or a pencil inside it.

Check your work

- I can name and point to T. rex, Triceratops and Brachiosaurus.
- I can show how a dinosaur's legs went straight down.
- I can tell one thing that makes each dinosaur special.

FIELD NOTEBOOK

1. Draw a T. rex. A parent writes the words your child says about it beside the drawing.
2. Draw a Triceratops head and count its horns aloud. Color the frill.
3. Draw a lizard with its legs out to the side and a dinosaur with its legs straight down. Put a check by the dinosaur.

From history. In 1868, the same Benjamin Waterhouse Hawkins helped set up a dinosaur skeleton in Philadelphia at the Academy of Natural Sciences. It was a duck-billed dinosaur called Hadrosaurus, and it was the first dinosaur skeleton ever stood up for people to see in a museum. Crowds lined up to look at it.

WORKED EXAMPLES

Example 1. Look at a picture of Triceratops. How many horns does it have on its face?

1. Point to the horn on its nose and say “one.”
2. Point to the long horn over one eye and say “two.”
3. Point to the long horn over the other eye and say “three.”
4. The name helps us remember: “tri” means three, like the three wheels on a tricycle.

Answer: Triceratops had 3 horns on its face.

PRACTICE

1. **EASY** Point to the dinosaur that had a very long neck. What is its name?
2. **EASY** How many legs did T. rex walk on? Show me with your fingers.
3. **MEDIUM** Sort your toy animals again: dinosaurs in one pile, not dinosaurs in the other. Count each pile.
4. **MEDIUM** Stand like a lizard (knees and elbows out). Now stand like a dinosaur (legs straight under you). Which way is easier for walking a long way?
5. **HARD** Tell me in your own words: How do we know about dinosaurs if nobody alive has seen one?

COMMON MISTAKES

- Thinking every big old animal was a dinosaur. Flying reptiles and big swimming reptiles were not dinosaurs, and neither are crocodiles.
- Thinking dinosaurs are make-believe, like dragons in a storybook. They were real animals, and we have their bones.
- Thinking all dinosaurs ate meat. Many dinosaurs, like Triceratops and Brachiosaurus, ate plants.

Make it a game • Dinosaur Says. Play like Simon Says. The parent calls out, “T. rex says stomp on two legs and wave tiny arms!” “Triceratops says put three horns on your head!” “Brachiosaurus says stretch your long neck up high!” If the parent leaves off the dinosaur’s name, do not move. Take turns being the caller.

Scripture. “And God made the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the earth after his kind: and God saw that it was

good.” (Genesis 1:25, KJV)

God made every kind of land animal, the dinosaurs too, and He called His work good.

Practice answers

1. Brachiosaurus.
2. 2 legs.
3. Answers will vary. Lizards, crocodiles, sharks and flying reptiles go in the not-dinosaur pile; T. rex, Triceratops and Brachiosaurus go in the dinosaur pile.
4. Standing like a dinosaur, with legs straight under the body, holds the weight up best.
5. We find their bones in rock and fit them together into skeletons.

7.2 HOW WE KNOW

OBJECTIVES

- Tell that a fossil is a bone or other part of a living thing that has been kept in rock.
- Dig “bones” out of sand slowly and carefully, the way a fossil hunter does, and fit them together.
- Retell the true story of how Sue Hendrickson found a T. rex in a cliff.

Warm-up. Press a toy, a shell or a key into a flat piece of play dough, then lift it out. Ask, “What is left behind?” The shape stays in the dough. Talk about it: rock can keep the shape of a bone in the same way.

Video. Coming soon. How dinosaur fossils are found and dug up for young children: Sue the T. rex, fossil digs, brushing bones out of rock (search Field Museum, Smithsonian National Museum of Natural History, SciShow Kids, Homeschool Pop (Alternate), dig-site footage).

KEY TERMS

fossil

A bone, shell, footprint or leaf from long ago that has been kept in rock.

dig

A place where fossil hunters carefully take bones out of the ground.

paleontologist

A scientist who finds and studies fossils. Say it: pay-lee-on-TALL-uh-jist.

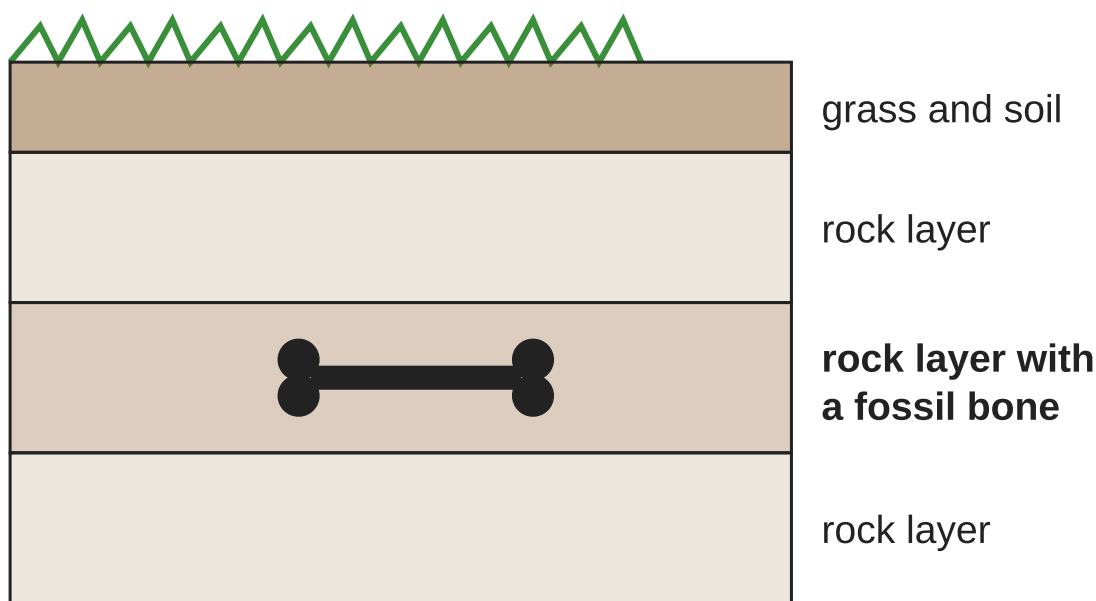
CORE IDEAS

The story. In the summer of 1990, a team of fossil hunters was working in the dry hills of South Dakota. One morning their truck had a flat tire. Most of the team drove to town to fix it. A woman named Sue Hendrickson stayed behind with her dog, Gypsy. She walked to a tall cliff she had wanted to see. At the bottom she spotted small pieces of bone. She looked up, and there, sticking out of the rock, were the big bones of a **T. rex**! The team named the dinosaur “Sue” after her. Today Sue’s skeleton stands in the Field Museum in Chicago.

How they figured it out. Fossil hunters do not grab bones and pull. They work slowly. They scrape away rock with small picks and brush away dust with paintbrushes. They take pictures and draw a map of where each bone lies. Then they wrap the bones in cloth and wet plaster, like a cast on a broken arm, to keep them safe on the trip to the museum. Back at the museum, workers clean every bone and fit them together like a giant puzzle. Sue’s team spent weeks digging her out of the cliff.

The big idea. A **fossil** is a bone, shell, footprint or leaf that has been kept in rock. A bone lying on top of the ground does not last. Animals chew it, and sun and rain break it down. To become a fossil, a bone has to be *covered up quickly* by mud or sand. Then water carrying tiny bits of stone soaks into the bone and makes it hard and heavy, like rock. That is why dinosaur bones are found in rock, and why we must dig to find them.

Try it and see. Today you will be a **paleontologist**. Your parent will bury “bones” in a tub of sand. You will dig them out slowly with a spoon and a paintbrush, lay them out, and fit them into a skeleton. The Bible says, “Speak to the earth, and it shall teach thee” (Job 12:8). When we dig carefully and look closely, the earth teaches us about the animals God made.



A fossil bone lies inside a layer of rock under the soil. Fossil hunters dig down to find it.

Thinking About Time

What the sign says. Museum signs say the rock layers that hold dinosaur bones built up slowly, a little at a time, over a very, very long time.

What we observe. A bone must be covered quickly to become a fossil. Many dinosaur bones are found mixed together in rock made of mud and sand. Scientists have even found soft, stretchy bits inside some dinosaur bones.

How Christians read it. Many Christians think most dinosaur bones were buried quickly in mud and sand during Noah’s Flood.

Try it. Bury a toy in wet sand and pat it down. See how fast mud can cover something up.

Genesis 7:19

PICTURE STUDY



Mary Anning with Her Dog Tray, Unknown English artist, before 1842 · Oil painting · Natural History Museum, London

Mary Anning lived by the sea in Lyme Regis, England. The cliffs there are full of fossils, and when storms knocked rock down to the beach, Mary went out to look. When she was about twelve, she and her brother found the skeleton of a big sea reptile in the cliff. It was not a dinosaur, but it was one of the most wonderful fossils anyone had seen.

Mary hunted fossils all her life. Scientists came from far away to buy her fossils and ask her questions. Her little dog Tray went with her on the beach every day. In this painting you can see Mary, Tray and the cliffs where she worked.

Look closely

- Find Mary's dog, Tray. Where is he?
- Look at what Mary is holding. What would a fossil hunter use it for?
- Find the cliffs behind her. Why would a fossil hunter want to walk beside cliffs?
- Look at her clothes. Are they good for hard work on a windy beach?

Talk about it

1. Mary walked the beach after storms. Why was that a good time to look for fossils?
2. How is Mary like Sue Hendrickson? (Both had a dog, and both found fossils in cliffs.)
3. What would you take with you on a fossil hunt?

Safety first. Use clean play sand. Small pasta pieces can be a choking danger for little brothers and sisters, so keep them out of reach. Do not pick up real bones you find outdoors; tell a grown-up. Wash hands after digging.

MAKE AND DO: SANDBOX FOSSIL DIG

Your parent buries a pasta skeleton in sand. You dig it out like a real paleontologist: slowly, gently, and keeping track of every bone.

You will need

- A plastic tub, baking pan or sandbox with sand
- Dry pasta in bone-like shapes: rigatoni or penne for the spine and legs, elbows for ribs, a shell for the skull (about 12 pieces)
- A plastic spoon and a soft paintbrush
- A dark sheet of paper and a glue stick
- A small cup of water

Steps

1. Before the child looks, the parent lays the pasta “bones” on the sand in the shape of a simple skeleton: a skull, a backbone, ribs, legs and a tail. Count them first and write the number down.
2. Cover the bones with sand. Sprinkle a little water on top and pat it down, like mud covering bones.
3. The child digs with the spoon, a little sand at a time. When a bone shows, switch to the paintbrush and brush the sand away.
4. Before lifting each bone, look at where it lies. Is it near the head end or the tail end?
5. Lay each bone on the dark paper in the same place it was found.
6. Count the bones you found. Did you find them all? If not, keep brushing!
7. Fit the bones into a skeleton and glue them down. Give your dinosaur a name, just as Sue’s team named Sue.

Tips

- Going slowly is the whole point. Real fossil hunters can spend a whole day on one bone.
- For a second dig, mix the bones up before burying them. Real bones are often found jumbled, and the puzzle is harder.

Check your work

- I can tell what a fossil is.
- I can dig slowly and brush gently.
- I can fit bones together to make a skeleton.

FIELD NOTEBOOK

1. Draw a cliff with a dinosaur bone sticking out of it, like the one Sue Hendrickson found.
2. Draw the tools of a fossil hunter: a spoon or little pick, a brush and a bucket.
3. Glue in your pasta skeleton, or draw it, and a parent writes the name you gave it.

From history. Sue the T. rex is one of the most complete T. rex skeletons ever found; most of her bones were dug out of that one cliff. In 2000 the Field Museum in Chicago set her skeleton up for visitors. Her real skull was so heavy that the museum shows it in its own case, and a lighter copy sits on top of the skeleton.

WORKED EXAMPLES

Example 1. Mom hid 8 pasta bones in the sand. You dug up 5. How many bones are still hiding?

1. Hold up 8 fingers. That is all the bones.
2. Fold down 1 finger for each bone you found: 1, 2, 3, 4, 5.
3. Count the fingers still standing up: 1, 2, 3.

Answer: 3 bones are still hiding in the sand. Keep digging!

PRACTICE

1. **EASY** Show me how a fossil hunter brushes sand off a bone: fast and hard, or slow and gentle?
2. **EASY** Point to the things that could be fossils: a dinosaur bone, a toy car, a shell in a rock, a sock, a leaf print in stone.
3. **MEDIUM** Count the pasta bones in your skeleton. How many did you glue down?
4. **MEDIUM** Who found the T. rex named Sue? Who was with her?
5. **HARD** Tell me in your own words: Why does a bone have to be covered up quickly to become a fossil?

COMMON MISTAKES

- Thinking scientists find whole dinosaurs lying on the ground. Most of the time they find a few bones in rock and must dig carefully.
- Thinking a fossil bone is just an old, dry bone. A fossil bone has been soaked with tiny bits of stone and is hard and heavy like rock.
- Thinking museum skeletons are always all real bone. Missing bones are often filled in with copies, and the real bones are sometimes kept safe in a back room.

Make it a game · Bone Hunt. A parent hides 10 pasta bones or paper bones around one room. The child hunts like a paleontologist, counting aloud each bone found. When all 10 are found, the child lays them out in a skeleton. Then switch: the child hides and the parent hunts.

Scripture. “Or speak to the earth, and it shall teach thee: and the fishes of the sea shall declare unto thee.” (Job 12:8, KJV)

God lets us learn from the things He made. When we dig and look carefully, the earth teaches us.

Practice answers

1. Slow and gentle, so the bone does not break.
2. The dinosaur bone, the shell in a rock and the leaf print in stone.
3. Answers will vary; about 12 if all the bones were found.
4. Sue Hendrickson found it, and her dog Gypsy was with her.
5. If it stays on top of the ground, animals chew it and sun and rain break it down. Covered in mud or sand, it is kept safe and can turn hard like rock.

7.3 BIG AND SMALL

OBJECTIVES

- Compare dinosaurs that were very big with dinosaurs that were small, using words like bigger, smaller, longer and taller.
- Draw a life-size T. rex footprint in chalk and measure it with shoes, hands and a ruler.
- Tell that dinosaur footprints, called tracks, are fossils too.

Warm-up. Step barefoot into a pan of damp sand or a patch of mud, then step out. Look at your footprint. Ask, “How long is it? Can you tell which way you were walking?” Then a parent steps beside it. Whose footprint is bigger?

Video. Coming soon. Dinosaur footprints and dinosaur sizes for young children: fossil trackways, big and small dinosaurs compared to people and buses (search Smithsonian National Museum of Natural History, Dinosaur State Park Connecticut, SciShow Kids, Homeschool Pop (Alternate), Science Max, trackway footage).

KEY TERMS

track

A footprint pressed into mud that has turned to stone. Tracks are fossils too.

measure

To find out how long, tall or heavy something is.

life-size

Just as big as the real thing.

CORE IDEAS

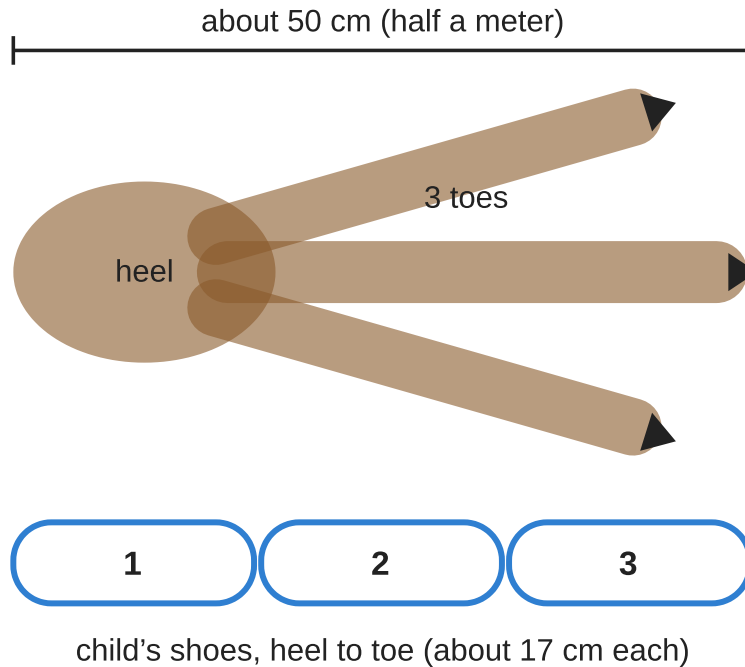
The story. In 1802, on a farm in South Hadley, Massachusetts, a boy named Pliny Moody was plowing a field. His plow turned up a flat stone with strange marks on it. They looked like the footprints of a giant bird, with three long toes. People called them the tracks of “Noah’s raven.” Many years later, scientists learned that these were dinosaur **tracks**: footprints pressed into soft mud that later turned to stone.

How they figured it out. A footprint tells a lot. The size of the print shows how big the foot was. The number of toes shows what kind of animal made it. The space between prints shows how long its steps were. T. rex walked on two legs, and each foot pressed three big toes into the mud. A grown-up T. rex footprint was about half a meter long or more. That is about as long as your whole arm, from your shoulder to your fingertips!

The big idea. God made dinosaurs in many sizes. **T. rex** was about as long as a school bus. **Brachiosaurus** was so tall it could have looked over the roof of a house. But some dinosaurs were small. A little dinosaur called **Compsognathus** (komp-SOG-nuh-thus) was about the

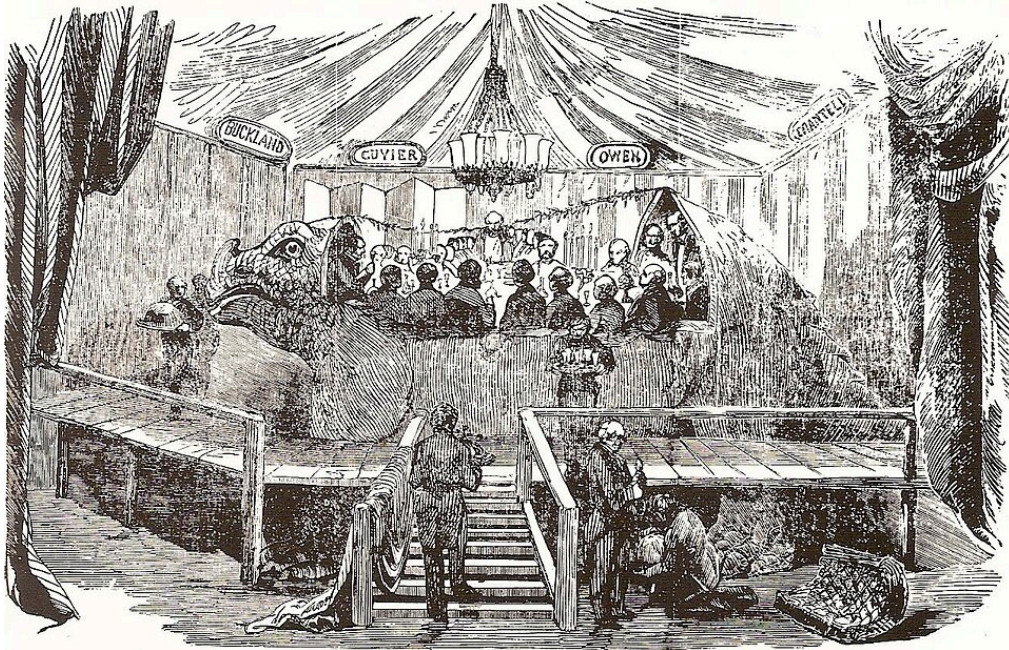
size of a turkey. And every big dinosaur started small, hatching out of an egg. We **measure** to find out how big things really are, instead of only guessing.

Try it and see. Today you will draw a **life-size** T. rex footprint in chalk on the driveway or sidewalk. Then you will measure it. How many of your shoes fit along it? How many of your hands? Can you stand inside it with both feet? “O LORD, how manifold are thy works!” says Psalm 104:24. Manifold means many and different, big and small.



A T. rex footprint is about 50 centimeters long. About 3 of a five-year-old's shoes fit along it.

PICTURE STUDY



Dinner in the Iguanodon, Engraving published in *The Illustrated London News*, January 7, 1854 · Wood engraving printed in a newspaper · *The Illustrated London News*; copies are kept in many libraries

Before the Crystal Palace dinosaur statues were finished, the artist Benjamin Waterhouse Hawkins had a merry idea. On the last night of 1853, he held a dinner party *inside* the mold for his Iguanodon. About twenty men sat at a table in the dinosaur's body and ate a fine supper.

A newspaper printed this picture of the dinner a week later. People all over England read about it and wanted to come see how big the dinosaurs were.

Look closely

- Find the dinosaur. Where is the table?
- Count the men you can see at the table. Are there more than ten?
- Look up above the table. What hangs over the dinner?
- How can you tell this dinosaur was very, very big?

Talk about it

1. Would you like to eat dinner inside a dinosaur? What would you eat?
2. Could you fit your whole family inside a T. rex footprint? Inside an Iguanodon statue?

Safety first. Draw only on a driveway or sidewalk with a grown-up watching, and only when no cars are coming or going. Wash chalk off hands before snacks.

MAKE AND DO: A LIFE-SIZE T. REX FOOTPRINT

You will draw a T. rex footprint just as big as a real one, then measure it with your shoes, your hands and a ruler.

You will need

- Sidewalk chalk in two colors
- A yardstick or meter stick (or a tape measure)
- The child's shoe
- A camera or phone to take a picture (optional)

Steps

1. The parent marks a line 50 centimeters long (about 20 inches) on the driveway with a ruler. This is how long the footprint will be.
2. At one end, draw a round heel. From the heel, draw three thick toes spreading forward to the other end of the line, like a giant bird's foot. Add a pointed claw at the tip of each toe.
3. The child colors in the footprint with chalk.
4. Measure with shoes: put the child's shoe at the heel and walk it, heel to toe, to the tip of the middle toe. Count aloud.
5. Measure with hands: lay hands one after another along the footprint and count.
6. Stand inside the footprint with both feet. Then have the parent stand in it. Do the parent's feet fit?
7. Next to it, trace around the child's own bare foot in the other color chalk. Compare: Which is bigger? Which is smaller?
8. Take a picture of the child lying down beside the footprint.

Tips

- Real T. rex prints show three big toes. A real T. rex also had a tiny fourth toe up high on its foot that did not touch the ground.
- If you have room, draw a second footprint a few big steps ahead. A T. rex took steps much longer than yours.

Check your work

- I can draw a T. rex footprint with three toes.
- I can measure by counting shoes or hands laid end to end.
- I can say which is bigger and which is smaller.

FIELD NOTEBOOK

1. Draw the T. rex footprint and your own footprint side by side. Color the bigger one.
2. Draw a big dinosaur and a small dinosaur. A parent writes "big" and "small" under them.

3. Glue in the picture of you lying beside the footprint, or draw it.

From history. The three-toed tracks in Pliny Moody's field caught the eye of Edward Hitchcock, a minister and a scientist who taught at Amherst College in Massachusetts. Starting in the 1830s he collected hundreds of stone slabs covered with fossil footprints from the Connecticut River valley. He thought giant birds had made them. Later scientists showed most were made by dinosaurs. Many of his slabs are still on display at Amherst College today.

WORKED EXAMPLES

Example 1. How many of your shoes fit along a T. rex footprint that is about 50 centimeters long?

(Use the map or drawing "Count the shoes laid heel to toe along the footprint." shown earlier in this lesson.)

1. Put your shoe on the footprint with its heel at the back of the heel. Say "one."
2. Pick it up and set its heel where its toe was. Say "two."
3. Do it again. Say "three." Now the shoe has reached the tip of the middle toe.
4. A five-year-old's shoe is about 17 centimeters long, so 3 shoes are about 51 centimeters: just the length of the footprint.

Answer: About 3 shoes long. Your count may be a little more or less, depending on the size of your shoe.

PRACTICE

1. **EASY** Point to the bigger footprint: yours or the T. rex's?
2. **EASY** How many toes did a T. rex footprint show? Hold up that many fingers.
3. **MEDIUM** Lay your hands one after another along the T. rex footprint. How many hands long is it?
4. **MEDIUM** Put these in order from smallest to biggest: a turkey-sized *Compsognathus*, you, a T. rex.
5. **HARD** Tell me in your own words: What can a dinosaur footprint tell us?

COMMON MISTAKES

- Thinking every dinosaur was huge. Some were as small as a turkey.
- Guessing size instead of measuring. Measuring with shoes, hands or a ruler gives a real answer.
- Thinking only bones are fossils. Footprints, eggs and teeth can be fossils too.

Make it a game • Follow the Tracks. A parent draws a trail of chalk footprints on the driveway: some big three-toed T. rex tracks, some small bird-like tracks and some round

four-legged tracks. The child walks the trail, saying “big” or “small” at each print and counting the steps. At the end of the trail, hide a toy dinosaur for the child to find.

Scripture. “O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.” (Psalm 104:24, KJV)

Manifold means many and different. God made creatures big and small, and each one is made with wisdom.

Practice answers

1. The T. rex footprint.
2. 3 toes.
3. About 4 or 5 hands for a young child; answers will vary with hand size.
4. Compsognathus, you, T. rex. (A child is much taller than Compsognathus was; T. rex was as long as a school bus.)
5. How big the foot was, how many toes it had, whether it walked on two or four legs, and how long its steps were.

7.4 BEHEMOTH

OBJECTIVES

- Listen to God’s words about Behemoth in Job 40 and retell three clues: it ate grass, its bones were strong, and it moved its tail like a cedar.
- Compare a hippo tail, an elephant tail and a long-necked dinosaur tail, and tell which is most like a cedar tree.
- Say that God made even the greatest animals, and He is greater than all of them.

Warm-up. Go outside and find the biggest tree you can safely reach. Hug the trunk. Can your arms reach all the way around? Now hold up a piece of string or a jump rope. Ask, “If an animal had a tail like this tree trunk, how big would that animal be?”

Video. Coming soon. Behemoth in Job 40 for young children, and long-necked dinosaur tails compared with hippo and elephant tails (search Creation Ministries International, Institute for Creation Research Homeschool Pop (Alternate), cedar of Lebanon tree footage, zoo footage of hippos and elephants).

KEY TERMS

Behemoth

A huge, strong animal God told Job about in Job 40. Say it: bee-HEE-moth.

cedar

A big, tall tree with a thick, strong trunk. King Solomon built God’s temple with cedar wood.

clue

A little piece of information that helps you figure out an answer.

CORE IDEAS

The story. The Bible tells of a man named Job who lived long ago. Job had many troubles, and he asked God many questions. Then God answered Job “out of the whirlwind” (Job 38:1). God asked Job to look at the sky, the sea, the snow and the animals He had made. Then God said, “Behold now behemoth, which I made with thee; he eateth grass as an ox.” **Behemoth** was an animal Job could look at. God made it, just as He made Job.

How they figured it out. Bible readers act like detectives. They look for **clues** in God’s words. Clue one: Behemoth “eateth grass as an ox,” so it ate plants. Clue two: “He moveth his tail like a cedar.” A **cedar** is a great tree with a thick, strong trunk. Clue three: “His bones are as strong pieces of brass; his bones are like bars of iron.” Clue four: God calls him “the chief of the ways of God,” which means one of the greatest animals God made.

The big idea. What animal could Behemoth be? Let's check some tails. A hippo eats grass, but its tail is short and stubby. An elephant eats grass, but its tail is thin like a rope. Now think of a long-necked dinosaur like Brachiosaurus. It ate plants. It had huge, strong bones. And it had a long, thick tail, like a tree trunk! That is why many Christians think Behemoth may have been a dinosaur like this. Other Bible teachers think it was a hippo or an elephant. All agree on the main thing: God made Behemoth, and God is far greater.

God's handiwork. Why did God tell Job about Behemoth? To show Job how great and wise God is. If God could make an animal so big and strong, He could take care of Job too. When you see a dinosaur skeleton, you can remember Job. The One who made the biggest animals made you, knows you and cares for you.



Thinking About Time

What the sign says. Museum signs say dinosaurs were all gone before there were any people.

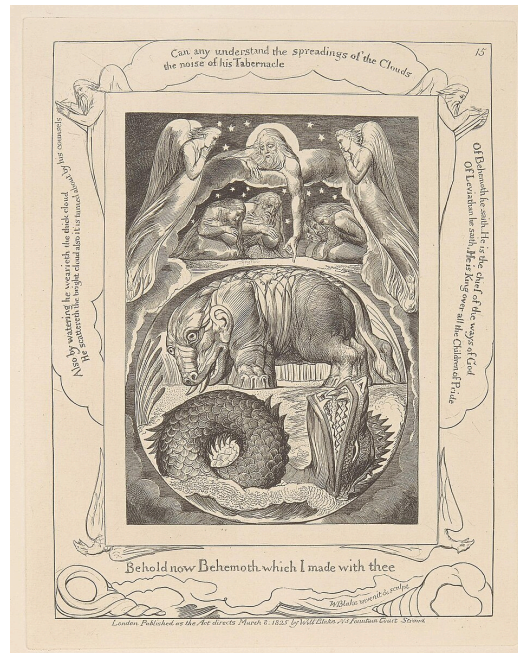
What we observe. Job tells about a huge grass-eating animal with strong bones and a tail like a cedar tree. Long-necked dinosaur bones show long, thick tails.

How Christians read it. Many Christians think people and dinosaurs lived at the same time, because God made the land animals and the first people on the same day. They think Job may have seen a dinosaur.

Try it. Ask your child: "What would Job have thought if he saw a Brachiosaurus?"

Job 40:17

PICTURE STUDY



Behemoth and Leviathan, William Blake, 1825 (from his *Illustrations of the Book of Job*) · Engraving · Prints are kept in many museums and libraries

William Blake was an English poet and artist who loved the Bible. When he was an old man, he made a set of pictures for the Book of Job, cutting every line into metal plates so the pictures could be printed. This one shows God showing Job the great Behemoth on the land and Leviathan in the sea.

Blake had never seen a dinosaur skeleton. He drew Behemoth from his imagination. Look carefully and see what you think of his Behemoth.

Look closely

- Find Behemoth on the land. What animal does Blake's Behemoth look like to you?
- Look at Behemoth's tail. Did Blake give it a tail like a cedar tree?
- Find Leviathan in the water below.
- Look at the top of the picture. Who is pointing down, and who is looking?

Talk about it

1. If you drew Behemoth, what would its tail look like?
2. Why do you think God wanted Job to look at Behemoth?

MAKE AND DO: BUILD A BEHEMOTH WITH A CEDAR TAIL

You will draw a big Behemoth from the clues in Job 40 and give it a strong, thick tail made from a cardboard tube.

You will need

- A large sheet of paper or a flattened cardboard box
- Crayons or markers
- An empty paper-towel tube
- Brown paper or brown crayon
- Tape or glue
- A piece of string and a small ball of play dough

Steps

1. The parent reads Job 40:15–19 aloud slowly. The child raises a hand at each clue.
2. Count the clues together on your fingers: eats grass, tail like a cedar, bones like iron, one of the greatest animals God made.
3. Draw a big Behemoth on the paper eating grass. Make its legs thick and strong.
4. Color the paper-towel tube brown like a cedar trunk. Tape it on as Behemoth's tail.
5. Now make a hippo tail (a little lump of play dough) and an elephant tail (a piece of string). Hold each one up next to the cedar tail.
6. Ask: Which tail is most like a cedar? Point to it.
7. Hang your Behemoth on the wall and tell a family member the clues.

Tips

- Keep the focus on the clues and on God's greatness. It is fine to say, "We are not sure, but here is what many Christians think."
- If you have a cedar, pine or other tall tree nearby, take the paper-towel tube outside and hold it up next to the trunk. A real cedar trunk is much thicker!

Check your work

- I can tell three clues about Behemoth from Job 40.
- I can say which tail is most like a cedar.
- I can say who made Behemoth.

FIELD NOTEBOOK

1. Draw a cedar tree with a thick trunk. Next to it, draw a long, thick dinosaur tail.
2. Draw three tails in a row: a hippo tail, an elephant tail and a long-necked dinosaur tail. Circle the one most like a cedar.
3. Draw Job looking at Behemoth. A parent writes the words, "Behold now behemoth, which I made with thee."

From history. The word *behemoth* is a Hebrew word. It comes from the Hebrew word for "beast" and means something like "the great beast." When the King James Bible was finished in 1611, its translators kept the Hebrew word instead of picking an animal name. Today English speakers still call anything huge "a behemoth."

WORKED EXAMPLES

Example 1. Look at the picture chart of three tails. Which tail is long and thick like a cedar tree trunk?



cedar tree trunk



hippo: short and stubby



elephant: thin like a rope



long-necked dinosaur: long and thick

Which tail is most like a cedar? (Not drawn to scale; the dinosaur tail was far longer.)

1. Point to the hippo tail. It is short and stubby. Not like a cedar.
2. Point to the elephant tail. It is thin like a rope. Not like a cedar.
3. Point to the long-necked dinosaur tail. It is long and thick, like a tree trunk lying down.
4. Compare with the cedar trunk in the chart. The dinosaur tail is the closest match.

Answer: The long-necked dinosaur tail is most like a cedar.

PRACTICE

1. **EASY** What did Behemoth eat?
2. **EASY** Who made Behemoth?
3. **MEDIUM** Count the clues about Behemoth on your fingers: eats grass, tail like a cedar, bones like iron, one of the greatest animals God made. How many clues?
4. **MEDIUM** Match each tail to its animal: short and stubby, thin like a rope, long and thick like a tree. The animals are an elephant, a long-necked dinosaur and a hippo.
5. **HARD** Tell me in your own words: Why did God tell Job about Behemoth?

COMMON MISTAKES

- Thinking Behemoth is a made-up monster. God told Job to “behold” it, which means to look at it, so it was a real animal Job could see.
- Thinking “tail like a cedar” means the tail was green and leafy. It means the tail was big, thick and strong like a cedar trunk.
- Forgetting the main point. The lesson of Behemoth is not only which animal it was, but how great God is.

Make it a game · Guess the Animal. The parent gives three clues about an animal, one at a time: what it eats, what its tail is like and how big it is. The child guesses after each clue. Try a cat, a horse, an elephant, a hippo and T. rex. Last of all, give Behemoth’s clues from Job 40. Then let the child give the clues and the parent guess.

Scripture. “Behold now behemoth, which I made with thee; he eateth grass as an ox.” (Job 40:15, KJV)

God made Behemoth, and He made Job too. The God who made the biggest animals made you and cares for you.

Practice answers

1. Grass, like an ox.
2. God made Behemoth (Job 40:15).
3. 4 clues.
4. Short and stubby: hippo. Thin like a rope: elephant. Long and thick like a tree: long-necked dinosaur.
5. To show Job how great and strong God is. If God made such a huge animal, He can take care of Job, and of us.

UNIT 7 REVIEW

An oral review. The parent asks each question aloud, and the child answers by telling, pointing, showing or drawing. Have toy dinosaurs or pictures of T. rex, Triceratops and Brachiosaurus nearby. The review is worth 20 points.

1. (3 pts) Point to T. rex, Triceratops and Brachiosaurus, and tell me one thing about each.
2. (2 pts) Show me how a lizard stands and how a dinosaur stood.
3. (3 pts) What is a fossil? Where do we find dinosaur fossils?
4. (3 pts) Show me how a fossil hunter digs out a bone. Tell me the story of Sue the T. rex.
5. (3 pts) How many toes did a T. rex footprint show? Which is bigger, your footprint or a T. rex footprint? How could we measure it?
6. (2 pts) Were all dinosaurs huge? Tell me about a big one and a small one.
7. (4 pts) Tell me about Behemoth. What did he eat? What was his tail like? Who made him?

UNIT PROJECT: MY DINOSAUR MUSEUM

Set up a little dinosaur museum on a shelf or table. Include your three play-dough dinosaurs, your glued pasta skeleton from the sandbox dig, a photo or drawing of you beside the chalk T. rex footprint, and your Behemoth with its cedar tail. Then invite your family to visit. Be the museum guide: tell the name of each dinosaur, how fossil hunters dig, how big a T. rex footprint is, and what God told Job about Behemoth. A parent writes down a few of your words for a museum sign.

- **Dinosaurs:** Names T. rex, Triceratops and Brachiosaurus and shows one true thing about each.
- **Fossils:** Explains that dinosaur bones are fossils kept in rock and shows how to dig slowly and carefully.
- **Measuring:** Tells how many shoes or hands long the T. rex footprint was and compares bigger and smaller.
- **Telling:** Retells the Behemoth clues from Job 40 and says that God made all the animals, big and small.

Answer key

1. T. rex: walked on two legs, big teeth, tiny arms. Triceratops: three horns and a frill, ate plants. Brachiosaurus: very long neck, front legs longer than back legs, ate plants. One point for each dinosaur.
2. Lizard: elbows and knees out to the sides. Dinosaur: legs straight down under the body.
3. A bone, shell, footprint or leaf kept in rock. We find dinosaur fossils by digging in rock, often in cliffs and hills.
4. Slowly and gently, with a small tool and a brush. Sue Hendrickson stayed behind with her dog when the truck had a flat tire, walked to a cliff and found T. rex bones; the dinosaur was named Sue after her.

5. 3 toes. The T. rex footprint is bigger. Measure by laying shoes or hands heel to toe along it and counting, or with a ruler.
6. No. T. rex was as long as a school bus, and Brachiosaurus was taller than a house, but Compsognathus was about the size of a turkey.
7. He ate grass like an ox. He moved his tail like a cedar tree. His bones were strong like iron. God made him (Job 40:15-19).

CARING FOR THE EARTH

All year long we have looked closely at God's world: rocks and dirt, water and weather, day and night, the seasons, and even dinosaur bones. Now we ask a new question: **What does God want us to do with His world?** The answer is in the very first garden. God put Adam in Eden "to dress it and to keep it" (Genesis 2:15). The earth belongs to the Lord, and He gave people the happy job of taking care of it.

In this unit your child will adopt a plant and be its keeper for a week, pick up litter safely and sort it into a picture chart, catch and count the water that runs down the drain, and finish the year with a slow thank-you walk. Along the way we meet George Washington Carver, who taught farmers to make tired soil strong again, Rebekah at the well, and Francis of Assisi, who sang thanks to God for sun, wind and water.

Caring for the earth is not about being afraid. It is about being thankful. A child who knows that every rock, raindrop and robin came from God's hand will want to treat them well.

BEFORE YOU BEGIN

- Can count objects to 15 by touching or pointing
- Can tell which of two rows is longer or which group has more
- Has heard the stories of creation and the garden of Eden (Genesis 1-2)
- Remembers some of this year's lessons on rocks, soil, water and weather

MASTERY CHECKLIST

- I can tell the job God gave Adam in the garden.
- I can show ways to take care of a plant.
- I can tell what litter is and pick it up safely with a grown-up.
- I can tell where our water comes from and show two ways to save it.
- I can count things and read a picture chart.
- I can thank God for things He made.

OPTIONAL BOOKS AND RESOURCES

- **USGS Water Science School** (<https://www.usgs.gov/special-topics/water-science-school>): Free. Clear pictures and short pages on where water comes from and how the water cycle works. Best for the parent to read and then explain (Lesson 8.3).
- **EPA WaterSense** (<https://www.epa.gov/watersense>): Free. Simple tips for saving water at home, such as turning off the tap while brushing and fixing leaks (Lesson 8.3).
- **Keep America Beautiful** (<https://kab.org/>): Free information on community clean-up days. A family can join a local clean-up as a follow-up to Lesson 8.2.

8.1 GOD GAVE US THE EARTH TO TEND ★

OBJECTIVES

- Tell in my own words the job God gave Adam in the garden of Eden (Genesis 2:15).
- Name three ways a child can take care of God's earth.
- Take care of one plant for a week and tell what it needed.

Warm-up. Set a houseplant (or a weed dug up into a cup) on the table. Let your child touch the soil. Is it dry or damp? Ask: "What does this plant need to stay alive?" (Water, light, good soil, room to grow.) Then ask: "Who takes care of this plant? What would happen if no one did?"

Video. Coming soon. Genesis 2:15 and the garden of Eden for children, simple plant care for kids, George Washington Carver for kids; search Homeschool Pop (Alternate), Moody Science classics, Smithsonian, and children's gardening channels.

KEY TERMS

tend

To take care of something so it stays healthy and good, like watering a plant every day.

dress and keep

Adam's job in the garden. To dress is to work it: dig, plant and water. To keep is to guard it and care for it.

steward

A helper who takes good care of something that belongs to someone else. The earth belongs to God, and we are His stewards.

creation

Everything God made: the ground, the sky, the water, the plants, the animals and people.

CORE IDEAS

The story. Pick up a handful of garden dirt, or hold a seed in your hand. God made the dirt and the seed. At the very beginning, God planted a garden in Eden. It had trees that were good for food and a river to water it. Then God put the first man, Adam, in the garden, and He gave Adam a job. The Bible says God put him there "to dress it and to keep it" (Genesis 2:15). To **dress** a garden means to work it: to dig, plant, trim and water. To **keep** it means to guard it and take good care of it. Adam's very first job was being a gardener!

How they figured it out. Long after Adam, a man named George Washington Carver loved plants and soil. In 1896 he went to teach at a school called Tuskegee, in Alabama. Many farmers there planted cotton in the same fields year after year, and the soil grew tired and weak. Carver studied the soil like a scientist. He taught the farmers to plant peanuts and peas, which help feed tired soil, and sweet potatoes, which gave families good food. Carver

showed that a good keeper of the ground looks closely, learns how God made things work, and leaves the land better than he found it.

The big idea. “The earth is the LORD’s, and the fulness thereof” (Psalm 24:1). The whole world belongs to God. God made people in His image and gave them a job: to rule over the earth and use it well (Genesis 1:28). We may eat the fruit, plant fields, cut wood and keep animals. But we use God’s world the way a good helper uses a borrowed tool: thankfully and carefully. A person who takes care of something that belongs to someone else is called a **steward**.

Try it and see. You can be a keeper too. You can water a plant, pull a weed, fill a bird bath, pick up sticks in the yard, or carry scraps to a compost pile. Each time you do, you are doing Adam’s first job. And each time, you are saying thank you to God for His good world.

PICTURE STUDY



The Gardeners (Les Jardiniers), Gustave Caillebotte, 1875–1877 · Oil on canvas · Private collection

Gustave Caillebotte was a French painter whose family had a large country garden near Paris. In this painting two gardeners walk along neat rows of vegetables on a bright, sunny day. They carry watering cans and give each plant a drink.

These gardeners are doing just what God told Adam to do. They are dressing the garden and keeping it.

Look closely

- Count the gardeners. How many do you see?
- Point to the watering cans. What is inside them?
- Look at the rows of plants. Are they neat or messy? Who made them that way?

- Look at the gardeners' feet. What do you notice?

Talk about it

1. What job are the gardeners doing? Why do plants need it?
2. How is their work like Adam's job in the garden of Eden?
3. What garden job could you do this week?

Safety first. Wash hands after touching soil. Use garden tools only with a grown-up. Some houseplants and garden plants are harmful to eat, so never taste leaves, berries or seeds.

MAKE AND DO: ADOPT A PLANT: I AM A KEEPER

For one week your child will be the keeper of one plant, just as Adam was the keeper of Eden. Each day the child checks the plant, gives it what it needs and tells a grown-up what he or she saw.

You will need

- One plant to adopt: a houseplant, a potted herb, a bush in the yard or a small tree
- A small watering can or a cup
- A craft stick or a strip of cardboard
- Crayons and paper
- Tape or string

Steps

1. Walk around the house or yard together and choose one plant to keep for a week.
2. Make a keeper's tag: on the craft stick or cardboard, your child draws a smiling face and a water drop. A parent writes the child's name and "Keeper." Tape or tie the tag beside the plant.
3. Draw the plant on the first day. Count its leaves or flowers if there are fewer than twenty.
4. Every day, do the keeper's check: Touch the soil. Is it dry? Then give the plant a drink. Is it damp? Then let it rest.
5. Look for keeping jobs: pull a weed near it, pick up sticks or trash around it, wipe dust off a leaf with a damp cloth, or turn a pot so the other side gets sun.
6. On the last day, draw the plant again. Put the two drawings side by side. What changed?
7. Say a short prayer of thanks to God for the plant and for the job of keeping it.

Tips

- Too much water can hurt a plant just like too little. The finger test (dry or damp?) teaches the child to look before acting, the way a scientist does.

- If it is winter, a houseplant or a pot of herbs on a sunny window works well.

Check your work

- I can tell the job God gave Adam.
- I can check if a plant needs water.
- I can show one other way to take care of a plant.

FIELD NOTEBOOK

1. Draw Adam in the garden of Eden doing one of his jobs: digging, planting or watering.
2. Draw your adopted plant with its keeper's tag beside it.
3. Draw three ways your family takes care of your yard, garden or home. A parent writes a label under each picture.

From history. John Chapman, remembered as Johnny Appleseed, was a real American who lived in the early 1800s. He walked through Pennsylvania, Ohio and Indiana planting apple seeds in small fenced nurseries, so that families moving west could buy young apple trees for their new farms. People remembered him for his hard work and for his kindness to animals.

WORKED EXAMPLES

Example 1. This week Leah watered her plant 3 times and pulled 4 weeds near it. How many keeping jobs did she do in all?

1. Hold up 3 fingers for the 3 times she watered.
2. Hold up 4 more fingers for the 4 weeds she pulled.
3. Count all the fingers you are holding up: 1, 2, 3, 4, 5, 6, 7.

Answer: 7 keeping jobs.

PRACTICE

1. **EASY** Who did God put in the garden of Eden to take care of it?
2. **EASY** What job did God give Adam in the garden? Say it in your own words.
3. **EASY** Thumbs up or thumbs down? A parent names each action, and the child shows thumbs up for caring and thumbs down for not caring: watering a flower; stomping on a flower bed; filling the bird bath; breaking a branch just for fun; picking up a wrapper in the grass.
4. **MEDIUM** You water 2 plants in the kitchen and 3 plants on the porch. How many plants did you water? Use your fingers.
5. **MEDIUM** Tell a grown-up: Why should we take care of the earth?

COMMON MISTAKES

- Thinking the earth belongs to us to do whatever we like. The earth is the Lord's (Psalm 24:1), and we are His helpers.
- Thinking caring for the earth means never using anything. God gave plants and animals for food and use. Good stewards use them wisely and thankfully.
- Thinking only grown-ups can take care of creation. Children can water, weed, pick up trash and feed the birds.

Make it a game • Keeper Says. Play like "Simon Says," but the leader says "Keeper says." Act out garden jobs: "Keeper says dig a hole." "Keeper says plant a seed." "Keeper says water the garden." "Keeper says pull a weed." "Keeper says pick up a stick." If the leader leaves off "Keeper says," freeze! Take turns being the leader.

Scripture. "And the LORD God took the man, and put him into the garden of Eden to dress it and to keep it." (Genesis 2:15, KJV)

God gave the first man real work to do in a real garden. Taking care of plants, animals and land is a good job that God Himself gave to people.

Practice answers

1. Adam, the first man.
2. To dress it and to keep it: to work the garden (dig, plant, water) and to take good care of it.
3. Thumbs up: watering a flower, filling the bird bath, picking up a wrapper. Thumbs down: stomping on a flower bed, breaking a branch just for fun.
4. 5 plants.
5. Any good answer, such as: the earth belongs to God; God gave people the job of taking care of it; caring for it helps people, animals and plants; it is a way to thank God.

8.2 PICKING UP LITTER

OBJECTIVES

- Tell what litter is and why it hurts people, animals and plants.
- Pick up litter safely with a grown-up and sort it into trash and recycling.
- Count litter by kind and read a picture chart.

Warm-up. Put five things on a tray: a leaf, a stick, a small rock, a candy wrapper and a bottle cap. Ask your child to sort them into two piles: “things God made that belong outside” and “things people made that belong in the trash or recycling.” Talk about it: what happens if a wrapper is left on the ground?

Video. Coming soon. Litter clean-up for kids, how leaves rot into soil, how recycling works for children; search Keep America Beautiful, SciShow Kids, Homeschool Pop (Alternate), Science Max, and nature footage of decomposers.

KEY TERMS

litter

Trash left on the ground where it does not belong, like a wrapper in the grass or a can by the road.

rot

When worms, bugs and tiny living things slowly break down old leaves and plants until they turn back into soil.

recycle

To send used things, like cans and paper, to be made into new things.

CORE IDEAS

The story. Hold a candy wrapper in your hand. When the candy is gone, where should the wrapper go? If it goes in the trash can, all is well. But if someone drops it on the sidewalk, it becomes **litter**. Litter is trash left where it does not belong: a wrapper in the grass, a cup by the road, a plastic bag caught in a bush.

How they figured it out. People who study the woods have watched what happens to things on the ground. When a leaf falls, worms, beetles, mushrooms and tiny living things eat it a little at a time. Slowly the leaf **rots** and turns back into soil. (Remember the worms that make soil?) God made the woods to clean up their own leaves! But a plastic bag, a glass bottle or a metal can does not rot like a leaf. It can lie on the ground for a very, very long time. Birds can get tangled in string and plastic, and animals may try to eat trash that makes them sick. Broken glass can cut bare feet and paws.

The big idea. God made a beautiful world, and we share it with our neighbors and with His creatures. One day Jesus fed a great crowd with five loaves and two fishes. When everyone was full, He told His disciples, “Gather up the fragments that remain, that nothing be lost” (John 6:12). They filled twelve baskets with the leftovers. Jesus did not leave a mess behind. When we pick up litter, we love our neighbors, we protect the animals, and we keep God’s world clean and lovely.

Try it and see. Some trash can be **recycled**. Cans, many bottles and paper can be melted or mashed and made into new things. The rest goes in the trash can, and a truck takes it away. With gloves and a grown-up, you can make one small place clean. Then stand back and look. It is like Adam keeping the garden!

PICTURE STUDY



The Courtyard of a House in Delft, Pieter de Hooch, 1658 · Oil on canvas · National Gallery, London

Pieter de Hooch was a Dutch painter who worked in the city of Delft. Visitors to Dutch towns long ago often wrote about how clean they were. Families swept their yards and scrubbed their front steps. In this painting we look into a tidy brick courtyard behind a house, on a quiet, sunny day.

Look closely

- Find the little girl. Who is with her?
- Look through the open passage on the left. Who is standing there? What might she see outside?
- Look at the brick floor of the courtyard. Do you see any trash on it?

Talk about it

1. How do you think this family kept their courtyard so clean?
2. Would you like to play in this courtyard? Why?
3. What place near your home could you help keep this tidy?

Safety first. Pick up litter only with a grown-up, and always wear gloves. Never touch broken glass, needles, sharp metal, dead animals or anything strange or dirty: point to it and tell a grown-up. Stay away from roads and traffic. Wash hands well with soap afterward.

MAKE AND DO: OUR CLEAN-UP WALK AND LITTER CHART

Your family will clean up one small place, such as your yard, the curb in front of your house or the edge of a park. Then you will sort what you found and make a picture chart, just like a scientist counting what she found in the field.

You will need

- Garden or rubber gloves for each person
- Two bags: one for trash and one for recycling
- A trash grabber or kitchen tongs, if you have them (for the grown-up)
- Old newspaper or a large piece of cardboard
- Paper and crayons

Steps

1. Choose a small place to clean. A grown-up walks it first to check for anything dangerous.
2. Put on gloves. Walk slowly and look closely, like a detective.
3. When you see litter, point to it first. The grown-up says “OK” or “I will get that one.”
4. Put each piece in the bag. Keep going until the place looks clean.
5. At home, spread the newspaper or cardboard on the ground outside. With gloves on, sort what you found into piles: wrappers, bottle caps, paper, cans and bottles, other.
6. Count each pile. On your paper, draw one little picture for each piece, in rows, to make a picture chart.
7. Put cans, bottles and clean paper in the recycling. Put the rest in the trash. Take off gloves and wash hands.
8. Go back and look at your clean place. Thank God for it.

Tips

- Keep it short and cheerful. Ten minutes of cleaning one spot is better than a long, tired walk.
- Check your town’s rules to see which things go in recycling.

Check your work

- I can tell what litter is.
- I can pick up litter safely with gloves and a grown-up.
- I can count my litter and make a picture chart.

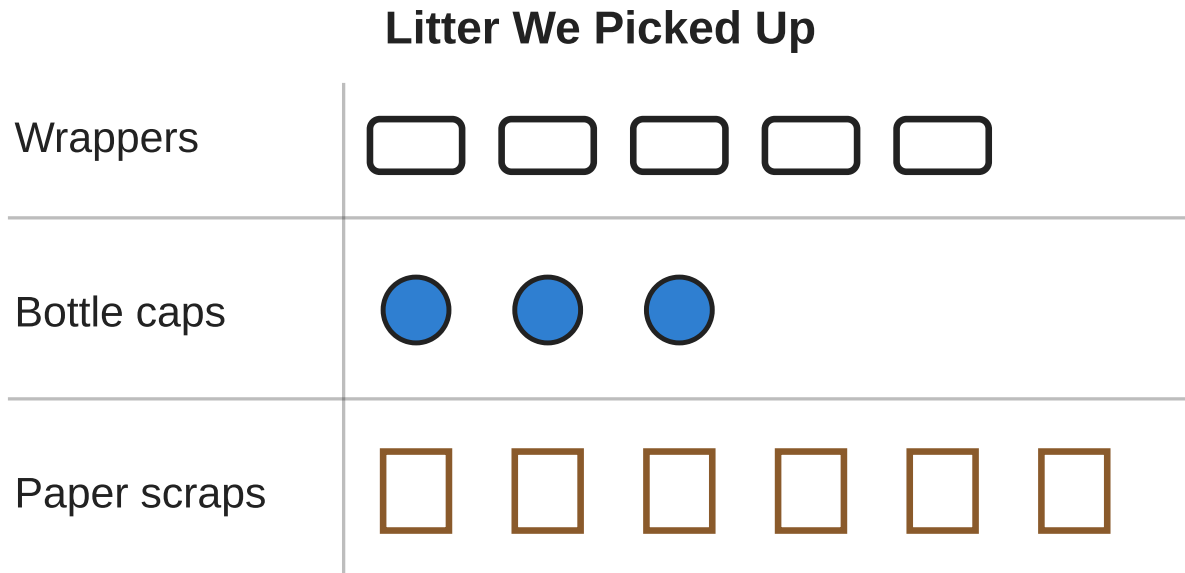
FIELD NOTEBOOK

1. Draw the place you cleaned, before and after. A parent writes “Before” and “After” under the pictures.
2. Draw a leaf and a can lying on the ground. Draw worms near the leaf. Which one will turn back into soil?
3. Draw an animal that is safer because you picked up litter.

From history. In 1971 the United States Forest Service gave children a new cartoon friend named Woodsy Owl. His motto was “Give a hoot, don’t pollute.” Woodsy Owl reminded families to keep parks, forests and roadsides clean, and many children learned his motto by heart.

WORKED EXAMPLES

Example 1. Look at the picture chart of litter one family picked up. Which kind of litter did they find the most of? How many pieces did they find in all?



One picture = one piece of litter

Litter one family picked up. One picture stands for one piece.

1. Count the wrappers in the top row: 1, 2, 3, 4, 5. There are 5 wrappers.
2. Count the bottle caps in the middle row: 1, 2, 3. There are 3 bottle caps.
3. Count the paper scraps in the bottom row: 1, 2, 3, 4, 5, 6. There are 6 paper scraps.
4. The longest row has the most. The paper row is longest, and 6 is more than 5 or 3.
5. To find how many in all, keep counting across every row without starting over: 5 wrappers, then 3 caps (6, 7, 8), then 6 paper scraps (9, 10, 11, 12, 13, 14).

Answer: Paper scraps were found the most (6). They found 14 pieces of litter in all.

PRACTICE

1. **EASY** What is litter? Tell it in your own words.
2. **EASY** A parent names these things: a leaf, a soda can, a stick, a candy wrapper, a rock, a piece of string. Clap once for each one that is litter.
3. **MEDIUM** Which one will rot and turn back into soil: a fallen leaf or a plastic bag?
4. **MEDIUM** You picked up 4 cans and your brother picked up 5 cans. How many cans did you pick up together?
5. **EASY** On a clean-up walk you see broken glass. What should you do?

COMMON MISTAKES

- Thinking litter just goes away by itself. Leaves rot, but plastic, glass and metal stay on the ground a very long time.
- Thinking “It is only one wrapper.” Many people dropping one wrapper each makes a big mess, and one piece of string can still trap a bird.
- Picking up everything with bare hands. Litter can be sharp or dirty, so wear gloves and let a grown-up handle anything dangerous.

Make it a game · Litter Spy. Hide eight clean “litter” pieces (a wrapper, a paper scrap, a bottle cap, a clean can and so on) around a room or the yard, among some leaves, sticks and rocks. Your child hunts for the litter only and puts it in a basket, leaving God’s leaves, sticks and rocks where they are. When all eight are found, count them together and sort them into trash and recycling.

Scripture. “When they were filled, he said unto his disciples, Gather up the fragments that remain, that nothing be lost.” (John 6:12, KJV)

After Jesus fed the crowd, He did not leave the leftovers lying on the hillside. His disciples gathered them up. Picking up after ourselves, and after others, is a way to follow Him.

Practice answers

1. Trash left on the ground where it does not belong.
2. Clap for the soda can, the candy wrapper and the string (3 claps). The leaf, stick and rock are part of God’s creation and belong outside.
3. The fallen leaf. Worms, bugs and tiny living things break it down. The plastic bag stays a very long time.
4. 9 cans.
5. Do not touch it. Point to it and tell a grown-up, who can pick it up safely.

8.3 SAVING WATER AT HOME

OBJECTIVES

- Tell where the water in our home comes from.
- Show two ways to save water at home.
- Count and compare cups of water caught from the faucet.

Warm-up. Stand at the kitchen sink together. Turn on the faucet and ask: “Where does this water come from? Where does it go when it runs down the drain?” Turn it off and listen. Then fill one cup and pour it into a bowl. Ask: “How many cups do you think run out while you brush your teeth?”

Video. Coming soon. Where tap water comes from for kids, saving water at home, wells and water towers, Roman aqueducts for children; search USGS Water Science School, EPA WaterSense, SciShow Kids, Homeschool Pop (Alternate), Science Max.

KEY TERMS

faucet

The handle and spout at a sink or tub that lets water out of the pipes. You can turn it on and turn it off.

waste

To use something up for no good reason, like letting water run down the drain when no one is using it.

save

To use only what you need so that nothing good is thrown away.

drip

One little drop of water falling, again and again, from a faucet that is not shut tight.

CORE IDEAS

The story. Squeeze toothpaste onto your brush and turn on the faucet. Splash, splash, splash! If the faucet keeps running while you brush, clean water pours past your brush and down the drain, and no one uses it at all. You can hear it go. Where does all that water come from?

How they figured it out. Long ago, homes had no faucets. People carried water from a well, a spring or a river in jars and buckets. In the Bible, a young woman named Rebekah went to the well with a pitcher on her shoulder. She drew water for a thirsty traveler, and then she drew water for all ten of his camels (Genesis 24)! Every drop took hard work. Today, rain and snow fill rivers, lakes and the ground under our feet. (Remember following the puddle to see where rain goes?) Some families pump water from a well in the yard. In towns, workers clean the water, and pumps push it through long pipes all the way to our sinks.

The big idea. Clean water at home is a gift from God, and it comes to us through the work of many people. To **waste** is to use something up for no good reason. We should still drink plenty of water and wash our hands well! But a good steward does not let water run away for nothing. Jesus told His disciples to gather up the leftovers “that nothing be lost” (John 6:12). Saving water is one more way to care for God’s good gifts.

Try it and see. Here are ways a child can **save** water at home. Turn the faucet off while you brush your teeth or scrub your hands, then turn it on to rinse. Tell a grown-up if a faucet has a **drip**. Give the water left in your cup to a plant instead of the drain. Put a bucket in the shower to catch the cold water that runs before it gets warm, and use it to water the garden.

PICTURE STUDY



The Water Urn (Woman Drawing Water from a Copper Cistern), Jean-Baptiste-Siméon Chardin, 1733 or 1735
· Oil on oak panel · Nationalmuseum, Stockholm

Photo: Jean-Baptiste-Siméon Chardin · CC BY-SA 4.0 (<https://creativecommons.org/licenses/by-sa/4.0>) · via Wikimedia Commons

Jean-Baptiste-Siméon Chardin was a French painter who loved quiet scenes of everyday home life. In his time most kitchens had no faucet in the wall. Water was carried to the house in buckets and kept in a big copper urn. Here a woman fills a jug from the urn’s little tap. Every drop in that urn had to be carried in by hand, so no one wanted to waste it.

Look closely

- Find the big copper urn. What color is it? Does it look shiny?
- Find the little tap on the urn. It works like our faucet. What is she catching under it?
- Look at the woman. Is she in a hurry, or is she careful?
- Look around the kitchen. What else do you see?

Talk about it

1. How did this family get water in their kitchen? How do we get ours?
2. Why would this family be careful not to spill or waste water?
3. If you had to carry all your water from a well, how would you use it?

Safety first. Use cool water for the activity. Mop up spills right away so no one slips. Never play in a bathtub, bucket, pond or pool without a grown-up watching closely: even a little water can be dangerous for small children. Empty buckets when you are done.

MAKE AND DO: CATCH THE RUNNING WATER

Your child will do a real test at the sink: How much water runs down the drain when we wash our hands with the faucet on the whole time, and how much when we turn it off while we scrub? The water you catch will not be wasted. It goes to the plants!

You will need

- A dishpan or large bowl that fits in the sink
- A measuring cup (1 cup) or a plastic drinking cup
- Soap and a towel
- A pitcher or watering can
- Paper and crayons
- A houseplant or garden plant that needs a drink

Steps

1. Put the dishpan in the sink so it will catch the water.
2. Test 1: Turn on the faucet with cool water. Wet your hands, add soap and scrub while you sing the "Happy Birthday" song two times. Rinse. Leave the faucet running the whole time, then turn it off.
3. Scoop the water out of the dishpan one cup at a time into the pitcher. Count each cup out loud. Draw one cup on your paper for each one.
4. Test 2: Turn on the faucet just to wet your hands. Turn it off. Add soap and scrub while you sing the song two times. Turn it on to rinse, then turn it off.
5. Scoop and count the cups again. Draw a second row of cups under the first.
6. Compare the two rows. Which test used less water? Point to the extra cups in the longer row. That is the water you saved.
7. Carry the pitcher and give all the water to your plants.
8. Draw a "Turn me off!" sign with a faucet and a happy face, and tape it by the sink as a reminder.

Tips

- Keep the faucet turned on the same amount both times. That makes it a fair test.
- If your child is excited by the counting, try the same test at toothbrushing time.

Check your work

- I can tell where our water comes from.
- I can show how to turn off the faucet while I scrub or brush.
- I can count cups and tell which row has more.

FIELD NOTEBOOK

1. Draw Rebekah at the well with her pitcher and the thirsty camels.
2. Draw your two rows of cups from Catch the Running Water. Color the cups you saved.
3. Draw one way water gets to your house: rain falling, a river or lake, a well, or a pipe going to your sink.

From history. Long, long ago the Romans built aqueducts: long stone channels that carried water downhill from springs in the hills to fountains in their cities. Where the land dipped low, the channels ran across tall bridges of stone arches. One of these bridges, the Pont du Gard in France, still stands today, and visitors can walk beside it.

WORKED EXAMPLES

Example 1. Look at the cup chart. When the tap was on the whole time, one family caught 8 cups of water. When they turned the tap off while scrubbing, they caught 2 cups. Which way used less water? How many cups did they save?

Water Caught While Washing Hands

Tap on
the whole time



Tap off
while scrubbing



One cup picture = one cup of water

Water caught while washing hands. One cup picture stands for one cup of water.

1. Count the cups in the top row: 1, 2, 3, 4, 5, 6, 7, 8. That is 8 cups.
2. Count the cups in the bottom row: 1, 2. That is 2 cups.
3. The bottom row is shorter, so turning the tap off used less water.
4. Match each bottom cup with a top cup. Now count the top cups that have no partner: 1, 2, 3, 4, 5, 6.

Answer: Turning the tap off while scrubbing used less water. They saved 6 cups.

PRACTICE

1. **EASY** Long ago, before faucets, where did people get their water?
2. **EASY** Saver or waster? A parent names each one and the child says “saver” or “waster”: turning off the faucet while brushing teeth; leaving the hose running in the yard; giving leftover water to a plant; playing with the faucet just to watch it run.
3. **MEDIUM** Mom pours 3 cups from the shower bucket into the watering can. You pour 4 cups. How many cups of water go to the garden?
4. **EASY** Which holds more water, a cup or a bucket? Show with your hands how big each one is.
5. **HARD** Tell a grown-up: Why should we save water, even when it keeps coming out of the faucet?

COMMON MISTAKES

- Thinking water comes from the faucet itself. The faucet only opens the pipe. The water comes from rain and snow that fill rivers, lakes and wells, and it is cleaned and pumped to our homes.
- Thinking saving water means not washing. We should still wash our hands well and drink plenty. We just turn the faucet off when no one is using the water.
- Thinking one little drip does not matter. Drip after drip, all day and all night, can fill a bucket. Tell a grown-up about a dripping faucet.

Make it a game • Rebekah's Water Relay. Outside or in the bathtub area, set a bowl of water at one end and an empty bowl at the other. Using a small cup or a big spoon, carry water from the full bowl to the empty bowl without spilling. Count your trips. When the full bowl is empty, talk about it: carrying water is hard work! Then pour all the water onto a plant so none is wasted.

Scripture. "He sendeth the springs into the valleys, which run among the hills." (Psalm 104:10, KJV)

God sends the water that fills the springs, rivers and wells. Every cup of water at our sink began as His gift.

Practice answers

1. From a well, a spring or a river. They carried it home in jars and buckets.
2. Saver: turning off the faucet while brushing, giving leftover water to a plant. Waster: leaving the hose running, playing with the faucet just to watch it run.
3. 7 cups.
4. A bucket holds more water. (Hands close together for a cup, far apart for a bucket.)
5. Any good answer, such as: water is a gift from God; many people work to clean it and pump it to our homes; wasting means using it for no good reason; Jesus said to gather up so nothing is lost; saved water can help plants.

8.4 A THANK-YOU WALK

OBJECTIVES

- On a walk, find things God made from this year’s lessons: rocks, soil, water, weather, sky, seasons and living things.
- Thank God out loud for the things we find.
- Count what we saw and read a picture chart.

Warm-up. Sit by a window together. Take turns naming one thing outside that God made: a cloud, a tree, a bird, a puddle, a stone. After each one, say together, “Thank you, God, for the ____.” How many can you name before you run out?

Video. Coming soon. Nature walk for kids, noticing God’s creation outdoors, the hymn “All Things Bright and Beautiful” for children; search Moody Science classics, Homeschool Pop (Alternate), Smithsonian, and calm nature footage of birds, trees and skies.

KEY TERMS

thankful

Knowing that something good was given to you, and being glad about it.

praise

Telling God how good and great He is, with words or with songs.

Creator

The One who made everything. God is the Creator of the heaven and the earth.

CORE IDEAS

The story. Long ago in Italy there lived a man named Francis, from the town of Assisi. Francis loved to walk outside and look at God’s world. He wrote a song of praise to God. In it he thanked God for the sun, the moon and the stars, for the wind and the weather, for water and fire, and for the earth that gives us fruit and flowers. He even called the sun his brother and the water his sister, because God made them all, just as God made him.

God’s handiwork. Long before Francis, the Bible already called all creation to **praise** God. Psalm 148 calls on the sun and moon, the stars, the mountains and trees, the animals, the creeping bugs and the flying birds. It even calls the weather: “Fire, and hail; snow, and vapour; stormy wind fulfilling his word” (Psalm 148:8). Rocks and rain cannot talk, but they show how wise and good their **Creator** is. When we see them, we can do the talking and say thank you.

The big idea. This year you have looked closely at God’s world like a real scientist. You picked up rocks and felt which were smooth and which were rough. You shook dirt in a jar,

watched worms, and followed a puddle. You made a weather chart, traced your shadow, watched the seasons change and measured a dinosaur footprint. A **thankful** heart takes good care of a gift. That is why the people who love God's world most are the ones who care for it best.

Try it and see. Today you will take a thank-you walk. Walk slowly. Look up at the sky and down at the ground. Listen for birds and wind. Touch the bark of a tree and a cool stone. Each time you find something God made, stop and say, "Thank you, God, for this!"

PICTURE STUDY



The Song of the Lark, Jules Breton, 1884 · Oil on canvas · Art Institute of Chicago

Jules Breton was a French painter who grew up in a farming village and loved to paint country people at work. Here a young farm girl stands in a field very early in the morning, on her way to work. The sun is just coming up. She has stopped to listen to a lark, a small brown bird that sings while it flies high up in the sky.

She cannot see the bird, but she can hear it. Sometimes the best way to enjoy God's world is to stop, be still and listen.

Look closely

- Find the sun. Is it high in the sky or low near the ground?
- Look at the girl's face. Is she talking, or listening?
- What is she holding in her hand? (A sickle: a curved tool for cutting grain or grass.)
- Look for the lark. Is it easy to find? Why do you think so?

Talk about it

1. What sounds do you hear early in the morning at your house?

2. Why do you think the girl stopped her work for a moment?
3. If you stood in this field, what would you thank God for?

Safety first. Walk with a grown-up and hold hands near streets. Look at wild animals, but never touch or chase them. Never eat berries, mushrooms or plants you find. Do not pick flowers from other people's yards. Never look straight at the sun.

MAKE AND DO: MY THANK-YOU WALK BOOK

Take a slow walk around your yard, street or a park. Look for one thing from each part of this year's science. Then make a little book of thanks that your family can read aloud as a prayer.

You will need

- A small bag for fallen treasures
- Three sheets of paper folded in half and stapled to make a little book
- Crayons
- Glue or tape
- A clipboard or a book to press on (optional)

Steps

1. Before you go, the grown-up names the things to find: a rock, some soil, water (a puddle, dew or a creek), the sky and the weather, a tree in its season, and a living creature such as a bird, a bug or a worm.
2. Walk slowly. When you find one, stop. Look, listen and touch it gently (but never touch wild animals). Then say, "Thank you, God, for ____."
3. Collect a few fallen treasures that are free to take: a fallen leaf, a seed or pinecone, a small pebble. Leave nests, living creatures and other people's flowers where they are.
4. Count what you see along the way. How many birds? How many trees? A grown-up keeps track with marks on paper.
5. At home, make your book. On each page, draw one thing you thanked God for, or glue on a fallen leaf. The grown-up writes your words under each picture.
6. On the last page, draw yourself taking care of God's world: watering, picking up litter or saving water.
7. Read the book aloud as a thank-you prayer at a family meal.

Tips

- You do not need a forest. A sidewalk crack with a weed, a puddle and a patch of sky are all God's handiwork.
- Let your child set the pace. A long stop to watch one ant is a good scientist's walk.

Check your work

- I can find a rock, soil, water, sky and a living thing on a walk.
- I can say thank you to God for things He made.
- I can count what I saw.

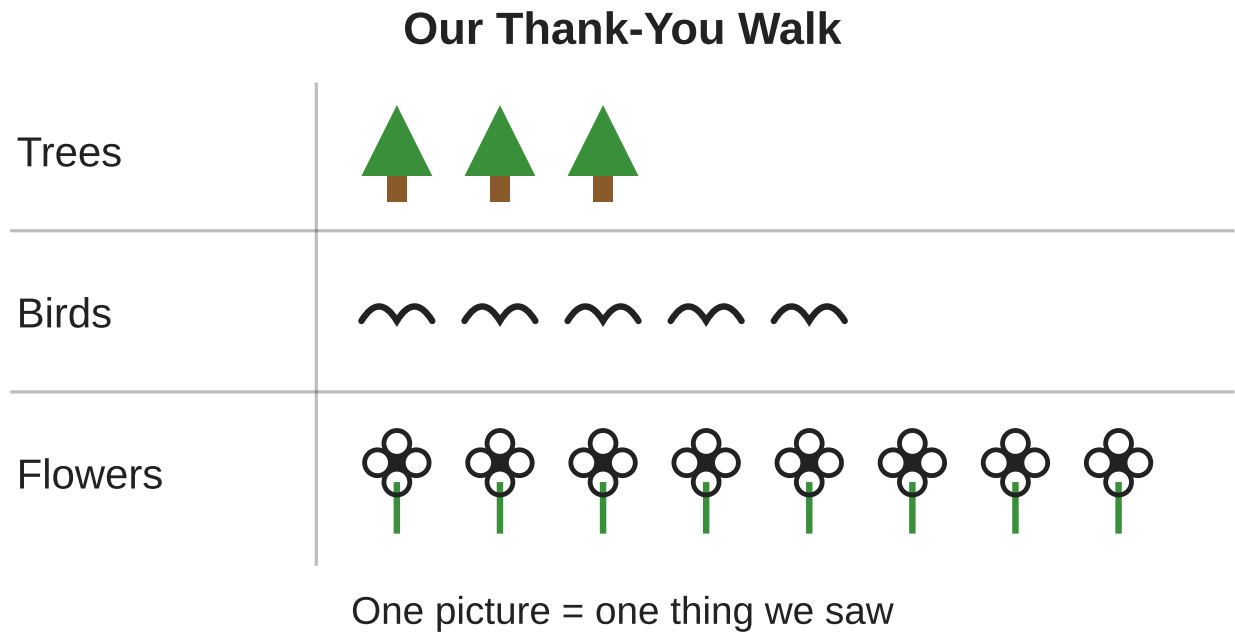
FIELD NOTEBOOK

1. Draw your favorite thing from the thank-you walk as carefully as you can, like Dürer drawing rocks.
2. Make a leaf rubbing: put a fallen leaf under paper and rub over it with the side of a crayon.
3. Draw the sky you saw on your walk. Was it sunny, cloudy, rainy or snowy?

From history. In 1848 Cecil Frances Alexander, a hymn writer in Ireland, published a book of hymns for children. She wrote them to help children learn what Christians believe. One hymn teaches that God is the Maker of heaven and earth, and children have sung it ever since: “All things bright and beautiful, All creatures great and small, All things wise and wonderful, The Lord God made them all.”

WORKED EXAMPLES

Example 1. Look at the picture chart from one family's thank-you walk. Which did they see the most of: trees, birds or flowers? How many more flowers than birds did they see?



What one family saw on their thank-you walk. One picture stands for one thing seen.

1. Count the trees: 1, 2, 3. There are 3 trees.
2. Count the birds: 1, 2, 3, 4, 5. There are 5 birds.
3. Count the flowers: 1, 2, 3, 4, 5, 6, 7, 8. There are 8 flowers.
4. The flower row is the longest, so they saw the most flowers.
5. Match each bird with a flower right under it. Count the flowers that have no bird partner: 1, 2, 3.

Answer: They saw the most flowers (8). They saw 3 more flowers than birds.

PRACTICE

1. **EASY** Name one thing God made that you could find on a walk for each of these: something hard, something wet, something in the sky.
2. **EASY** Point to one thing God made and one thing people made, in your room or outside.
3. **MEDIUM** On your walk you found 6 fallen leaves and 2 pebbles. How many treasures did you find?
4. **MEDIUM** Take it or leave it? A parent names each one: a fallen leaf; a bird's nest with eggs in it; a neighbor's tulip; a small pebble from your own yard.
5. **HARD** Tell back the story: What did Francis of Assisi thank God for in his song? Name three things.

COMMON MISTAKES

- Thinking only big, beautiful things are worth thanking God for. A pebble, a worm and a gray cloud are His handiwork too.
- Thinking it is fine to take home anything we find. Leave nests, eggs, living creatures and other people's flowers where they are.
- Thinking thank-you is only said at mealtime. We can thank God anytime, anywhere, even in the middle of a walk.

Make it a game · Thank-You Toss. Stand in a circle and toss a soft ball back and forth. Each time you catch it, say "Thank you, God, for ____" and name something He made that we studied this year: a rock, mud, rain, a rainbow, the wind, the moon, snow, a dinosaur. No repeats! If you get stuck, the grown-up gives a hint like "something in the sky."

Scripture. "O give thanks unto the LORD; for he is good: for his mercy endureth for ever." (Psalm 136:1, KJV)

The best way to end a year of looking at God's world is to say thank you. Everything we studied, from rocks to rain to dinosaur bones, came from His good hand.

Practice answers

1. Answers will vary. Examples: hard, a rock; wet, a puddle, dew or a creek; in the sky, a cloud, the sun, the moon or a bird.
2. Answers will vary. Examples: God made a tree, a stone, a bird or the sky; people made a chair, a car, a house or a fence (from things God made).
3. 8 treasures.
4. Take it: the fallen leaf and the pebble from your own yard. Leave it: the bird's nest with eggs and the neighbor's tulip.
5. Any three of: the sun, the moon, the stars, the wind, the weather, water, fire, the earth, fruit and flowers.

UNIT 8 REVIEW

This is an oral review. Ask each question aloud and let your child answer in his or her own words, point, or show with fingers. Give full points for any answer that shows understanding. The review is worth 20 points.

1. (3 pts) What job did God give Adam in the garden of Eden?
2. (3 pts) Whose earth is it? Show me one way you can take care of a plant.
3. (3 pts) What is litter? Why is litter bad for animals?
4. (3 pts) Which one will rot and turn back into soil, a leaf or a can? And what do you do if you see broken glass?
5. (3 pts) Where does the water in our house come from? Show me two ways to save water.
6. (3 pts) With the tap running, we caught 7 cups of water. With the tap turned off while scrubbing, we caught 3 cups. Which way used less? How many cups did we save? (Use your fingers or 7 blocks.)
7. (2 pts) Tell me about your thank-you walk. Name three things you thanked God for.

UNIT PROJECT: MY EARTH KEEPER BOOK

Gather the year's last pictures into one book that shows how your child takes care of God's world. Include the first-day and last-day drawings of the adopted plant, the litter picture chart, the two rows of cups from Catch the Running Water, and the Thank-You Walk Book. Your child draws a cover showing himself or herself as an earth keeper, and tells the whole book aloud to a grandparent or friend while a parent writes down a few of the child's words.

- **Keeping:** The plant drawings show the plant on the first and last day, and the child can tell what he or she did to care for it.
- **Counting and charts:** The litter chart and cup chart have one picture for each thing, and the child can tell which row has more.
- **Telling:** The child tells Adam's job, why litter is harmful, and how to save water in his or her own words.
- **Thankfulness and care:** The thank-you pages name real things God made, and the drawings are done slowly and carefully.

Answer key

1. To dress it and to keep it: to work the garden (dig, plant, water) and take good care of it (Genesis 2:15).
2. The earth belongs to God ("The earth is the LORD's," Psalm 24:1). Any good way: check the soil and water it if dry, pull weeds, pick up trash around it, give it sun.
3. Trash left on the ground where it does not belong. Animals can get tangled in it, eat it and get sick, or cut their paws on broken glass.
4. The leaf. If you see broken glass, do not touch it; tell a grown-up.
5. From rain and snow that fill rivers, lakes and wells; it is cleaned and pumped through pipes (or pumped from a well). Any two: turn off the faucet while brushing or scrubbing, tell a

grown-up about drips, give leftover water to plants, catch shower water in a bucket.

6. Turning the tap off used less. We saved 4 cups.

7. Any three things God made, such as a rock, soil, a puddle, the sky, a cloud, a tree, a bird or a worm.

BONUS: FIELD LAB

This bonus unit takes everything outdoors. All year you have learned that God made the ground and the sky. Now you will go out and look at them like a real scientist, with a bag, a magnifying glass, sidewalk chalk, a stick and a notebook full of drawings. Each lab is short and playful, and each one can be done in your own yard or a nearby park.

You will go on a **rock hunt** and build a little rock museum. After a rain you will draw a **puddle map** and watch a puddle shrink. You will lie on a blanket and keep a **cloud chart** for a week. On a sunny day you will build a **shadow clock** with a stick and stones. In every lab you will look closely, sort, count, draw and tell what you found, and thank God for His good world.

BEFORE YOU BEGIN

- Can count objects to 12
- Has sorted rocks or toys by color (Lesson 1.1) and watched a puddle or a shadow (Lessons 3.2 and 5.2) with a parent
- Can tell big from small and long from short
- Knows never to look straight at the sun

MASTERY CHECKLIST

- I can go on a rock hunt and sort my rocks two different ways.
- I can draw a map of my yard from above and show where the puddles are.
- I can tell where a puddle's water goes when it dries up.
- I can name puffy, flat and wispy clouds and keep a cloud chart.
- I can make a shadow clock and tell when shadows are long and short.

OPTIONAL BOOKS AND RESOURCES

- **NOAA SciJinks** (<https://scijinks.gov/>): Free. Weather pages, pictures and games from NOAA and NASA. A parent can find simple pictures of cumulus, stratus and cirrus clouds to show beside the cloud chart (Lesson 9.3).
- **NASA Space Place** (<https://spaceplace.nasa.gov/>): Free. Short, bright pages about the sun, the earth and shadows. A parent can look for ideas about sundials and the sun's path to go with the shadow clock (Lesson 9.4).

9.1 ROCK HUNT

OBJECTIVES

- Go on a rock hunt outdoors with a grown-up and collect a small set of rocks.
- Look closely at rocks with a magnifying glass and with water, and tell what you see.
- Sort a rock collection in more than one way and say the rule out loud.

Warm-up. Put three rocks or pebbles from the yard on a plate. Close your eyes. Your parent hands you one rock. Feel it all over. Is it smooth or rough? Big or small? Now open your eyes and find the rock you felt. Real rock hunters use their hands as well as their eyes!

Video. Coming soon. Rock collecting for young children: how to start a rock collection, looking at rocks with a magnifying glass, sorting rocks by color and texture; search USGS, Smithsonian National Museum of Natural History, SciShow Kids, Homeschool Pop (Alternate) and nature walk footage.

KEY TERMS

rock hunter

Someone who goes outside to look for rocks and look at them closely. Scientists who study rocks are called geologists.

collection

A group of things you gather and keep together, like a box of rocks you found.

magnifying glass

A curved glass that makes small things look bigger when you look through it.

sort

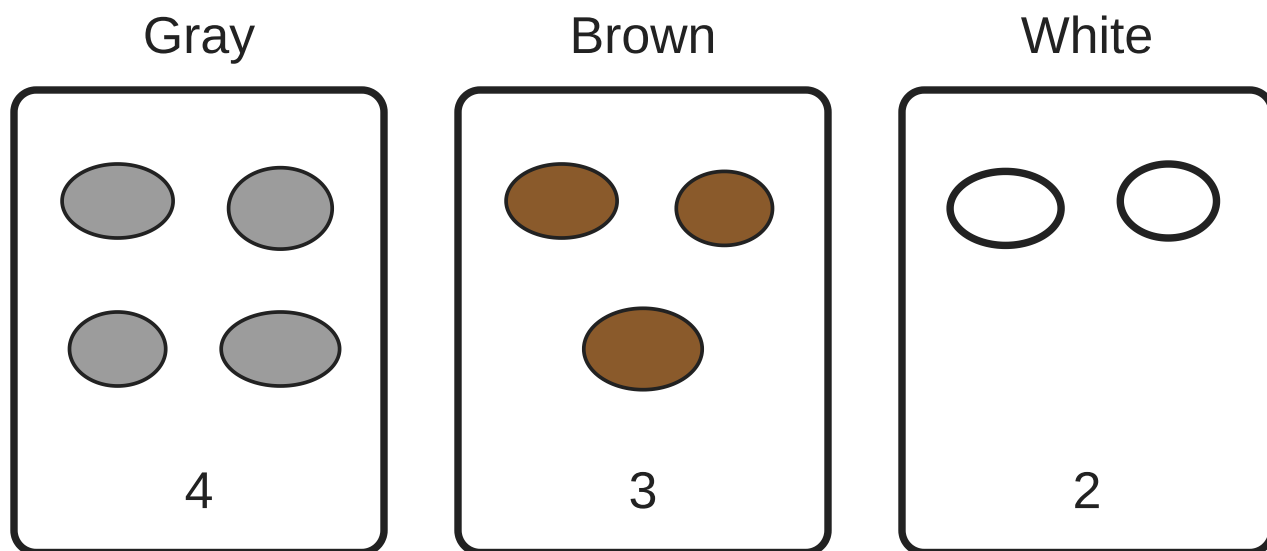
To put things into groups that are alike, such as all the gray rocks together.

CORE IDEAS

The story. Today you are a rock hunter! Rocks are hiding everywhere: in the gravel of the driveway, at the edge of the garden, under the swing set and along the bank of a creek. Real geologists go outside with a bag, a magnifying glass and a notebook, and that is just what you will do. Walk slowly. Look down. Pick up a rock and turn it over in your hand. Is it heavy or light? Warm from the sun or cool from the shade?

The big idea. A good rock hunter looks very closely. Look for color, size and shape. Feel for smooth or rough. Look for tiny shiny specks, little holes or stripes. Here is a secret trick: dip a rock in water. A dull, dusty rock often shows bright colors and stripes when it is wet! Then a rock hunter **sorts**. You can sort by color, by size, or by smooth and rough. The same rocks can be sorted in many ways, so always say your rule: “These are all smooth.” A rock hunter keeps only a few rocks and remembers where each one was found.

God's handiwork. No two rocks are exactly alike. God made the ground under our feet, and every pebble is part of His good world. The Bible even calls God our rock: "The LORD is my rock, and my fortress." A rock is strong and does not move. When you hold a rock in your hand, you can remember that God is strong and does not change.



A rock hunter sorts by color: 4 gray, 3 brown, 2 white.

PICTURE STUDY



Pegwell Bay, Kent: a Recollection of October 5th 1858, William Dyce, about 1858-1860 · Oil on canvas · Tate Britain, London

William Dyce was a Scottish painter who loved to study rocks. Here he painted his own family on the beach at Pegwell Bay in England at low tide. His wife and her two sisters have

been gathering shells and stones, and his son stands with a spade. Behind them rise tall cliffs made of chalk, a soft white rock. It is the same kind of rock as the chalk you scratched with a coin!

Look high in the sky for a thin white streak. That is a comet that people could see in the autumn of 1858. Dyce painted the rocks and the comet carefully, just as a good scientist looks carefully.

Look closely

- Find the boy with the spade. What might he dig for?
- Find the women gathering things from the beach. What do you think they picked up?
- Look at the cliffs. Can you see stripes or layers in them?
- Find the thin white streak in the sky.

Talk about it

1. If you could hunt on this beach, what would you hope to find?
2. Why do you think the cliffs look pale and white?
3. Low tide is a good time to hunt on a beach. Why do you think that is?

Safety first. Hunt only with a grown-up. Lift rocks by tipping them away from you, because snakes, spiders or stinging bugs may hide underneath, and set them back the way you found them so the little creatures keep their homes. Stay far back from cliff edges and fast water. Do not put rocks in your mouth, and wash your hands when you come inside. Ask before you take a rock home: many parks do not allow rock collecting.

MAKE AND DO: MY EGG-CARTON ROCK MUSEUM

You will go on a real rock hunt, clean your rocks, look at them like a geologist and set them out in a little museum made from an egg carton.

You will need

- A small bag or bucket for collecting
- An empty egg carton (12 cups)
- A magnifying glass
- A bowl of water and an old toothbrush
- A towel
- Crayons and paper

Steps

1. Walk with your grown-up around the yard, the driveway edge or a park where collecting is allowed. Pick up rocks that catch your eye.
2. Choose your best rocks, enough to fill some of the egg cups. Rocks should fit inside one cup.

3. Scrub each rock in the bowl of water with the toothbrush. Watch the colors come out! Dry them on the towel.
4. Look at each rock through the magnifying glass. Tell your parent one thing you see: a shiny speck, a stripe, a tiny hole, or a rough spot.
5. Sort your rocks on the table. First sort by color. Then mix them up and sort by smooth and rough.
6. Put one rock in each egg cup. Your parent can write a word on the lid for each rock that you choose, such as “sparkly” or “from the creek.”
7. Give a museum tour! Show your family your rocks and tell where you found your favorite one.

Tips

- Keep a rock wet to see its true colors. When it dries, it may look dull again.
- Small, interesting rocks are better than big ones. A real collection fits on a shelf.

Check your work

- I went on a rock hunt with a grown-up.
- I looked at my rocks with a magnifying glass and with water.
- I sorted my rocks two ways and said my rule.

FIELD NOTEBOOK

1. Draw your favorite rock as big as the page. Color it the way it looks when it is wet.
2. Draw the place where you found your rocks: the driveway, the garden or the creek.
3. Draw two circles. Put a smooth rock drawing in one and a rough rock drawing in the other.

From history. Mary Anning grew up in Lyme Regis, a seaside town in England, long ago. She and her brother Joseph walked the beaches after storms, when bits of the crumbly cliffs fell down onto the sand. They looked carefully at every stone. Mary found many fossils, including the bones of great sea reptiles, and she sold some of her finds to help her family. Scientists came from far away to talk with her, because she knew the rocks of her beach so well.

WORKED EXAMPLES

Example 1. A rock hunter sorted some rocks by color. Look at the sorting mat. Which box has the most rocks? How many rocks are there in all?

(Use the map or drawing “Count each box, then count them all.” shown earlier in this lesson.)

1. Point to the Gray box and count: 1, 2, 3, 4. There are 4 gray rocks.
2. Point to the Brown box and count: 1, 2, 3. There are 3 brown rocks.
3. Point to the White box and count: 1, 2. There are 2 white rocks.
4. 4 is more than 3, and 3 is more than 2. So the Gray box has the most.
5. Count all of them together: 4 and 3 make 7, and 2 more make 9.

Answer: The Gray box has the most rocks. There are 9 rocks in all.

PRACTICE

1. **EASY** Hold up two rocks from your collection. Point to the bigger one. Point to the smaller one.
2. **EASY** Name three things a rock hunter takes on a rock hunt.
3. **MEDIUM** An egg carton has 12 cups. You put a rock in 7 cups. How many cups are still empty? Count them on a real egg carton.
4. **MEDIUM** Why does a rock hunter dip a rock in water?
5. **HARD** Sort your rocks one way and tell your rule. Then mix them up and sort them a different way and tell your new rule.

COMMON MISTAKES

- Thinking all rocks are plain and gray. Look closely, and wet them: rocks can be pink, red, white, black, green and striped.
- Thinking a bigger rock is always heavier than a smaller one. Pumice can be big but very light.
- Thinking there is only one right way to sort. The same rocks can be sorted by color, size or feel. Just say your rule.

Make it a game · Which Rock Am I? Set out your rock collection. Your parent picks one rock in secret and gives clues: “I am brown. I am smooth. I have a white stripe.” You find the rock. Then trade places and give clues for your parent to guess. Use color, size, shape and smooth or rough in your clues.

Scripture. “The LORD is my rock, and my fortress, and my deliverer; my God, my strength, in whom I will trust; my buckler, and the horn of my salvation, and my high tower.” (Psalm 18:2, KJV)

King David knew rocks well. He hid among them and picked smooth stones from a brook. When he wanted to say how strong and safe God is, he called God his rock.

Practice answers

1. Answers will vary. The child points to the larger rock and says “bigger,” then points to the other and says “smaller.”
2. Any three of these: a bag or bucket, a magnifying glass, a notebook or paper and a crayon, an egg carton, and a grown-up.
3. 5 cups are empty (12 take away 7 is 5).
4. Water washes off the dust and makes the colors, specks and stripes show up brighter, so you can see the rock better.
5. Answers will vary. Example: first by color (gray, brown, white), then by feel (smooth and rough). The child should say each rule out loud.

9.2 PUDDLE MAP

OBJECTIVES

- Find the puddles in the yard after a rain and tell why puddles form in low places.
- Draw a simple map of the yard from above and mark the puddles on it.
- Watch a puddle get smaller and tell where the water went.

Warm-up. Put a toy car, a cup and a spoon on the table. Stand on a chair (with your parent holding it) and look straight down at them. Now draw what you see from up high: a box for the car, a circle for the cup, a line for the spoon. You just drew a map, the way a bird sees things!

Video. Coming soon. Puddles and maps for young children: where rainwater goes, water flowing downhill, puddles drying up (evaporation and soaking in), drawing a bird's-eye map; search NOAA SciJinks, USGS Water Science School, SciShow Kids, Homeschool Pop (Alternate) and rainy-day nature footage.

KEY TERMS

puddle

A small pool of rainwater that sits in a low place on the ground.

downhill

Toward the lower side. Water always runs downhill.

map

A drawing of a place as if you were looking down on it from above, like a bird.

evaporate

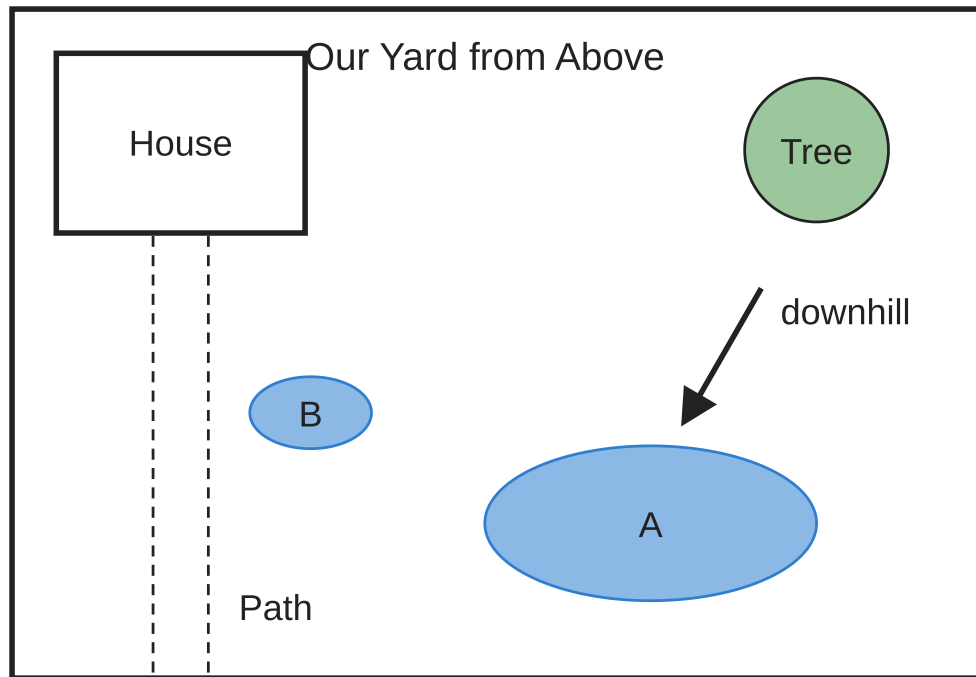
When water slowly goes up into the air as tiny bits too small to see. That is one way a puddle dries up.

CORE IDEAS

The story. After a good rain, put on your boots and go outside. Where are the puddles? Some puddles sit on the driveway. Some sit in a dip in the grass or at the bottom of a slope. Water always runs **downhill**, and it stops where the ground is low, like a ball rolling into a hole. That is why the same puddles show up in the same places every time it rains. Your yard has low spots, and the rain finds them every time.

The big idea. Scientists write down what they find, and a **map** is a great way to do it. A map is a picture of a place seen from above, the way a bird sees it. On a map, the house is a box, a tree is a circle, a path is two lines, and a puddle is a blue shape. When you put the puddles on a map, you can see where the low places are. Then draw a chalk line around one puddle and come back later. The puddle shrinks inside the line! Some of the water soaked down into the ground, and some **evaporated** up into the air.

God's handiwork. Rain is a gift. The Bible says God "giveth rain upon the earth, and sendeth waters upon the fields." The water in your puddle does not disappear. It soaks in to water the roots of plants, or it rises into the air to help make new clouds and new rain.



A puddle map: the yard seen from above. Water runs downhill into the low places.

PICTURE STUDY



Rainy Day, Boston, Childe Hassam, 1885 · Oil on canvas · Toledo Museum of Art, Toledo, Ohio

Childe Hassam was an American painter who lived in Boston. He painted this street corner near his own home on Columbus Avenue on a rainy day. Hassam said he thought the street

looked very pretty when it was wet and shining and caught the reflections of the people and carriages passing by. Look how the wet ground shines like a mirror!

Look closely

- Find the shiny wet street. What can you see reflected in it?
- Count the umbrellas you can see.
- Find a horse and carriage. Which way is it going?
- Look at the sky. Is the rain finished, or might more come?

Talk about it

1. Where do you think the rainwater on this street goes?
2. If a bird flew over this street, what would its map look like?
3. What would you wear to walk on this street?

Safety first. Play only in small puddles in your own yard or on a quiet path, with a grown-up. Stay away from streets, ditches, storm drains and any moving or deep water, even if it looks shallow. Wait until the thunder and lightning are over before going out. Wet ground is slippery, so walk. Wash your hands when you come inside.

MAKE AND DO: OUR PUDDLE MAP

After a rain you will find the puddles in your yard, draw a map that shows where they are, and watch one puddle shrink.

You will need

- Rain boots
- A large sheet of paper on a clipboard or a piece of cardboard
- Crayons, including blue
- Sidewalk chalk
- A ruler or a stick (optional)

Steps

1. After a rain, walk around the yard with your grown-up. Point to every puddle you find.
2. Stand in one spot and look around. Your parent helps you draw the house as a box and the trees as circles. Draw paths as two lines.
3. Color each puddle on your map in blue, in the right place. Make big puddles big and small puddles small.
4. Give each puddle a letter. Your parent can write A, B, C on the map.
5. Find a puddle on the driveway or sidewalk. Draw a chalk line all the way around its edge.
6. Come back after lunch and draw a new chalk line around the puddle. Come back again the next day. What happened?

7. Look at your map. Point to the low places where water gathers. Tell your family where the water went.

Tips

- No rain this week? Pour a bucket of water on the driveway or a dirt slope and watch where it runs and where it stops.
- Turn your map so the house on the paper is on the same side as the real house. Then the map is easy to read.

Check your work

- I found the puddles and drew them on a map.
- I can point to a low place where water gathers.
- I watched a puddle shrink and told where the water went.

FIELD NOTEBOOK

1. Draw a map of your bedroom from above: a box for the bed, a box for the dresser, a door.
2. Draw your chalk-line puddle three times: right after rain, after lunch and the next day.
3. Draw a raindrop running downhill and stopping in a puddle at the bottom.

From history. Matthew Fontaine Maury was an officer in the United States Navy who loved the Bible and the sea. He gathered the logbooks of many ships and studied where the winds blew and where the ocean water flowed. Then he drew maps of the winds and currents. Ships that used his maps could choose better paths and finish their trips sooner. Maury was glad to read in Psalm 8 about “the paths of the seas,” because he believed God had made the sea with paths that people could find and map.

WORKED EXAMPLES

Example 1. Look at the puddle map. Puddle A is 6 footsteps across. Puddle B is 3 footsteps across. Which puddle is bigger? How many more footsteps across is it?

(Use the map or drawing “Puddle A is the big one at the bottom of the slope.” shown earlier in this lesson.)

1. To measure a puddle in footsteps, walk heel to toe along one side of it and count your steps.
2. Puddle A is 6 footsteps. Puddle B is 3 footsteps.
3. 6 is more than 3, so Puddle A is bigger.
4. Count up from 3 to 6: 4, 5, 6. That is 3 more footsteps.

Answer: Puddle A is bigger. It is 3 footsteps wider than Puddle B.

PRACTICE

1. **EASY** Look at the puddle map. Point to the house, the tree and the two puddles. How many puddles are on the map?
2. **EASY** Where do puddles form: on the high places or the low places?
3. **MEDIUM** You drew a chalk line around a puddle. The next day the puddle is much smaller. Where did the water go?
4. **MEDIUM** On a map, how would you draw a tree? A house? A puddle? Draw all three.
5. **HARD** Pour a cup of water at the top of a slope in the dirt or on the driveway. Before you pour, point to where you think the water will stop. Then pour and watch. Were you right?

COMMON MISTAKES

- Thinking a puddle just disappears. The water goes somewhere: down into the soil or up into the air.
- Thinking water can run uphill by itself. Water always runs downhill.
- Drawing a map from the side, like a picture of the front of the house. A map shows things from above, the way a bird sees them.

Make it a game · Treasure Map. While you look away, your parent hides a small toy outside and marks an X on your puddle map. Use the map to find the toy. Then hide a toy for your parent and mark the X yourself. Take turns until everyone has found a treasure.

Scripture. “Who giveth rain upon the earth, and sendeth waters upon the fields:” (Job 5:10, KJV)

Every puddle starts as rain that God sends. The water soaks in to help the grass grow, and some rises again to make new clouds.

Practice answers

1. The child points to the box (house), the green circle (tree) and the two blue shapes (puddles). There are 2 puddles.
2. In the low places. Water runs downhill and stops where the ground is low.
3. Some soaked down into the ground, and some evaporated up into the air.
4. A tree is a circle, a house is a box (square), and a puddle is a blue shape. Drawings will vary.
5. Answers will vary. The water runs downhill and stops in the lowest spot it can reach. The child should compare the guess with what happened.

9.3 CLOUD CHART

OBJECTIVES

- Name three kinds of clouds by how they look: puffy (cumulus), flat (stratus) and wispy (cirrus).
- Watch the sky each day for a week and keep a picture cloud chart.
- Count the marks on a cloud chart and tell which kind of cloud came most often.

Warm-up. Breathe out slowly onto a cold window or a cold mirror. A little foggy cloud appears! Your warm breath has water in it, and the cold glass turns it into tiny drops. A real cloud in the sky is made of tiny drops of water (or tiny bits of ice) floating together.

Video. Coming soon. Cloud types for young children: cumulus, stratus and cirrus clouds, what clouds are made of, cloud watching and making a cloud chart; search NOAA SciJinks, NASA Space Place, SciShow Kids, Homeschool Pop (Alternate), Science Max and time-lapse cloud footage.

KEY TERMS

cloud

Lots and lots of tiny drops of water, or tiny bits of ice, floating together in the sky.

cumulus

Puffy clouds that look like heaps of cotton balls. They often float by on sunny days.

stratus

Flat, gray clouds that spread across the sky like a blanket. They can bring drizzle.

cirrus

Thin, wispy clouds high up in the sky that look like feathers or curls of hair.

CORE IDEAS

The story. Spread a blanket in the grass and lie on your back. Look up! The sky is a moving picture. Long ago in London, a man named Luke Howard loved to watch the clouds. He saw that clouds come in a few main kinds, and he gave them names that scientists still use. Today you will learn three of them and keep a **cloud chart**, just like a weather scientist.

The big idea. **Cumulus** clouds are puffy, like heaps of cotton balls or scoops of whipped cream. They often float across a blue sky on a nice day. **Stratus** clouds are flat and gray. They spread over the whole sky like a blanket, and sometimes they bring a gentle drizzle. **Cirrus** clouds are thin and wispy, very high up, like white feathers or curls of hair. When clouds grow tall and dark gray, rain is often on the way. To make a cloud chart, go out at the same time each day, look at the sky, and draw the kind of cloud you see. At the end of the week, count!

God’s handiwork. The Bible says God is the one “who covereth the heaven with clouds, who prepareth rain for the earth.” Clouds carry water over the land and drop it as rain to make the grass grow. They also give us cool shade. Watch for cloud shadows sliding across a field on a sunny day!

Our Cloud Chart

 Puffy (cumulus)	
 Flat (stratus)	
 Wispy (cirrus)	

One week of cloud watching: one mark for each day.

PICTURE STUDY



View of Haarlem with Bleaching Fields, Jacob van Ruisdael, about 1670–1675 · Oil on canvas · Mauritshuis, The Hague, Netherlands

Jacob van Ruisdael was a Dutch painter who loved to paint skies. The land in Holland is very flat, so the sky looks enormous. In this painting the sky takes up most of the picture! Down below, people have laid long strips of white linen cloth in the fields so the sunshine can bleach them whiter. Far away you can see the great church of Saint Bavo in the town of Haarlem.

Look closely

- Put your hand across the picture where the land meets the sky. Is there more land or more sky?
- Find the puffy clouds. Are some white and some gray?
- Find the bright patches and the dark patches on the ground. The dark patches are cloud shadows!
- Find the long white strips of cloth in the fields and the tall church far away.

Talk about it

1. What kind of clouds did Ruisdael paint: puffy, flat or wispy?
2. Do you think it will rain soon in this picture? Why?
3. Why would people put their cloth out on a sunny day and not a rainy one?

Safety first. Never look straight at the sun, not even with sunglasses, and never through binoculars or a magnifying glass. Look at the clouds on the other side of the sky, away from the sun, or lie in the shade of a tree. If you hear thunder, go inside right away.

MAKE AND DO: MY CLOUD CHART WEEK

For five days you will go outside at the same time, look at the clouds and mark what you see on a picture chart. At the end of the week you will count your marks.

You will need

- A large sheet of paper or poster board
- Cotton balls and glue
- Gray crayon or gray paper
- White crayon or chalk and a sheet of blue paper (optional)
- Stickers or a crayon for marks
- A blanket for cloud watching

Steps

1. With your parent, make a chart with three rows. In the first row glue a fluffy cotton ball: that is Puffy. In the second row color a flat gray stripe: that is Flat. In the third row draw thin curly lines: that is Wispy.
2. Your parent can draw a box for no clouds at all, with a sun, for clear days.

3. Pick a time each day, such as right after breakfast. Go outside, turn away from the sun, and look at the sky.
4. Decide which kind of cloud you see the most. Put one sticker or mark in that row.
5. Tell your parent one more thing: Is it windy? Is it raining? Are the clouds moving fast or slow?
6. Do this for five days.
7. At the end of the week, count the marks in each row. Which kind of cloud came most often? Which came least?

Tips

- If you see two kinds of clouds, choose the kind that covers the most sky.
- Clouds can change quickly. Look again after lunch and see if they changed.

Check your work

- I can point to a cloud and say if it is puffy, flat or wispy.
- I marked my cloud chart for five days.
- I counted my marks and told which cloud came most often.

FIELD NOTEBOOK

1. Draw the three kinds of clouds: puffy, flat and wispy. Use blue for the sky around them.
2. Find a cloud that looks like an animal. Draw the cloud and the animal it looks like.
3. Draw a dark gray rain cloud with raindrops falling to the ground.

From history. Luke Howard was a Quaker who made medicines in London and loved to watch the weather. In 1802 he gave a talk to a small club of science friends and showed them his names for clouds. He used Latin words: *cumulus* means “heap,” *stratus* means “layer” or “spread out,” and *cirrus* means “curl of hair.” People liked his names so much that weather scientists all over the world still use them. The German poet Goethe even wrote a poem to honor him.

WORKED EXAMPLES

Example 1. Read the cloud chart. Which kind of cloud came most often this week? How many days did we watch?

(Use the map or drawing “Count each row, then count them all.” shown earlier in this lesson.)

1. Point to the Puffy row and count the marks: 1, 2, 3. Puffy has 3.
2. Point to the Flat row and count: 1. Flat has 1.
3. Point to the Wispy row and count: 1. Wispy has 1.
4. 3 is more than 1, so Puffy came most often.
5. Count all the marks: 3 and 1 make 4, and 1 more makes 5. We watched for 5 days.

Answer: Puffy (cumulus) clouds came most often, 3 days. We watched for 5 days.

PRACTICE

1. **EASY** Go outside (or look out a window, away from the sun). Point to a cloud. Is it puffy, flat or wispy?
2. **EASY** What is a cloud made of?
3. **MEDIUM** Match each cloud to the thing it looks like: puffy, flat, wispy. Things: a feather, a cotton ball, a gray blanket.
4. **MEDIUM** A cloud chart shows 4 puffy days and 2 flat days. How many days in all? Use your fingers.
5. **HARD** Why must you never look straight at the sun when you are cloud watching? What should you do instead?

COMMON MISTAKES

- Thinking clouds are made of smoke or cotton. Clouds are made of tiny drops of water or bits of ice.
- Thinking every cloud brings rain. Puffy white clouds and thin wispy clouds usually do not. Dark, thick clouds are the ones to watch.
- Thinking the sun goes away on a cloudy day. The sun is still shining above the clouds; the clouds just block our view.

Make it a game • Puffy, Flat, Wispy. Your parent calls out a cloud. For “Puffy!” puff up your cheeks and make your arms round. For “Flat!” lie down flat on the grass. For “Wispy!” wave your fingers high over your head like feathers. Your parent calls faster and faster. Then take a turn being the caller.

Scripture. “Who covereth the heaven with clouds, who prepareth rain for the earth, who maketh grass to grow upon the mountains.” (Psalm 147:8, KJV)

Clouds are part of God's good plan for watering the earth. When you see clouds roll in, you can remember that God is caring for the grass, the gardens and the fields.

Practice answers

1. Answers will vary with the day. Puffy heaps are cumulus, a flat gray blanket is stratus, and thin feathery streaks are cirrus.
2. Lots of tiny drops of water, or tiny bits of ice, floating together in the sky.
3. Puffy (cumulus) goes with the cotton ball. Flat (stratus) goes with the gray blanket. Wispy (cirrus) goes with the feather.
4. 6 days (4 and 2 make 6).
5. The sun is so bright it can hurt your eyes. Turn your back to the sun and look at the clouds on the other side of the sky, or watch from the shade.

9.4 SHADOW CLOCK

OBJECTIVES

- Make a shadow clock with a stick and stones and mark the shadow during one sunny day.
- Tell that a shadow points away from the sun and is shortest near the middle of the day.
- Use the shadow clock on another sunny day to tell about what time it is.

Warm-up. In a dark room, stand a toy on the table and shine a flashlight on it. Hold the flashlight low, near the table: the shadow is long. Hold it high, right above the toy: the shadow is short. Move the flashlight around the toy and watch the shadow swing the other way. The sun works just like your flashlight.

Video. Coming soon. Shadows and sundials for young children: why shadows change length during the day, making a shadow clock or sundial with a stick, the sun's path across the sky; search NASA Space Place, SciShow Kids, Homeschool Pop (Alternate), Science Max and time-lapse shadow footage.

KEY TERMS

shadow

A dark shape on the ground where something blocks the sunlight.

shadow clock

A stick standing in the sun whose shadow moves around it during the day, so you can tell the time. Another name is a sundial.

noon

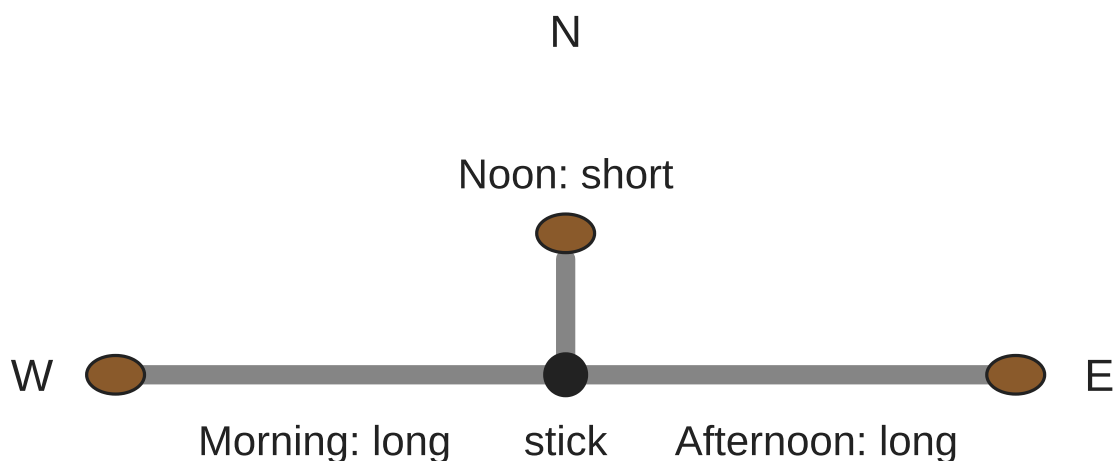
The middle of the day, when the sun is highest in the sky and shadows are shortest.

CORE IDEAS

The story. Long, long ago there were no watches or wall clocks. So how did people know the time? They watched shadows! A stick standing in the sun makes a shadow, and that shadow moves all day long. People learned to read the shadow like the hand of a clock. Today you will build one in your own yard.

The big idea. A **shadow** always points away from the sun. In the morning the sun is low in the east, so the shadow of your stick is long and points the other way, toward the west. As the sun climbs higher, the shadow gets shorter. Near the middle of the day, at **noon**, the sun is highest, so the shadow is shortest. (In most of North America it points north then.) In the afternoon the sun sinks toward the west, and the shadow grows long again, pointing east. The shadow swings around the stick like the hand of a clock! The sun looks like it moves across the sky because God made the earth to turn, like a slow merry-go-round.

Try it and see. Push a stick into the ground in a sunny spot. Every hour, set a stone at the tip of the shadow and have your parent tell you the time. On the next sunny day, look at your stones. When the shadow touches a stone, you know about what time it is. The Bible says, "From the rising of the sun unto the going down of the same the LORD's name is to be praised." Every time you check your shadow clock, you can thank God for the day He gave you.



Shadows point away from the sun.

A shadow clock seen from above in North America. Shadows point away from the sun.

PICTURE STUDY



A Sunday on La Grande Jatte, Georges Seurat, 1884-1886 · Oil on canvas · Art Institute of Chicago

Georges Seurat was a French painter. He painted this huge picture of people enjoying a sunny afternoon in a park on an island in the river Seine, near Paris. He made it with thousands and thousands of tiny dots of paint placed side by side. Up close you see dots. Step back, and your eyes blend them into grass, water, sunlight and shade.

Look closely

- Find the dark shadows on the grass. Which things are making them?
- Find the lady with the parasol. Why is she carrying it on a sunny day?
- Find the monkey and the dog.
- Look for people sitting in the shade. Why might they choose the shade?

Talk about it

1. Are the shadows in this painting long or short? What time of day do you think it is?
2. Which way is the sun shining from? How can you tell?
3. What would you do if you spent a sunny day in this park?

Safety first. Never look straight at the sun, not even for a moment and not even with sunglasses. Look at the shadow on the ground instead. Wear a hat and sunscreen on a long sunny day. Put a ball of clay, a cork or a tennis ball on top of the stick so no one gets poked, and let a grown-up push the stick into the ground.

MAKE AND DO: MAKE A SHADOW CLOCK

On one sunny day you will build a shadow clock, mark the shadow every hour with a stone, and then test your clock on another sunny day.

You will need

- A straight stick or a garden stake about as long as your arm
- A ball of clay, a cork or a tennis ball for the top of the stick
- 8 to 10 small stones
- Sidewalk chalk (if you build on the driveway instead)
- A paper towel tube and a lump of modeling clay (driveway version)
- A clock or watch for your grown-up

Steps

1. Choose an open, sunny spot that will not be shaded by trees or the house all day.
2. Your grown-up pushes the stick straight up into the ground and puts the soft cap on top. (On a driveway, stand the paper towel tube up in a lump of clay.)
3. In the morning, find the tip of the stick's shadow. Set a stone right on the tip. Your grown-up tells you the time and can write it on the stone with chalk or marker.
4. Come back every hour and set a new stone at the shadow tip. Watch the shadow get shorter and shorter toward the middle of the day.

5. After noon, watch it grow long again on the other side. Keep setting stones until afternoon.
6. Stand back and look. Your stones make a curve around the stick, like the numbers on a clock!
7. On the next sunny day, go out and look at the shadow. Which stone is it pointing to? Tell your parent about what time it is, then check the clock.

Tips

- Do not move the stick or the stones, or your clock will be wrong.
- The clock only works when the sun shines. On a cloudy day or at night there is no shadow to read.
- The shadow moves a little differently as the seasons change, so test your clock within a few days.

Check your work

- I made a shadow clock and marked the shadow with stones.
- I can tell when the shadow is long and when it is short.
- I used my shadow clock on another day to tell about what time it was.

FIELD NOTEBOOK

1. Draw your stick and its shadow in the morning, at noon and in the afternoon. Make the noon shadow the shortest.
2. Draw yourself outside with your own shadow. Draw the sun on the other side of you.
3. Draw your shadow clock from above, with the stick in the middle and all your stones around it.

From history. People in ancient Egypt used shadow clocks to tell the time of day, and later many people built sundials of stone and metal. The Bible tells of a sundial too. When King Hezekiah was sick, God gave him a sign: the shadow on the dial of Ahaz went backward instead of forward (2 Kings 20:9-11). For hundreds of years, many churches and town squares had sundials on their walls, and people set their clocks and watches by the sun.

WORKED EXAMPLES

Example 1. In the morning the stick's shadow is 9 hands long. At noon it is 3 hands long. Which shadow is shorter? How many hands shorter?

(Use the map or drawing "The noon shadow is the shortest." shown earlier in this lesson.)

1. To measure a shadow in hands, lay your hand flat on the ground at the stick and walk your hands, one in front of the other, to the tip of the shadow. Count each hand.
2. The morning shadow is 9 hands. The noon shadow is 3 hands.
3. 3 is less than 9, so the noon shadow is shorter.
4. Count up from 3 to 9: 4, 5, 6, 7, 8, 9. That is 6 more hands.

Answer: The noon shadow is shorter, by 6 hands. At noon the sun is high, so the shadow is short.

PRACTICE

1. **EASY** Look at the shadow clock picture. Point to the shortest shadow. What time of day is it?
2. **EASY** Stand outside on a sunny day. Point to your shadow. Now point to where the sun is (without looking at it). Are they on the same side or opposite sides of you?
3. **MEDIUM** You set a stone at the shadow tip at 9, 10, 11, 12, 1, 2 and 3 o'clock. How many stones did you use? Count them.
4. **MEDIUM** Can you use your shadow clock on a cloudy day or at night? Why or why not?
5. **HARD** With a flashlight and a toy, show your parent a morning shadow and a noon shadow. Tell which one is longer and why.

COMMON MISTAKES

- Thinking a shadow stays the same all day. Shadows change length and direction as the sun moves across the sky.
- Thinking the sun really travels around the earth. The earth turns, and that makes the sun look like it moves across the sky.
- Looking up at the sun to see where it is. Never do that. Look at your shadow instead: the sun is on the other side.

Make it a game • Shadow Tag. On a sunny day, play tag by stepping on each other's shadows. If someone steps on your shadow, you are It. Try to hide your shadow in the shade of a tree! Play once in the morning and once near noon. When is it easier to keep your shadow safe: when it is long or when it is short?

Scripture. “And God said, Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, and for days, and years:”
(Genesis 1:14, KJV)

God made the sun to mark out our days. Every shadow clock is a little picture of this verse: the sun’s light, moving across the sky, tells us the time God has given us.

Practice answers

1. The child points to the short shadow pointing toward N. It is noon, the middle of the day.
2. Opposite sides. A shadow always points away from the sun.
3. 7 stones.
4. No. With no sunshine there is no shadow, so there is nothing to read.
5. Holding the light low makes a long shadow, like the morning sun low in the sky. Holding it high above makes a short shadow, like the noon sun high in the sky. The morning shadow is longer because the light is lower.

UNIT 9 REVIEW

This is an oral review. Read each question aloud and let your child answer by telling, pointing, sorting or drawing. Give full points for a clear answer in the child's own words. The review is worth 20 points.

1. (3 pts) Tell me how you went on your rock hunt. What did you take with you, and what did you do with the rocks you found?
2. (3 pts) Here are some rocks. Sort them into groups and tell me your rule. Why do we dip a rock in water?
3. (3 pts) Where do puddles form? Point to a puddle on your puddle map and tell me where its water went when it dried up.
4. (3 pts) What is a map? Draw a tree and a house the way they look on a map.
5. (4 pts) Name the three kinds of clouds we watched and show me with your hands what each one looks like. Then tell me which kind came most often on your cloud chart.
6. (4 pts) Tell me how you made your shadow clock. When was the shadow shortest? Which way does a shadow point?

UNIT PROJECT: MY FIELD LAB BOOK

Make a Field Lab Book that holds all four labs. Put in a drawing of your rock museum (or a photo), your puddle map with the chalk-line puddle drawings, your week-long cloud chart and a drawing of your shadow clock from above. Then give your family a "field tour": walk them around the yard, show where you found your rocks, where the puddles form, where you watched the clouds and where your shadow clock stands, and tell one thing you learned at each stop.

- **Looking closely:** Drawings show real details the child saw: rock colors and stripes, puddle shapes, cloud kinds and shadow lengths.
- **Records:** The puddle map, cloud chart and shadow clock drawing are complete, and the child can count and explain the marks.
- **Telling:** On the field tour the child explains in their own words why puddles form in low places, what clouds are made of and why shadows change.
- **Care:** The child followed the safety rules, put living things back, kept the work neat and thanked God for something seen outdoors.

Answer key

1. Any good narration, such as: I took a bag and a magnifying glass. I picked up rocks, washed them, looked at them closely and put them in my egg-carton museum.
2. Any sensible sort with the rule said aloud (by color, size, or smooth and rough). Water makes the colors and stripes show up brighter.
3. Puddles form in low places, because water runs downhill. The water soaked into the ground and evaporated into the air.

4. A map is a drawing of a place seen from above, like a bird sees it. A tree is a circle and a house is a box.
5. Puffy (cumulus) like cotton balls, flat (stratus) like a gray blanket, wispy (cirrus) like feathers. The last part depends on the child's own chart; the child should count the marks to answer.
6. I put a stick in a sunny spot and set a stone at the tip of the shadow every hour. The shadow was shortest at noon, in the middle of the day. A shadow points away from the sun.